CHAPTER 43

RELEASE FREQUENCY QUANTIFICATION

43.1 Introduction

The scope of this chapter is to provide for internal initiating events at power the fission product release category frequencies defined by the end states of the containment event tree model developed in Chapter 35.

The following seven fission product release categories are defined by the end states of the containment event tree:

Release Category	Description
BP	Containment Bypass
CFE	Early Containment Failure
CFI	Intermediate Containment Failure
CFL	Late Containment Failure
CFV	Containment Venting
CI	Containment Isolation Failure
IC	Intact Containment

In Chapter 33, the plant core damage frequency (CDF) for internal initiating events at power is calculated. The end states of the event trees used for core damage modeling are referred to as plant damage states (PDS). In this chapter, first the PDS frequencies are calculated and PDS cutsets are identified in Section 43.1. Then the containment event tree (CET) node probabilities are calculated in Section 43.2. Finally, the CETs for all PDSs are quantified to calculate the fission product release category frequencies (Section 43.3).

The summary of results is discussed in Section 43.4; importance and sensitivity analyses are provided in Section 43.5. Conclusions and insights are given in Section 43.6.

Two acronyms used in this chapter are defined below.

- Containment Effectiveness (C_{eff}):

  Ratio of the frequency of core damage sequences ending in "Intact Containment" (IC) end state to the plant CDF.

- Large Release Frequency (LRF):

  Frequency of containment failure plus bypass sequences (excluding IC).

  LRF includes frequencies of BP, CI, CFE, CFI, CFL, and CFV release categories.

Also, the terms "accident class" and "plant damage state" are used interchangeably in the present document.

43.2 Plant Damage State Frequency Calculations

During the plant CDF analysis of Chapter 33 for internal initiating events at power, 190 dominant accident sequences are identified and their cutsets are stored in individual files. These sequences and summary of information about them is provided in Table 43A-1 of Attachment 43A. Note that each sequence file starts with the 2-character designation for an end state (PDS). These PDS designations are:

PDS	Accident Class	Description
1A	1A	High RCS Pressure (Transient or SLOCA)
1P	1AP	High RCS Pressure (PRHR operating or MLOCA)
3A	3A	High RCS Pressure and ATWS
3C	3C	Vessel Failure
3D	3D+1D	Partial RCS Depressurization
2E	3BE	RCS Depressurized
2L	3BL	RCS Depressurized (Gravity Injection successful; Sump Recirculation fails)
2R	3BR	RCS Depressurized (CMT and ACC fail)
6	6E+6L	Containment Bypass by SGTR or ISLOCA
Others		Not further modeled since the CDF is very small (1.2 E-11/year)

Thus, 9 PDS categories are identified at the end of CDF analysis for further processing. The CDF for each of these PDS categories is calculated as shown in Table 43-1 and Figure 43-1.

Attachment 43A provides information about calculation of PDS frequencies. Note that PDS and accident class designators are used interchangeably throughout the chapter.

43.3 Containment Event Tree Node Frequencies

43.3.1 CET Nodes

For each PDS state defined in Section 43.2, the CET (as defined in Chapter 35) is to be quantified with potentially different event tree nodal probabilities to obtain the Release

Frequency Calculations (RFCs). The PDS cutset files are the input to the CET as the "initiating events." There are 14 CET top events:

1. AC (PDS) PDS Occurs (CUTSETS)
2. DP RCS Depressurization After Core Uncovery (CUTSETS)
3. IS Containment Isolation (CUTSETS)
4. IR Reactor Cavity Flooding (CUTSETS)
5. RFL Reflooding of a Degraded Core
6. VF Debris Relocation to the Reactor Cavity
7. PC Passive Containment Cooling
8. VT Containment Venting – Operator Action
9. IF Overpressured Containment Intact at 24 Hrs
10. IG Hydrogen Control System (CUTSETS)
11. DF Diffusion Flame
12. DTE Early Hydrogen Detonation
13. DFG Hydrogen Deflagration
14. DTI Intermediate Hydrogen Detonation

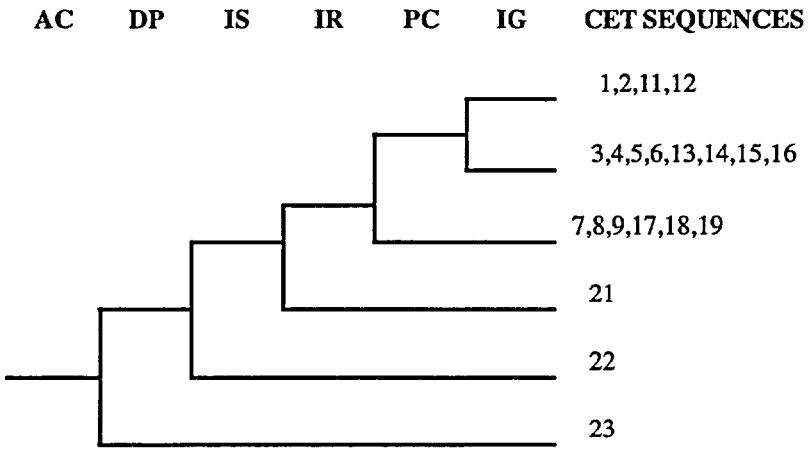
The CET is shown in Figure 43-2.

Five of the 14 event tree nodes are represented by cutsets, rather than scalars. The Boolean Logic multiplication of these nodes must be performed first, and their nodal probabilities are obtained, before the CET is quantified using scalar operations. To reduce the cutsets to scalar probabilities, the model in the next subsection is first used.

43.3.2 CET Node Probabilities From Boolean Expressions

In this section, a model is developed to calculate the probabilities of those CET nodes represented by fault tree models, and resulting cutset files. There are four such nodes (DP, IS, IR, IG) plus the accident classes (AC), as given in the previous subsection.

A sub-event tree containing the five nodes with cutsets is constructed as follows:



CET sequences 10 and 20 not shown above contain success of IS, and IR nodes, but do not involve the PC and IG nodes.

Boolean multiplication by using the WLINK code is first used to evaluate the expression such as:

SYS-AC SYS-DP CET Seq. 23
SYS-AC DEL-DP SYS-IS CET Seq. 22
SYS-AC DEL-DP DEL-IS SYS-IR CET Seq. 21
SYS-AC DEL-DP DEL-IS DEL-IR SYS-PC
SYS-AC DEL-DP DEL-IS DEL-IR DEL-PC SYS-IG

whenever applicable for each PDS category. Then, scalar event tree node probabilities are assigned to each of the nodes AC, DP, IS, IR, PC, and IG by taking the appropriate ratios of the above numbers with the PDS frequencies.

To perform the above-mentioned scalar probability assignment to the five nodes, first the success criteria definitions in Chapter 35 are used to identify the needed cutset files for each PDS state. These are summarized as follows:

AC	DP	IS	IR	PC	IG
2E	0	CIC	IWF	PCS	VLH
2L	0	CIC	0	PCS	VLH
2R	0	CID	0	PCS	VLH
1A	ADTLT	CIC	0	PCS	VLH
1P	ADTLT	CIC	0	PCS	VLH
3A	ADALT	CID	0	PCS	VLH
3C	0	XCID	0	PCS	VLH
3D	0	CIC	IWF	PCS	VLH
6	Note 6				

Notes:

1. 0 means the success of the node is given by the definition of the PDS state.
2. 1 means the failure of the node is given by the definition of the PDS state.
3. XCID = CID + OTH-CNU
4. ADALT = CM2NL + RCN + PRTA + OTH-SGTR

5. OTH-CNU = 0.001
   OTH-SGTR = 0.01

6. DP failure for PDS-6 is calculated in Attachment 43C for the other CET nodes, 3BL probabilities are used; for IR node, 3BE is used.

From the above definitions, Boolean expressions are defined for the sub-event tree for all PDSs. These are shown in Table 43-2. Twenty nine runs with WLINK are made for each of these expressions, which are named Q1 through Q29. The frequencies obtained in this file will be referred to as Q1 through Q29, respectively. These frequencies are placed in column D of Table 43-3.

Another set of probabilities are defined as P1 through P15 (representing success paths associated with CET nodes represented by fault trees) in Table 43-4 and are calculated using WLINK code system. The results are given in Table 43-3. These probabilities are also placed in Table 43-3, column G.

The PDS frequencies are calculated in Attachment A and are placed in column A of Table 43-3.

Q, P, and PDS frequencies are used to calculate the probabilities of various CET event tree nodes, as given in Table 43-3. This table contains the following data.

Column B on the top left-hand-side contains the PDS frequencies input. Column D contains the frequencies Q1 to Q29. Column H contains the frequencies P1 through P15. Column L shows the DP, IS, IR, PC and IG node probabilities calculated in the spreadsheet. The second page of the table contains the actual event tree node probabilities used to quantify the CETs.

All the probabilities used for CET quantification of the nine PDS states are summarized on the second page of Table 43-3. These probabilities are either calculated in this section, as shown above, or are taken from PRA Chapters.

When a CET node involves a Boolean expression (e.g., FT cutsets), the split fraction for that node is calculated as follows:

> A Boolean expression qn is generated to calculate the product of cutsets of the PDS state, the failed node, and the success of the other nodes in between containing Boolean expression. Another Boolean expression, pm, containing the product of PDS state cutsets and the success of other nodes in between the PDS and the node in question is also created. The ratio of the value of qn to pm is the conditional probability of failure of the node in question. Note that this conditional probability must be equal to or larger than the value of the Boolean expression for the node in question. The equality only holds if the cutsets of the node are not contained in the PDS cutsets (those that are not already removed by the failure of the previous nodes with Boolean expressions).

By this process, the Boolean expressions are replaced by scalar split fractions to quantify the CET.

43.3.3 Probabilities for Hydrogen-Related CET Nodes

The probabilities of CET event nodes DF, DTE, DFG, and DTI are taken from Chapter 35. These probabilities are summarized below.

Accident Class	DF Node Probability	DTE Node Probability	DFG Node Probability	DTI Node Probability
3BE	0	0.245 if RFL is successful	0	0.124 if RFL is successful
	0	0.117 if RFL fails	0	0.0013 if RFL fails
3BL	0	0.005	0	0.0013
3BR	0	0.19	0	0.13
1A	0	0	0	0
1AP	0.017	0.054	0	0.13
3A	0	0	0	0
3C	0	0.19	0	0.13
3D	0.017	0.115	0	0.0013
6	0	0.005	0	0.0013

43.3.4 Other CET Node Probabilities

The remaining CET nodes are RFL and VF. Probabilities of RFL and VF nodes are taken from Chapter 35.

The VT and IF nodes are assigned conservative failure probabilities.

These probabilities are given in Table 43-3, and are also summarized below:

PDS	RFL	VF	VT	IF
2E	0.267	0	1	1
2L	1.0	0	1	1
2R	0	0	1	1
1A	0	0	1	1
1P	0	0	1	1
3A	0	0	1	1
3C	0	0.1	1	1
3D	1.0	0	1	1
6	1.0	0	1	1

43.4 Containment Event Tree Quantification

43.4.1 Containment Event Tree

The CETs are quantified by using the event tree node probabilities from Table 43-3. The results are shown in Figures 43-3 through 43-11.

Most of the CET sequences go to the containment intact containment end state, which does not have severe fission product release potential. Only 8.1 percent of the PDS frequency goes to containment failure end states, such as BP, CFE, etc. Thus, the containment effectiveness is 91.9 percent in avoiding severe release given core damage.

Contribution of PDS to LRF is shown in Table 43-5 and Figure 43-12.

43.4.2 Dominant CET Sequences

Dominant CET sequences contributing to LRF are given in Table 43-6. The top sequences are BP release category.

43.4.3 LRF Cutsets for Dominant Sequences

The large release frequency cutsets in terms of initiating events, component and operator action failures, and containment safeguards failures are identified for the dominant accident sequences. For this purpose, the top 6 LRF CET sequences are used from Table 43-6.

The cutsets for the dominant CET LRF sequences are following:

	SEQUENCE		
1	23	BP	3A
2	23	BP	6
3	21	CFE	2E
4	21	CFE	3D
5	23	BP	1A
6	10	CFE	3C

43.5 Summary of Results

The fission product release category frequencies from the nine PDS states quantified in Section 43.4 are combined to obtain the total release category frequencies. These results are summarized in Tables 43-7, 43-8 and 43-9.

The results show that following a core damage event, the containment will be intact 91.9 percent of the time, preventing a severe fission product release. This is given by the ratio

of the CET end state IC (Intact Containment) frequency divided by the CDF. This quantity is termed as Containment Effectiveness which has a value of 0.919.

8.1 percent of the total CDF for internal initiating events (events at power) results in containment failure (including containment bypass), leading to potentially severe release categories (CET end states other than IC). The frequency of CET sequences where the containment is bypassed or failed (LRF) is 1.95 E-08/year. The containment event tree quantification results are displayed in Figure 43-13.

The containment bypass and failure CET sequences are dominated by release categories BP (bypass) and CFE (early containment failure) with contributions of 6.6 percent and 3.9 percent respectively to the plant CDF. With a total frequency of 1.8 E-08, these two categories make up 92 percent of the plant LRF, followed by 7 percent contribution from containment isolation failure category. Contributions of CFL and CFI categories to LRF are negligible.

Figure 43-12 shows the contribution of accident classes to LRF.

43.6 Importance and Sensitivity Analyses

In this section, CET node importance and sensitivity analyses are performed to provide a better understanding of the contributors to LRF.

43.6.1 CET Event Node Importance Analysis

In this section, the importances of the eleven CET nodes are calculated by setting the failure probability of each of these nodes to 1.0 (failure). The results are summarized in Table 43-10.

43.6.2 No Credit Taken for DP Node for PDS-6

Set DP(fail) = 1.0 for PDS-6.

In this case, the LRF becomes 2.49 E-08/year, with a containment failure probability of 10.3 percent.

43.6.3 Lesser Reliability for Containment Isolation

Set IS(fail) = 0.1 (all PDS)

In this case, the LRF becomes 4.05 E-08/year, with a containment failure probability of 16.8 percent.

43.6.4 Lesser Reliability for Hydrogen Igniters

In this sensitivity analysis, the VLH (IG node) probability is assigned a value of 0.1 for all PDS. The LRF becomes 2.31 E-08/year.

From this sensitivity analysis results, it is concluded that the LRF is not sensitive to the VLH failure as long is this failure probability is 0.1 or less. On the other hand, the LRF is sensitive to the failure of VLH (e.g. when no credit is taken for VLH).

43.6.5 Lesser Reliability for PCS

In this sensitivity analysis, the PCS failure probability is assigned a value of 0.001 for all PDSs. The LRF becomes 1.97 E-08/year.

From this sensitivity analysis results, it is concluded that the LRF is not sensitive to the PCS failure as long is this failure probability is 0.001 or less. On the other hand, the LRF is sensitive to the failure of PCS (e.g., when no credit is taken for PCS).

43.6.6 No Credit for Depressurization for High Pressure PDS

Set DP(fail) = 1.0 for all HP PDS: 1A, 1AP, 3A, 6.

This is the same as the node importance calculated in 44.5.1. The LRF is 2.91 E-08/year.

43.6.7 Set PDS-3C Vessel Failure Probability to 1.0

Set VF(fail) = 1.0 for PDS-3C.

This is the same as the node importance calculated in 44.5.1. The LRF is 2.85 E-08/year.

44.6.8 Set 3D and 1AP Diffusion Flame and Detonation Failure Probability to 1.0

Set DF(fail) = 1.0 for PDS-3D and 1AP.

Set DTE(fail) = 1.0 for PDS-3D and 1AP.

In this case, the LRF becomes 7.66 E-08/year.

43.7 Conclusions and Insights

From the results of the containment event tree quantification and sensitivity analyses, the following conclusions and insights related to AP1000 LRF can be derived:

1. The containment effectiveness for AP1000 is over 90 percent, which provides an order of magnitude decrease from CDF to LRF. Since this results already includes CDF sequences that directly bypass the containment, the containment effectiveness for remaining sequences is actually much better. For example, for five (3BE,3BL,3BR,3C,3D) of the nine accident classes studied, the containment effectiveness ranges from 90 percent to 99.8 percent.

2. The containment effectiveness is lowest for the 3A accident class where the reactor coolant system (RCS) pressure is high after core damage. The post-core-damage depressurization for this class proves to be ineffective since failure of the automatic

depressurization systems (ADS) by common cause failures leading to core damage also causes failure of post-core-damage depressurization.

3. Based on detailed analysis, the containment effectiveness for accident class 6, mainly steam generator tube rupture (SGTR) events, is 56.9 percent, due to those sequences where the RCS pressure is low after the postulated core damage. In such sequences, the fission products can be retained in the pressure vessel, shielded by the water in the faulted steam generator. A sensitivity analysis where all accident class 6 events are assigned to LRF shows that the plant containment effectiveness drops slightly to 89.7 percent (from 91.9 percent). Thus, the LRF results are not very sensitive to the treatment of the SGTR events for LRF.

4. A frequency of 1.0E-08/year has been assigned to the vessel failure initiating event (accident class 3C). In 90 percent of these events, the vessel is assumed to undergo failures that will be above the beltline: in which case the molten core could be cooled and containment would not be challenged. In the remaining 10 percent of the cases, the failure is assumed to be below the pressure vessel beltline, whereby the molten core would drop into the containment. In this case, it is conservatively assumed that the containment would fail. A sensitivity analysis is made whereby 100 percent of the failures would be below the beltline. The result shows that the containment effectiveness drops to 88.2 percent. This change is not significant, and the assumptions behind the case are very conservative.

5. The LRF results are sensitive to failure of hydrogen igniters. If no credit is taken for hydrogen igniters, the containment effectiveness drops to 74 percent.

6. However, LRF is not very sensitive to the reliability of hydrogen igniters; if IG reliability is assumed to be degraded (0.1) across the board for all accident classes, the containment effectiveness becomes 90.5 percent, which is an insignificant change from the base case.

7. For accident classes 3D and 1AP, if the large hydrogen releases through the in-containment refueling water storage tank (IRWST) is conservatively assumed to cause containment failure, the containment effectiveness drops to 84.5 percent. The LRF increases to 7.58 E-08/year. The increase is about a factor of 4 of the base. Such an increase is significant. This sensitivity analysis addresses the uncertainties in hydrogen mixing model for the case where the hydrogen is released into the IRWST and comes out from the IRWST vents above the operating deck.

8. The LRF is dominated (53.9 percent) by containment failures or bypasses due to SGTR, and unmitigated high-RCS-pressure core damage sequences, classified as BP. The remaining containment failures are dominated by an early containment failure due to reactor cavity flooding failure.

9. The LRF is not very sensitive to the reliability of PCS. If PCS reliability is assumed to be 0.001 across the board for all accident classes, the LRF becomes 1.97E-08, which is an insignificant change from the base case.

Table 43-1

ACCIDENT CLASS FREQUENCIES

PDS	Frequency	%	Description
1A	5.01E-09	2.1%	High RCS Pressure (Transient or SLOCA)
1P	1.48E-09	0.6%	High RCS Pressure (PRHR operating)
2E	8.06E-08	33.4%	RCS Depressurized
2L	2.40E-08	9.9%	RCS Depres. (Gravity Injection succ.; Sump Recirc. fails)
2R	4.63E-08	19.2%	RCS Depressurized (CMT and ACC fail)
3A	4.43E-09	1.8%	High RCS Pressure and ATWS
3C	1.00E-08	4.2%	Vessel Failure
3D	5.97E-08	24.8%	Partial RCS Depressurization
6	9.52E-09	4.0%	Containment Bypass by SGTR or ISLOCA
CDF =	2.41E-07	100.0%	

Table 43-2

BOOLEAN EXPRESSIONS TO CALCULATE Q1-Q29

1	1.00E-04	2	SYS-2E	SYS-CIC			
2	9.90E-05	3	SYS-2E	DEL-CIC	SYS-IWF		
3	9.70E-05	5	SYS-2E	DEL-CIC	DEL-IWF	DEL-PCT	SYS-VLH
4	1.00E-04	2	SYS-2L	SYS-CIC			
5	9.80E-05	4	SYS-2L	DEL-CIC	DEL-PCT	SYS-VLH	
6	1.00E-04	2	SYS-2R	SYS-CID			
7	9.80E-05	4	SYS-2R	DEL-CID	DEL-PCT	SYS-VLH	
8	1.00E-04	2	SYS-1A	SYS-ADTLT			
9	1.00E-06	3	SYS-1A	DEL-ADTLT	SYS-CIC		
10	9.80E-07	5	SYS-1A	DEL-ADTLT	DEL-CIC	DEL-PCT	SYS-VLH
11	1.00E-04	2	SYS-1P	SYS-ADTLT			
12	1.00E-06	3	SYS-1P	DEL-ADTLT	SYS-CIC		
13	9.80E-07	5	SYS-1P	DEL-ADTLT	DEL-CIC	DEL-PCT	SYS-VLH
14	1.00E-04	2	SYS-3A	SYS-ADALT			
15	1.00E-06	3	SYS-3A	DEL-ADALT	SYS-CID		
16	9.80E-07	5	SYS-3A	DEL-ADALT	DEL-CID	DEL-PCT	SYS-VLH
17	1.00E-04	2	SYS-3C	SYS-XCID			
18	9.80E-05	4	SYS-3C	DEL-XCID	DEL-PCT	SYS-VLH	
19	1.00E-04	2	SYS-3D	SYS-CID			
20	9.90E-05	3	SYS-3D	DEL-CID	SYS-IWF		
21	9.70E-05	5	SYS-3D	DEL-CID	DEL-IWF	DEL-PCT	SYS-VLH
22	9.80E-05	4	SYS-2E	DEL-CIC	DEL-IWF	SYS-PCT	
23	9.90E-05	3	SYS-2L	DEL-CIC	SYS-PCT		
24	9.90E-05	3	SYS-2R	DEL-CID	SYS-PCT		
25	9.90E-07	4	SYS-1A	DEL-ADTLT	DEL-CIC	SYS-PCT	
26	9.90E-07	4	SYS-1P	DEL-ADTLT	DEL-CIC	SYS-PCT	
27	9.90E-07	4	SYS-3A	DEL-ADALT	DEL-CID	SYS-PCT	
28	9.90E-05	3	SYS-3C	DEL-XCID	SYS-PCT		
29	9.80E-05	4	SYS-3D	DEL-CID	DEL-IWF	SYS-PCT	

Table 43-3 (Sheet 1 of 3)

CET NODE PROBABILITIES

PDS	Frequency		Probability	Symbol	Description		Probability	Symbol	Description	Failure Prob.	Node
2E	8.06E-08		1.32E-10	Q1	2E/CIC		8.05E-08	P1	2E/CIC	4.08E-01	1A-DP
2L	2.40E-08		2.67E-09	Q2	2E/IWF		7.85E-08	P2	2E/CIC/IWF	4.10E-01	1P-DP
2R	4.63E-08		2.67E-09	Q3	2E/VLH		7.85E-08	P3	2E/CIC/IWF/PCT	9.21E-01	3A-DP
1A	5.01E-09		5.83E-10	Q4	2L/CIC		2.34E-08	P4	2L/CIC	1.64E-03	2E-IS
1P	1.48E-09		3.66E-11	Q5	2L/VLH		4.63E-08	P5	2R/CID	2.43E-02	2L-IS
3A	4.43E-09		7.67E-11	Q6	2R/CID		3.35E-09	P6	1A/ADTLT	1.66E-03	2R-IS
3C	1.00E-08		5.28E-11	Q7	2R/VLH		3.35E-09	P7	1A/ADTLT/CIC	1.55E-03	1A-IS
3D	5.97E-08		2.04E-09	Q8	1A/ADTLT		9.61E-10	P8	1P/ADTLT	1.52E-03	1P-IS
6	9.52E-09		5.20E-12	Q9	1A/CIC		9.61E-10	P9	1P/ADTLT/CIC	1.81E-02	3A-IS
			2.17E-11	Q10	1A/VLH		3.61E-10	P10	3A/ADALT	2.66E-03	3C-IS
CDF =	2.409E-07		6.05E-10	Q11	1P/ADTLT		3.61E-10	P11	3A/ADALT/CID	6.07E-03	3D-IS
			1.46E-12	Q12	1P/CIC		1.00E-08	P12	3C/XCID	3.32E-02	2E-IR
			1.04E-12	Q13	1P/VLH		5.97E-08	P13	3D/CID	3.45E-02	3D-IR
			4.08E-09	Q14	3A/ADALT		5.81E-08	P14	3D/CID/IWF	3.40E-02	2E-IG
			6.53E-12	Q15	3A/CID		5.81E-08	P15	3D/CID/IWF/PCT	1.56E-03	2L-IG
			7.58E-12	Q16	3A/VLH					1.14E-03	2R-IG
			2.66E-11	Q17	3C/XCID					6.49E-03	1A-IG
			1.15E-11	Q18	3C/VLH					1.08E-03	1P-IG

Table 43-3 (Sheet 2 of 3)

CET NODE PROBABILITIES

PDS	Frequency		Probability	Symbol	Description		Probability	Symbol	Description	Failure Prob.	Node
			3.62E-10	Q19	3D/CID					2.10E-02	3A-IG
			2.06E-09	Q20	3D/IWF					1.15E-03	3C-IG
			1.50E-10	Q21	3D/VLH					2.59E-03	3D-IG
			1.35E-13	Q22	2E/PCT					1.72E-06	2E-PCT
			2.35E-14	Q23	2L/PCT					1.01E-06	2L-PCT
			5.21E-14	Q24	2R/PCT					1.12E-06	2R-PCT
			1.10E-14	Q25	1A/PCT					3.28E-06	1A-PCT
			0.00E+00	Q26	1P/PCT					0.00E+00	1P-PCT
			2.54E-14	Q27	3A/PCT					7.04E-05	3A-PCT
			1.16E-14	Q28	3C/PCT					1.16E-06	3C-PCT
			8.73E-14	Q29	3D/PCT					1.50E-06	3D-PCT
	2E	**2L**	**2R**	**1A**	**1P**	**3A**	**3C**	**3D**	**6**		
AC	8.06E-08	2.40E-08	4.63E-08	5.01E-09	1.48E-09	4.43E-09	1.00E-08	5.97E-08	9.52E-09		
DP	0.00E+00	0.00E+00	0.00E+00	4.08E-01	4.10E-01	9.21E-01	0.00E+00	0.00E+00	3.97E-01		
IS	1.64E-03	2.43E-02	1.66E-03	1.55E-03	1.52E-03	1.81E-02	2.66E-03	6.07E-03	2.43E-02		
IR	3.32E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.45E-02	3.32E-02		
RFL	2.67E-01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+00	1.00E+00		

Table 43-3 (Sheet 3 of 3)

CET NODE PROBABILITIES

PDS	Frequency		Probability	Symbol	Description		Probability	Symbol	Description	Failure Prob.	Node
VF	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-01	0.00E+00	0.00E+00		
PC	1.72E-06	1.01E-06	1.12E-06	3.28E-06	0.00E+00	7.04E-05	1.16E-06	1.50E-06	1.01E-06		
VT	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00		
IF	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00		
IG	3.40E-02	1.56E-03	1.14E-03	6.49E-03	1.08E-03	2.10E-02	1.15E-03	2.59E-03	1.56E-03		
DF	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.70E-02	0.00E+00	0.00E+00	1.70E-02	0.00E+00		
DTE	2.45E-01	5.00E-03	1.90E-01	0.00E+00	5.40E-02	0.00E+00	1.90E-01	1.15E-01	5.00E-03		
DFG	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
DTI	1.24E-01	1.30E-03	1.30E-01	0.00E+00	1.30E-01	0.00E+00	1.30E-01	1.30E-03	1.30E-03		
DTI-2	1.30E-03	(if RFL fails)									
DTE-2	0.117	(if RFL fails)									

Table 43-4

BOOLEAN EXPRESSIONS FOR P1-P15

1	9.90E-03	2	SYS-2E	DEL-CIC		
2	9.80E-03	3	SYS-2E	DEL-CIC	DEL-IWF	
3	9.70E-03	4	SYS-2E	DEL-CIC	DEL-IWF	DEL-PCT
4	9.90E-03	2	SYS-2L	DEL-CIC		
5	9.90E-03	2	SYS-2R	DEL-CID		
6	1.00E-04	2	SYS-1A	DEL-ADTLT		
7	9.90E-05	3	SYS-1A	DEL-ADTLT	DEL-CIC	
8	1.00E-04	2	SYS-1P	DEL-ADTLT		
9	9.90E-05	3	SYS-1P	DEL-ADTLT	DEL-CIC	
10	1.00E-04	2	SYS-3A	DEL-ADALT		
11	9.90E-05	3	SYS-3A	DEL-ADALT	DEL-CID	
12	9.90E-03	2	SYS-3C	DEL-XCID		
13	9.90E-03	2	SYS-3D	DEL-CID		
14	9.80E-03	3	SYS-3D	DEL-CID	DEL-IWF	
15	9.70E-03	4	SYS-3D	DEL-CID	DEL-IWF	DEL-PCT

Table 43-5 (Sheet 1 of 3)

CONTRIBUTION OF PDS TO LRF

CET SEQ	REL CAT	PDS	FREQ	%	Sequence Description
23	BP	3A	4.08E-09	20.9%	Containment Bypass
23	BP	6	3.78E-09	19.4%	Containment Bypass
21	CFE	2E	2.67E-09	13.7%	Sump Flooding Fails
21	CFE	3D	2.05E-09	10.5%	Sump Flooding Fails
23	BP	1A	2.04E-09	10.5%	Containment Bypass
10	CFE	3C	9.97E-10	5.1%	Vessel Failure
12	CFE	3D	9.71E-10	5.0%	Core Reflooding Fails; Diffusion Flame
23	BP	1P	6.05E-10	3.1%	Containment Bypass
22	CI	2L	5.83E-10	3.0%	Containment Isolation Fails
6	CFE	2E	4.75E-10	2.4%	Hydrogen Igniters Fail; Early DDT
22	CI	3D	3.62E-10	1.9%	Containment Isolation Fails
21	CFE	6	1.86E-10	1.0%	Sump Flooding Fails
4	CFI	2E	1.82E-10	0.9%	Hydrogen Igniters fails; Intermediate DDT
22	CI	6	1.40E-10	0.7%	Containment Isolation Fails
22	CI	2E	1.32E-10	0.7%	Containment Isolation Fails
16	CFE	2E	8.27E-11	0.4%	Core Reflooding Fails; Hydrogen Igniters Fail; Early DDT
22	CI	2R	7.67E-11	0.4%	Containment Isolation Fails
22	CI	3C	2.66E-11	0.1%	Containment Isolation Fails

Table 43-5 (Sheet 2 of 3)

CONTRIBUTION OF PDS TO LRF

CET SEQ	REL CAT	PDS	FREQ	%	Sequence Description
16	CFE	3D	1.70E-11	0.1%	Core Reflooding Fails; Hydrogen Igniters Fail; Early DDT
2	CFE	1P	1.48E-11	0.1%	Diffusion Flame
6	CFE	2R	1.00E-11	0.1%	Hydrogen Igniters Fail; Early DDT
22	CI	3A	6.33E-12	0.0%	Containment Isolation Fails
4	CFI	2R	5.55E-12	0.0%	Hydrogen Igniters Fails; Intermediate DDT
22	CI	1A	4.60E-12	0.0%	Containment Isolation Fails
6	CFE	3C	1.95E-12	0.0%	Hydrogen Igniters Fail; Early DDT
22	CI	1P	1.32E-12	0 0%	Containment Isolation Fails
4	CFI	3C	1.08E-12	0 0%	Hydrogen Igniters Fails; Intermediate DDT
14	CFI	2E	8.11E-13	0.0%	Core Reflooding Fails; Hydrogen Igniters fails; Intermediate DDT
16	CFE	2L	1.83E-13	0.0%	Core Reflooding Fails; Hydrogen Igniters Fail; Early DDT
14	CFI	3D	1.70E-13	0.0%	Core Reflooding Fails; Hydrogen Igniters fails; Intermediate DDT
4	CFI	1P	1.15E-13	0.0%	Hydrogen Igniters Fails; Intermediate DDT
9	CFL	2E	9.80E-14	0.0%	Passive Containment Cooling Fails; Venting Fails; Containment Fails
19	CFL	3D	8.60E-14	0.0%	Core Reflooding Fails; Passive Containment Cooling Fails; Venting Fails; Containment Fails
9	CFL	2R	5.20E-14	0.0%	Passive Containment Cooling Fails; Venting Fails; Containment Fails
6	CFE	1P	5.05E-14	0.0%	Hydrogen Igniters Fail; Early DDT
14	CFI	2L	4.72E-14	0.0%	Core Reflooding Fails; Hydrogen Igniters Fails, Intermediate DDT

Table 43-5 (Sheet 3 of 3)

CONTRIBUTION OF PDS TO LRF

CET SEQ	REL CAT	PDS	FREQ	%	Sequence Description
16	CFE	6	4.23E-14	0.0%	Core Reflooding Fails; Hydrogen Igniters Fail; Early DDT
19	CFL	2E	3.57E-14	0.0%	Core Reflooding Fails; Passive Containment Cooling Fails; Venting Fails; Containment Fails
9	CFL	3A	2.42E-14	0.0%	Passive Containment Cooling Fails; Venting Fails; Containment Fails
19	CFL	2L	2.35E-14	0.0%	Core Reflooding Fails; Passive Containment Cooling Fails; Venting Fails; Containment Fails
14	CFI	6	1.09E-14	0.0%	Core Reflooding Fails; IHydrogen Igniters fails; Intermediate DDT
9	CFL	3C	1.04E-14	0.0%	Passive Containment Cooling Fails; Venting Fails; Containment Fails
9	CFL	1A	9.71E-15	0.0%	Passive Containment Cooling Fails; Venting Fails; Containment Fails
19	CFL	6	5.44E-15	0.0%	Core Reflooding Fails; Passive Containment Cooling Fails; Venting Fails; Containment Fails
		Sum	**1.95E-08**	**100.0%**	

Table 43-6 (Sheet 1 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Title: LRF Cutsets for 23BP3A

Reduced Sum of Cutsets: 4.0770E-09

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
1	3.01E-09	73.83	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
2	6.95E-10	17.05	ATWS PRECURSOR WITH MFW AVAILA. INITIATING EVENT OCCURS	1.17E+00	IEV-ATW-T
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-03	ATW-MAN05
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
			COND. PROB. OF ATW-MAN06 (OPER. FAILS TO TRIP REACTOR	5.00E-01	ATW-MAN06C
3	1.58E-10	3.88	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C

Table 43-6 (Sheet 2 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
4	9.25E-11	2.27	ATWS PRECURSOR WITH SI SIGNAL INITIATING EVENT OCCURS	1.48E-02	IEV-ATW-S
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
5	5.71E-11	1.4	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
6	1.39E-11	0.34	ATWS PRECURSOR WITH MFW AVAILA. INITIATING EVENT OCCURS	1.17E+00	IEV-ATW-T
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-03	ATW-MAN05
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS

Table 43-6 (Sheet 3 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
7	1.00E-11	0.25	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			CONTROL ROD MG SETS FAIL TO TRIP	1.75E-03	OTH-MGSET
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
8	9.15E-12	0.22	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
9	4.96E-12	0.12	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7 89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM

Table 43-6 (Sheet 4 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
10	4.96E-12	0.12	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
11	4.86E-12	0.12	ATWS PRECURSOR WITH SI SIGNAL INITIATING EVENT OCCURS	1.48E-02	IEV-ATW-S
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
12	3.00E-12	0.07	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS

Table 43-6 (Sheet 5 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
13	2.43E-12	0.06	ATWS PRECURSOR WITH MFW AVAILA. INITIATING EVENT OCCURS	1.17E+00	IEV-ATW-T
			CONTROL ROD MG SETS FAIL TO TRIP	1.75E-03	OTH-MGSET
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-03	ATW-MAN05
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
14	1.76E-12	0.04	ATWS PRECURSOR WITH SI SIGNAL INITIATING EVENT OCCURS	1.48E-02	IEV-ATW-S
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
15	1.74E-12	0.04	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07

Table 43-6 (Sheet 6 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
16	9.68E-13	0.02	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			REACTOR TRIP BREAKERS CCF	8.10E-06	RCX-RB-FA
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA DAS	5.20E-02	ATW-MAN04
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
17	9.68E-13	0.02	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			REACTOR TRIP BREAKERS CCF	8.10E-06	RCX-RB-FA
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA DAS	5.20E-02	ATW-MAN04
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
18	8.26E-13	0.02	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			TURBINE IMPULSE CHAMBER PRESSURE TRANSMITTER 002 FAILURE	5.23E-03	MSHTP002RI
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR

Table 43-6 (Sheet 7 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
19	8.26E-13	0.02	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			TURBINE IMPULSE CHAMBER PRESSURE TRANSMITTER 001 FAILURE	5.23E-03	MSHTP001RI
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
20	5.68E-13	0.01	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			REACTOR TRIP BREAKERS CCF	8.10E-06	RCX-RB-FA
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
21	5.68E-13	0.01	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			REACTOR TRIP BREAKERS CCF	8.10E-06	RCX-RB-FA
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR

Table 43-6 (Sheet 8 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
22	5.25E-13	0.01	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			CONTROL ROD MG SETS FAIL TO TRIP	1.75E-03	OTH-MGSET
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
23	5.25E-13	0.01	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			CONTROL ROD MG SETS FAIL TO TRIP	1.75E-03	OTH-MGSET
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
24	4.24E-13	0.01	ATWS PRECURSOR WITH MFW AVAILA. INITIATING EVENT OCCURS	1.17E+00	IEV-ATW-T
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-03	ATW-MAN05
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07

Table 43-6 (Sheet 9 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
25	3.08E-13	0.01	ATWS PRECURSOR WITH SI SIGNAL INITIATING EVENT OCCURS	1.48E-02	IEV-ATW-S
			CONTROL ROD MG SETS FAIL TO TRIP	1.75E-03	OTH-MGSET
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
26	2.88E-13	0.01	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
27	2.88E-13	0.01	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR

Table 43-6 (Sheet 10 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
28	2.82E-13	0.01	ATWS PRECURSOR WITH SI SIGNAL INITIATING EVENT OCCURS	1.48E-02	IEV-ATW-S
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
29	2.62E-13	0.01	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			FAILURE OF INPUT GROUP # (P##MOD3#)	5.02E-03	PMAMOD31
			FAILURE OF INPUT GROUP # (P##MOD3#)	5.02E-03	PMBMOD32
30	2.08E-13	0.01	PRZ SV FAILURE FOR LOSS OF MFW ATWS, NO UET	2.00E-03	OTH-PRES
			ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR

Table 43-6 (Sheet 11 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
31	1.86E-13	0	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			REACTOR TRIP BREAKERS CCF	8.10E-06	RCX-RB-FA
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
32	1.86E-13	0	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			REACTOR TRIP BREAKERS CCF	8.10E-06	RCX-RB-FA
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
33	1.53E-13	0	ATWS PRECURSOR WITH SI SIGNAL INITIATING EVENT OCCURS	1.48E-02	IEV-ATW-S
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM

Table 43-6 (Sheet 12 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
34	1.53E-13	0	ATWS PRECURSOR WITH SI SIGNAL INITIATING EVENT OCCURS	1.48E-02	IEV-ATW-S
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
35	1.36E-13	0	PRZ SV FAILURE FOR LOSS OF MFW ATWS, NO UET	2.00E-03	OTH-PRES
			ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			CONTROL ROD MG SETS FAIL TO TRIP	1.75E-03	OTH-MGSET
			REACTOR TRIP BREAKERS CCF	8.10E-06	RCX-RB-FA
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
36	1.34E-13	0	ATWS PRECURSOR WITH SI SIGNAL INITIATING EVENT OCCURS	1.48E-02	IEV-ATW-S
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO

Table 43-6 (Sheet 13 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
37	1.09E-13	0	PRZ SV FAILURE FOR LOSS OF MFW ATWS, NO UET	2.00E-03	OTH-PRES
			ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			TURBINE IMPULSE CHAMBER PRESSURE TRANSMITTER 002 FAILURE	5.23E-03	MSHTP002RI
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
38	1.09E-13	0	PRZ SV FAILURE FOR LOSS OF MFW ATWS, NO UET	2.00E-03	OTH-PRES
			ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			TURBINE IMPULSE CHAMBER PRESSURE TRANSMITTER 001 FAILURE	5.23E-03	MSHTP001RI
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR

Table 43-6 (Sheet 14 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
39	1.07E-13	0	INADEQUATE PRS RELIEF FOR LOSS OF MFW ATWS, WITH UET	2.00E-03	OTH-PRESU
			ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			COND. PROB. OF ATW-MAN01 (OPER. FAILS TO STEP-IN CONTROL ROD)	5.17E-01	ATW-MAN01C
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
40	9.43E-14	0	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM

Table 43-6 (Sheet 15 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
41	9.43E-14	0	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
42	9.24E-14	0	ATWS PRECURSOR WITH SI SIGNAL INITIATING EVENT OCCURS	1.48E-02	IEV-ATW-S
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
43	8.81E-14	0	ATWS PRECURSOR WITH SI SIGNAL INITIATING EVENT OCCURS	1.48E-02	IEV-ATW-S
			CONTROL ROD MG SETS FAIL TO TRIP	1.75E-03	OTH-MGSET
			REACTOR TRIP BREAKERS CCF	8.10E-06	RCX-RB-FA
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO

Table 43-6 (Sheet 16 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
44	7.55E-14	0	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
45	7.55E-14	0	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
46	6.91E-14	0	PRZ SV FAILURE FOR LOSS OF MFW ATWS, NO UET	2.00E-03	OTH-PRES
			ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			CONTROL ROD MG SETS FAIL TO TRIP	1.75E-03	OTH-MGSET
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR

Table 43-6 (Sheet 17 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
47	6.31E-14	0	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
			FIXED COMPONENT FAILS: CKT BKR, INVERTER, OR STATIC XFER	5.04E-04	ED3MOD01
			STATIC TRANSFER SWITCH FAILS TO TRANSFER OR BKR FAILS OPEN	2.19E-02	ED3MOD04
48	5.61E-14	0	INADEQUATE PRS RELIEF FOR LOSS OF MFW ATWS, WITH UET	2.00E-03	OTH-PRESU
			ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			TURBINE IMPULSE CHAMBER PRESSURE TRANSMITTER 002 FAILURE	5.23E-03	MSHTP002RI
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			COND. PROB. OF ATW-MAN01 (OPER. FAILS TO STEP-IN CONTROL ROD)	5.17E-01	ATW-MAN01C
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR

Table 43-6 (Sheet 18 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
49	5.61E-14	0	INADEQUATE PRS RELIEF FOR LOSS OF MFW ATWS, WITH UET	2.00E-03	OTH-PRESU
			ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			TURBINE IMPULSE CHAMBER PRESSURE TRANSMITTER 001 FAILURE	5.23E-03	MSHTP001RI
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			COND. PROB. OF ATW-MAN01 (OPER. FAILS TO STEP-IN CONTROL ROD)	5.17E-01	ATW-MAN01C
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
50	5.36E-14	0	ATWS PRECURSOR WITH SI SIGNAL INITIATING EVENT OCCURS	1.48E-02	IEV-ATW-S
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07

Table 43-6 (Sheet 19 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Title: LRF Cutsets for 23BP6

Reduced Sum of Cutsets: 3.7730E-09

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
1	7.59E-11	2.01	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			COGNITIVE OPERATOR ERROR	1.84E-03	CIB-MAN00
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPER. FAILS TO RECOG. THE NEED FOR RCS DEPRESS. DURING SLOCA	5.00E-01	LPM-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS
2	7.59E-11	2.01	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			COGNITIVE OPERATOR ERROR	1.84E-03	CIB-MAN00
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			COND. PROB. OF ADN-MAN01(OPER. FAILS TO ACT. ADS)	5.00E-01	ADN-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS

Table 43-6 (Sheet 20 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
3	6.39E-11	1.69	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			FAILURE TO ALIGN CVCS IN AUX. SPRAY MODE	3.10E-03	CVN-MAN00
			OPERATOR FAILS TO FULFILL MANUAL ACTUATION OF ADS	5.00E-01	ADF-MAN01
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			COND. PROB. OF ADN-MAN01(OPER. FAILS TO ACT. ADS)	5.00E-01	ADN-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS
4	5.52E-11	1.46	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			OPERATOR ERROR TO CLOSE VALVES ON RUPTURED SG	1.34E-03	CIB-MAN01
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPER. FAILS TO RECOG. THE NEED FOR RCS DEPRESS. DURING SLOCA	5.00E-01	LPM-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS
5	4.95E-10	13.12	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS

Table 43-6 (Sheet 21 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
6	4.27E-10	11.32	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
7	3.88E-10	10.28	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
8	3.34E-10	8.85	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
9	1.86E-11	0.49	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			COGNITIVE OPERATOR ERROR	1.84E-03	CIB-MAN00
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			CCF OF ESF INPUT LOGIC (HARDWARE)	1.03E-04	CCX-INPUT-LOGIC
			COND. PROB. OF ADN-MAN01(OPER. FAILS TO ACT. ADS)	5.00E-01	ADN-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS

Table 43-6 (Sheet 22 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
10	1.86E-11	0.49	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			COGNITIVE OPERATOR ERROR	1.84E-03	CIB-MAN00
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			CCF OF ESF INPUT LOGIC (HARDWARE)	1.03E-04	CCX-INPUT-LOGIC
			OPER. FAILS TO RECOG. THE NEED FOR RCS DEPRESS. DURING SLOCA	5.00E-01	LPM-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS
11	1.12E-11	0.3	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			COGNITIVE OPERATOR ERROR	1.84E-03	CIB-MAN00
			COMMON CAUSE FAILURE OF 4 AOVS TO OPEN	6.20E-05	CCX-AV-LA
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			COND. PROB. OF ADN-MAN01(OPER. FAILS TO ACT. ADS)	5.00E-01	ADN-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS
12	9.43E-12	0.25	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			FAILURE TO ALIGN CVCS IN AUX. SPRAY MODE	3.10E-03	CVN-MAN00
			OPERATOR FAILS TO FULFILL MANUAL ACTUATION OF ADS	5.00E-01	ADF-MAN01
			COMMON CAUSE FAILURE OF 4 AOVS TO OPEN	6.20E-05	CCX-AV-LA
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			COND. PROB. OF ADN-MAN01(OPER. FAILS TO ACT. ADS)	5.00E-01	ADN-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS

Table 43-6 (Sheet 23 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
13	9.21E-12	0.24	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			COGNITIVE OPERATOR ERROR	1.84E-03	CIB-MAN00
			COMMON CAUSE FAILURE OF 4 CHECK VALVES TO OPEN	5.10E-05	CMX-CV-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			COND. PROB. OF ADN-MAN01(OPER. FAILS TO ACT. ADS)	5.00E-01	ADN-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS
14	7.76E-12	0.21	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			FAILURE TO ALIGN CVCS IN AUX. SPRAY MODE	3.10E-03	CVN-MAN00
			OPERATOR FAILS TO FULFILL MANUAL ACTUATION OF ADS	5.00E-01	ADF-MAN01
			COMMON CAUSE FAILURE OF 4 CHECK VALVES TO OPEN	5 10E-05	CMX-CV-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			COND. PROB. OF ADN-MAN01(OPER. FAILS TO ACT. ADS)	5.00E-01	ADN-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS
15	7.12E-11	1.89	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			CCF OF RTD LEVEL TRANSMITTERS	3.84E-05	CMX-VS-FA

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DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
16	5.40E-11	1.43	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
17	4.66E-11	1.24	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
18	3.59E-12	0.1	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			MECHANICAL FAILURE OF AOV V084 AND CV V085 TO OPEN	2.88E-02	CVMOD05
			OPERATOR FAILS TO FULFILL MANUAL ACTUATION OF ADS	5.00E-01	ADF-MAN01
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPER. FAILS TO FULFILL MANUAL ACTUATION OF ADS	3.02E-03	ADN-MAN01
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS

Table 43-6 (Sheet 25 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
19	3.37E-12	0.09	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			MECHANICAL FAILURE OF AOV V081 FAILS TO CLOSE	2.71E-02	CVMOD07
			OPERATOR FAILS TO FULFILL MANUAL ACTUATION OF ADS	5.00E-01	ADF-MAN01
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPER. FAILS TO FULFILL MANUAL ACTUATION OF ADS	3.02E-03	ADN-MAN01
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS
20	2.45E-11	0.65	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			UNAVAILABILITY OF BUS ECS ES 1 DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC1BS001TM
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
21	2.45E-11	0.65	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			BUS UNAVAILABLE DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC1BS012TM
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2

Table 43-6 (Sheet 26 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
22	1.96E-11	0.52	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			MECHANICAL FAILURE OF RNS MOV V055	1.41E-02	RN55MOD1
23	1.96E-11	0.52	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			HARDWARE FAILURE OF ISOLATION MOV 011	1.41E-02	RN11MOD3
24	1.96E-11	0.52	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			HARDWARE FAILS TO OPEN MOV V022/CB FTC/RELAY FTC	1.41E-02	RN22MOD4

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DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
25	1.96E-11	0.52	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			HARDWARE FAILS TO OPEN MOV V023/CB FTC/RELAY FTC	1.41E-02	RN23MOD5
26	1.95E-11	0.52	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1 40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			UNAVAILABILITY OF BUS ECS ES 1 DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC1BS001TM
			COMMON CAUSE FAILURE OF THE BATTERIES IDSA-DB-1A/1B	4.70E-05	CCX-BY-PN
27	1.95E-11	0.52	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			BUS UNAVAILABLE DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC1BS012TM
			COMMON CAUSE FAILURE OF THE BATTERIES IDSA-DB-1A/1B	4.70E-05	CCX-BY-PN

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DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
28	1.95E-11	0.52	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			COMMON CAUSE FAILURE OF THE BATTERIES IDSA-DB-1A/1B	4.70E-05	CCX-BY-PN
			UNAVAILABILITY OF BUS ECS ES 2 DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC2BS002TM
29	1.95E-11	0.52	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			COMMON CAUSE FAILURE OF THE BATTERIES IDSA-DB-1A/1B	4.70E-05	CCX-BY-PN
			BUS UNAVAILABLE DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC2BS022TM
30	1.95E-11	0.52	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			COMMON CAUSE FAILURE OF THE BATTERIES IDSA-DB-1A/1B	4.70E-05	CCX-BY-PN
			BUS UNAVAILABLE DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC2BS221TM

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DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
31	1.59E-12	0.04	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			MECHANICAL FAILURE OF AOV V084 AND CV V085 TO OPEN	2.88E-02	CVMOD05
			OPERATOR FAILS TO FULFILL MANUAL ACTUATION OF ADS	5.00E-01	ADF-MAN01
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPER. FAILS TO RECOG. THE NEED FOR RCS DEPRESS. DURING SLOCA	1.34E-03	LPM-MAN01
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1 00E-01	PDS6-MANADS
32	1.51E-12	0.04	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPER. FAILS TO FULFILL MANUAL ACTUATION OF ADS	3.02E-03	ADN-MAN01
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS

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DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
33	1.50E-12	0.04	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			COGNITIVE OPERATOR ERROR	1.84E-03	CIB-MAN00
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			COND. PROB. OF ADN-MAN01(OPER. FAILS TO ACT. ADS)	5.00E-01	ADN-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS
34	1.50E-12	0.04	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			COGNITIVE OPERATOR ERROR	1.84E-03	CIB-MAN00
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			OPER. FAILS TO RECOG. THE NEED FOR RCS DEPRESS. DURING SLOCA	5.00E-01	LPM-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS
35	1.50E-12	0.04	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			MECHANICAL FAILURE OF AOV V081 FAILS TO CLOSE	2.71E-02	CVMOD07
			OPERATOR FAILS TO FULFILL MANUAL ACTUATION OF ADS	5.00E-01	ADF-MAN01
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPER. FAILS TO RECOG. THE NEED FOR RCS DEPRESS. DURING SLOCA	1.34E-03	LPM-MAN01
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS

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DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
36	1.47E-11	0.39	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			MECHANICAL FAILURE OF RNS MOV V055	1.41E-02	RN55MOD1
37	1.47E-11	0.39	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			HARDWARE FAILURE OF ISOLATION MOV 011	1.41E-02	RN11MOD3
38	1.47E-11	0.39	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			HARDWARE FAILS TO OPEN MOV V022/CB FTC/RELAY FTC	1.41E-02	RN22MOD4

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DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
39	1.47E-11	0.39	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			HARDWARE FAILS TO OPEN MOV V023/CB FTC/RELAY FTC	1.41E-02	RN23MOD5
40	1.39E-11	0.37	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			CASK LOADING PIT UNAVAILABLE DUE TO FUEL UNLOADING OPERATIONS	1.00E-02	CLP-UNAVAILABLE
41	1.39E-11	0.37	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			BUS UNAVAILABLE DUE TO TEST OR CORRECTIVE MAINTENANCE	3.00E-04	IDDBSDS1TM
			BUS UNAVAILABLE DUE TO TEST OR CORRECTIVE MAINTENANCE	3.00E-04	IDBBSDS1TM

Table 43-6 (Sheet 33 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
42	1.39E-11	0.37	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			BUS UNAVAILABLE DUE TO TEST OR CORRECTIVE MAINTENANCE	3.00E-04	IDDBSDS1TM
			BUS UNAVAILABLE DUE TO TEST OR CORRECTIVE MAINTENANCE	3.00E-04	IDBBSDD1TM
43	1 39E-11	0.37	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			BUS UNAVAILABLE DUE TO TEST OR CORRECTIVE MAINTENANCE	3.00E-04	IDDBSDD1TM
			BUS UNAVAILABLE DUE TO TEST OR CORRECTIVE MAINTENANCE	3 00E-04	IDBBSDS1TM
44	1.39E-11	0.37	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			BUS UNAVAILABLE DUE TO TEST OR CORRECTIVE MAINTENANCE	3.00E-04	IDDBSDD1TM
			BUS UNAVAILABLE DUE TO TEST OR CORRECTIVE MAINTENANCE	3.00E-04	IDBBSDD1TM

Table 43-6 (Sheet 34 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
45	1.30E-12	0.03	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			FAILURE OF AIR COMPRESSOR TRANSMITTER	5.23E-03	CANTP011RI
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPER. FAILS TO FULFILL MANUAL ACTUATION OF ADS	3.02E-03	ADN-MAN01
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS
46	1.27E-12	0.03	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			MAIN GEN. BKR ES 01 FAILS TO OPEN	5.08E-03	EC0MOD01
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPER. FAILS TO FULFILL MANUAL ACTUATION OF ADS	3.02E-03	ADN-MAN01
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS
47	1.26E-12	0.03	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			FAILURE TO ALIGN CVCS IN AUX. SPRAY MODE	3.10E-03	CVN-MAN00
			OPERATOR FAILS TO FULFILL MANUAL ACTUATION OF ADS	5.00E-01	ADF-MAN01
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			COND. PROB. OF ADN-MAN01(OPER. FAILS TO ACT. ADS)	5.00E-01	ADN-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS

Table 43-6 (Sheet 35 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
48	1.25E-11	0.33	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			UNAVAILABILITY OF BUS ECS ES 1 DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC1BS001TM
			DUE TO CCF OF 4TH STAGE ADS SQUIB VALVES TO OPERATE	3.00E-05	ADX-EV-SA
49	1.25E-11	0.33	CONSEQUENTIAL SGTR OCCURS	1 00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			BUS UNAVAILABLE DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC1BS012TM
			DUE TO CCF OF 4TH STAGE ADS SQUIB VALVES TO OPERATE	3.00E-05	ADX-EV-SA
50	1.13E-12	0.03	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			COND. PROB OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPER. FAILS TO FULFILL MANUAL ACTUATION OF ADS	3.02E-03	ADN-MAN01
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1 00E-01	PDS6-MANADS

Table 43-6 (Sheet 36 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Title: LRF Cutsets for 21CFE2E

Reduced Sum of Cutsets: 2.6710E-09

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
1	6.48E-10	24.26	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
2	2.24E-10	8.39	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			IWRST DISCHARGE LINE "A" STRAINER PLUGGED	2.40E-04	IWA-PLUG
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
3	1.73E-10	6.48	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			IWRST DISCHARGE LINE "A" STRAINER PLUGGED	2.40E-04	IWA-PLUG
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03
4	8.46E-11	3.17	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			MECHANICAL FAILURE OF RNS MOV V055	1.41E-02	RN55MOD1
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
5	8.46E-11	3.17	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			HARDWARE FAILURE OF ISOLATION MOV 011	1.41E-02	RN11MOD3
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP

Table 43-6 (Sheet 37 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
6	8.46E-11	3.17	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			HARDWARE FAILS TO OPEN MOV V022/CB FTC/RELAY FTC	1.41E-02	RN22MOD4
			CCF OF STRAINERS IN IRWST TANK	1 20E-05	IWX-FL-GP
7	8.46E-11	3.17	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			HARDWARE FAILS TO OPEN MOV V023/CB FTC/RELAY FTC	1.41E-02	RN23MOD5
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
8	7.38E-11	2.76	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			MECHANICAL FAILURE OF RNS MOV V055	1.41E-02	RN55MOD1
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
9	7.38E-11	2.76	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			HARDWARE FAILURE OF ISOLATION MOV 011	1.41E-02	RN11MOD3
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
10	7.38E-11	2.76	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			HARDWARE FAILS TO OPEN MOV V022/CB FTC/RELAY FTC	1.41E-02	RN22MOD4
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
11	7.38E-11	2.76	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			HARDWARE FAILS TO OPEN MOV V023/CB FTC/RELAY FTC	1.41E-02	RN23MOD5
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP

Table 43-6 (Sheet 38 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
12	6.00E-11	2.25	LARGE LOCA INITIATING EVENT OCCURS	5.00E-06	IEV-LLOCA
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
13	6.00E-11	2.25	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			CASK LOADING PIT UNAVAILABLE DUE TO FUEL UNLOADING OPERATIONS	1.00E-02	CLP-UNAVAILABLE
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
14	5.23E-11	1.96	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			CASK LOADING PIT UNAVAILABLE DUE TO FUEL UNLOADING OPERATIONS	1.00E-02	CLP-UNAVAILABLE
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
15	2.94E-11	1.1	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			CCF OF STOP CHECK VALVES V015A/B TO OPEN	4.90E-03	RNX-KV1-GO
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
16	2.80E-11	1.05	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			CCF OF 4 GRAVITY INJECTION CVs	3.00E-05	IWX-CV-AO
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
17	2.56E-11	0.96	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			CCF OF STOP CHECK VALVES V015A/B TO OPEN	4.90E-03	RNX-KV1-GO
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP

Table 43-6 (Sheet 39 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
18	2.43E-11	0.91	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			CCF OF 4 GRAVITY INJECTION & 2 RECIRCULATION SQUIB VALVES	2.60E-05	IWX-EV-SA
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
19	2.16E-11	0.81	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			CCF OF 4 GRAVITY INJECTION CVs	3.00E-05	IWX-CV-AO
			FAILURE TO OPEN RECIRC MOVs	3 40E-03	REN-MAN03
20	1.87E-11	0.7	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			CCF OF 4 GRAVITY INJECTION & 2 RECIRCULATION SQUIB VALVES	2.60E-05	IWX-EV-SA
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03
21	1.74E-11	0.65	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			OPERATOR FAILS TO ALIGN AND ACTUATE THE RNS	2.90E-03	RHN-MAN01
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
22	1.62E-11	0.61	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			UNAVAILABILITY OF BUS ECS ES 1 DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC1BS001TM
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
23	1.62E-11	0.61	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			BUS UNAVAILABLE DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC1BS012TM
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP

Table 43-6 (Sheet 40 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
24	1.62E-11	0.61	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			BUS UNAVAILABLE DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC1BS122TM
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
25	1.58E-11	0.59	CMT LINE BREAK INITIATING EVENT OCCURS	9.31E-05	IEV-CMTLB
			MECHANICAL FAILURE OF RNS MOV V055	1.41E-02	RN55MOD1
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
26	1.58E-11	0.59	CMT LINE BREAK INITIATING EVENT OCCURS	9.31E-05	IEV-CMTLB
			HARDWARE FAILURE OF ISOLATION MOV 011	1.41E-02	RN11MOD3
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
27	1.58E-11	0.59	CMT LINE BREAK INITIATING EVENT OCCURS	9.31E-05	IEV-CMTLB
			HARDWARE FAILS TO OPEN MOV V022/CB FTC/RELAY FTC	1.41E-02	RN22MOD4
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
28	1.58E-11	0.59	CMT LINE BREAK INITIATING EVENT OCCURS	9.31E-05	IEV-CMTLB
			HARDWARE FAILS TO OPEN MOV V023/CB FTC/RELAY FTC	1.41E-02	RN23MOD5
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
29	1.54E-11	0.58	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			HARDWARE FAILURE OF VALVES ON DVI LINE A (V 015A & 017A)	5.07E-02	RNAMOD09
			HARDWARE FAILURE OF VALVES ON DVI LINE B (V 015B & 017B)	5.07E-02	RNBMOD10
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP

Table 43-6 (Sheet 41 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
30	1.52E-11	0.57	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			OPERATOR FAILS TO ALIGN AND ACTUATE THE RNS	2.90E-03	RHN-MAN01
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
31	1 41E-11	0.53	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			UNAVAILABILITY OF BUS ECS ES 1 DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC1BS001TM
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
32	1.41E-11	0.53	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			BUS UNAVAILABLE DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC1BS012TM
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
33	1.41E-11	0.53	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			BUS UNAVAILABLE DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC1BS122TM
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
34	1.34E-11	0.5	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			HARDWARE FAILURE OF VALVES ON DVI LINE A (V 015A & 017A)	5.07E-02	RNAMOD09
			HARDWARE FAILURE OF VALVES ON DVI LINE B (V 015B & 017B)	5.07E-02	RNBMOD10
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
35	1.12E-11	0.42	CMT LINE BREAK INITIATING EVENT OCCURS	9.31E-05	IEV-CMTLB
			CASK LOADING PIT UNAVAILABLE DUE TO FUEL UNLOADING OPERATIONS	1.00E-02	CLP-UNAVAILABLE
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP

Table 43-6 (Sheet 42 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
36	1.05E-11	0.39	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			CHECK VALVE V013 FAILURE TO OPEN	1.75E-03	RNNCV013GO
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
37	9.16E-12	0.34	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			CHECK VALVE V013 FAILURE TO OPEN	1.75E-03	RNNCV013GO
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
38	7.61E-12	0.28	CORE POWER EXCURSION INITIATING EVENT OCCURS	4.50E-03	IEV-POWEX
			EITHER PRZR SV FAILS TO RECLOSE	1.00E-02	OTH-PRSOV
			MECHANICAL FAILURE OF RNS MOV V055	1.41E-02	RN55MOD1
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
39	7.61E-12	0.28	CORE POWER EXCURSION INITIATING EVENT OCCURS	4.50E-03	IEV-POWEX
			EITHER PRZR SV FAILS TO RECLOSE	1.00E-02	OTH-PRSOV
			HARDWARE FAILURE OF ISOLATION MOV 011	1.41E-02	RN11MOD3
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
40	7.61E-12	0.28	CORE POWER EXCURSION INITIATING EVENT OCCURS	4.50E-03	IEV-POWEX
			EITHER PRZR SV FAILS TO RECLOSE	1.00E-02	OTH-PRSOV
			HARDWARE FAILS TO OPEN MOV V022/CB FTC/RELAY FTC	1.41E-02	RN22MOD4
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP

Table 43-6 (Sheet 43 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
41	7.61E-12	0.28	CORE POWER EXCURSION INITIATING EVENT OCCURS	4.50E-03	IEV-POWEX
			EITHER PRZR SV FAILS TO RECLOSE	1.00E-02	OTH-PRSOV
			HARDWARE FAILS TO OPEN MOV V023/CB FTC/RELAY FTC	1.41E-02	RN23MOD5
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
42	7.13E-12	0 27	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF 4 GRAVITY INJECTION CVs	3 00E-05	IWX-CV-AO
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
43	6.94E-12	0.26	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			PUMP 01A FAILS & ST CK V007A &C B FTC & RE FTC & CB ECS131 SP	3.40E-02	RNAMOD06
			PUMP 01B FAILS & ST CK V007B & C B FTC & RE FTC & CB ECS231 SP	3.40E-02	RNBMOD07
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
44	6.18E-12	0.23	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF 4 GRAVITY INJECTION & 2 RECIRCULATION SQUIB VALVES	2.60E-05	IWX-EV-SA
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
45	6.05E-12	0.23	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			PUMP 01A FAILS & ST CK V007A &C B FTC & RE FTC & CB ECS131 SP	3.40E-02	RNAMOD06
			PUMP 01B FAILS & ST CK V007B & C B FTC & RE FTC & CB ECS231 SP	3.40E-02	RNBMOD07
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP

Table 43-6 (Sheet 44 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
46	5.51E-12	0.21	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF 4 GRAVITY INJECTION CVs	3.00E-05	IWX-CV-AO
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03
47	5.47E-12	0.2	CMT LINE BREAK INITIATING EVENT OCCURS	9.31E-05	IEV-CMTLB
			CCF OF STOP CHECK VALVES V015A/B TO OPEN	4.90E-03	RNX-KV1-GO
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
48	5.41E-12	0.2	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			CCF OF 2 GRAVITY INJECTION SQUIB VALVES IN 1/1 LINES TO OPEN	5.80E-06	IWX-EV1-SA
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
49	5.40E-12	0.2	CORE POWER EXCURSION INITIATING EVENT OCCURS	4.50E-03	IEV-POWEX
			EITHER PRZR SV FAILS TO RECLOSE	1.00E-02	OTH-PRSOV
			CASK LOADING PIT UNAVAILABLE DUE TO FUEL UNLOADING OPERATIONS	1.00E-02	CLP-UNAVAILABLE
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
50	4.77E-12	0.18	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF 4 GRAVITY INJECTION & 2 RECIRCULATION SQUIB VALVES	2.60E-05	IWX-EV-SA
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03

Table 43-6 (Sheet 45 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Title: LRF Cutsets for 21CFE3D

Reduced Sum of Cutsets: 2.059.00E-08

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
1	5.94E-10	28.85	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
2	4.65E-10	22.58	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
3	6.48E-11	3.15	SPURIOUS ADS INITIATING EVENT OCCURS	5 40E-05	IEV-SPADS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
4	5.56E-11	2.7	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
5	5.50E-11	2.67	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
6	5.50E-11	2.67	LARGE LOCA INITIATING EVENT OCCURS	5.00E-06	IEV-LLOCA
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW

Table 43-6 (Sheet 46 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
7	4.80E-11	2.33	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
8	4.36E-11	2.12	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
9	4.31E-11	2.09	LARGE LOCA INITIATING EVENT OCCURS	5.00E-06	IEV-LLOCA
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
10	4.25E-11	2.06	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03
11	3.76E-11	1.83	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
12	2.80E-11	1.36	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			DUE TO CCF OF 4TH STAGE ADS SQUIB VALVES TO OPERATE	3.00E-05	ADX-EV-SA
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO

Table 43-6 (Sheet 47 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
13	2.71E-11	1.32	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
14	2.45E-11	1.19	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF ESF INPUT LOGIC (HARDWARE)	1.03E-04	CCX-INPUT-LOGIC
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
15	2.33E-11	1.13	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
16	2.16E-11	1.05	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2 12E-04	IEV-SI-LB
			DUE TO CCF OF 4TH STAGE ADS SQUIB VALVES TO OPERATE	3.00E-05	ADX-EV-SA
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03
17	2.12E-11	1.03	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
18	1.89E-11	0.92	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF ESF INPUT LOGIC (HARDWARE)	1.03E-04	CCX-INPUT-LOGIC
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03

Table 43-6 (Sheet 48 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
19	1.83E-11	0.89	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
20	1.47E-11	0.71	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			COMMON CAUSE FAILURE OF 4 AOVS TO OPEN	6.20E-05	CCX-AV-LA
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
21	1.40E-11	0.68	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
22	1.21E-11	0.59	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			COMMON CAUSE FAILURE OF 4 CHECK VALVES TO OPEN	5.10E-05	CMX-CV-GO
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
23	1.19E-11	0.58	CMT LINE BREAK INITIATING EVENT OCCURS	9.31E-05	IEV-CMTLB
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
24	1.14E-11	0.55	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			COMMON CAUSE FAILURE OF 4 AOVS TO OPEN	6.20E-05	CCX-AV-LA
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03

Table 43-6 (Sheet 49 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
25	1.08E-11	0.52	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03
26	1.02E-11	0.5	CMT LINE BREAK INITIATING EVENT OCCURS	9.31E-05	IEV-CMTLB
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
27	9.36E-12	0.45	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			COMMON CAUSE FAILURE OF 4 CHECK VALVES TO OPEN	5.10E-05	CMX-CV-GO
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03
28	9.31E-12	0.45	CMT LINE BREAK INITIATING EVENT OCCURS	9.31E-05	IEV-CMTLB
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
29	9.12E-12	0.44	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF RTD LEVEL TRANSMITTERS	3.84E-05	CMX-VS-FA
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
30	8.03E-12	0.39	CMT LINE BREAK INITIATING EVENT OCCURS	9.31E-05	IEV-CMTLB
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM

Table 43-6 (Sheet 50 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
31	7.13E-12	0.35	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			DUE TO CCF OF 4TH STAGE ADS SQUIB VALVES TO OPERATE	3.00E-05	ADX-EV-SA
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
32	7.05E-12	0.34	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF RTD LEVEL TRANSMITTERS	3.84E-05	CMX-VS-FA
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03
33	6.07E-12	0.29	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
34	6.00E-12	0.29	LARGE LOCA INITIATING EVENT OCCURS	5.00E-06	IEV-LLOCA
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
35	5.74E-12	0.28	CORE POWER EXCURSION INITIATING EVENT OCCURS	4.50E-03	IEV-POWEX
			EITHER PRZR SV FAILS TO RECLOSE	1.00E-02	OTH-PRSOV
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
36	5.51E-12	0.27	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			DUE TO CCF OF 4TH STAGE ADS SQUIB VALVES TO OPERATE	3.00E-05	ADX-EV-SA
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03

Table 43-6 (Sheet 51 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
37	5.23E-12	0.25	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
38	4 95E-12	0.24	CORE POWER EXCURSION INITIATING EVENT OCCURS	4.50E-03	IEV-POWEX
			EITHER PRZR SV FAILS TO RECLOSE	1.00E-02	OTH-PRSOV
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
39	4 50E-12	0.22	CORE POWER EXCURSION INITIATING EVENT OCCURS	4.50E-03	IEV-POWEX
			EITHER PRZR SV FAILS TO RECLOSE	1.00E-02	OTH-PRSOV
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
40	3.88E-12	0.19	CORE POWER EXCURSION INITIATING EVENT OCCURS	4.50E-03	IEV-POWEX
			EITHER PRZR SV FAILS TO RECLOSE	1.00E-02	OTH-PRSOV
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
41	2.95E-12	0 14	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS

Table 43-6 (Sheet 52 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
42	2.61E-12	0.13	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF ESF INPUT LOGIC SOFTWARE	1.10E-05	CCX-IN-LOGIC-SW
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
43	2.61E-12	0.13	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF PMS ESF ACTUATION LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD2-SW
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
44	2.54E-12	0.12	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
45	2.27E-12	0.11	LARGE LOCA INITIATING EVENT OCCURS	5.00E-06	IEV-LLOCA
			CCF OF ESF INPUT LOGIC (HARDWARE)	1.03E-04	CCX-INPUT-LOGIC
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
46	2.02E-12	0.1	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF ESF INPUT LOGIC SOFTWARE	1.10E-05	CCX-IN-LOGIC-SW
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03
47	2.02E-12	0.1	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF PMS ESF ACTUATION LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD2-SW
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03

Table 43-6 (Sheet 53 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
48	1.83E-12	0.09	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			MECHANICAL FAILURE OF RNS MOV V055	1.41E-02	RN55MOD1
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
49	1.83E-12	0.09	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			HARDWARE FAILURE OF ISOLATION MOV 011	1.41E-02	RN11MOD3
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
50	1.83E-12	0.09	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			HARDWARE FAILS TO OPEN MOV V022/CB FTC/RELAY FTC	1.41E-02	RN22MOD4
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO

Table 43-6 (Sheet 54 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Title: LRF Cutsets for 23BP1A

Reduced Sum of Cutsets: 2.0420E-09

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
1	5.12E-10	25.07	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
2	1.95E-10	9.55	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
3	1.68E-10	8.23	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
4	1.23E-10	6.02	LOSS OF MAIN FEEDWATER INITIATING EVENT OCCURS	3.35E-01	IEV-LMFW
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07

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DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
5	7.03E-11	3.44	LOSS OF MFW TO ONE SG INITIATING EVENT OCCURS	1.92E-01	IEV-LMFW1
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
6	5.50E-11	2.69	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	ADN-REC01
7	5.50E-11	2.69	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	LPM-REC01
8	5.27E-11	2.58	LOSS OF CCW/SW INITIATING EVENT OCCURS	1.44E-01	IEV-LCCW
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07

Table 43-6 (Sheet 56 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
9	4.66E-11	2.28	LOSS OF MAIN FEEDWATER INITIATING EVENT OCCURS	3.35E-01	IEV-LMFW
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
10	4.10E-11	2.01	LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
11	4.02E-11	1.97	LOSS OF MAIN FEEDWATER INITIATING EVENT OCCURS	3.35E-01	IEV-LMFW
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
12	3.07E-11	1.5	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
13	2.67E-11	1.31	LOSS OF MFW TO ONE SG INITIATING EVENT OCCURS	1.92E-01	IEV-LMFW1
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS

Table 43-6 (Sheet 57 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
14	2.30E-11	1.13	LOSS OF MFW TO ONE SG INITIATING EVENT OCCURS	1.92E-01	IEV-LMFW1
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
15	2.00E-11	0.98	LOSS OF CCW/SW INITIATING EVENT OCCURS	1.44E-01	IEV-LCCW
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
16	1.73E-11	0.85	LOSS OF CCW/SW INITIATING EVENT OCCURS	1.44E-01	IEV-LCCW
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
17	1.56E-11	0.76	LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS

Table 43-6 (Sheet 58 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
18	1.34E-11	0.66	LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
19	1.31E-11	0.64	LOSS OF MAIN FEEDWATER INITIATING EVENT OCCURS	3.35E-01	IEV-LMFW
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	ADN-REC01
20	1.31E-11	0.64	LOSS OF MAIN FEEDWATER INITIATING EVENT OCCURS	3.35E-01	IEV-LMFW
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	LPM-REC01

Table 43-6 (Sheet 59 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
21	1.31E-11	0.64	LOSS OF MAIN FEEDWATER INITIATING EVENT OCCURS	3.35E-01	IEV-LMFW
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5 00E-02	ADN-REC01
22	1.31E-11	0.64	LOSS OF MAIN FEEDWATER INITIATING EVENT OCCURS	3.35E-01	IEV-LMFW
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	LPM-REC01
23	1.30E-11	0.64	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			EDS3 EA 1 DISTR PNL FAILURE OR T&M	3.05E-04	ED3MOD07
			STANDBY DG UNAVAILABLE DUE TO TEST AND MAINTENANCE	4 60E-02	ZO1DG001TM
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW

Table 43-6 (Sheet 60 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
24	1.17E-11	0.57	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
25	1.13E-11	0.55	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			DUE TO FAILURE OF OPERATOR TO REFILL BASIN	4.00E-02	SWN-MAN03
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
26	1.02E-11	0.5	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
			STANDBY DG UNAVAILABLE DUE TO TEST AND MAINTENANCE	4.60E-02	ZO1DG001TM
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM

Table 43-6 (Sheet 61 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
27	1.01E-11	0.49	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
28	8.83E-12	0.43	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			DUE TO FAILURE OF OPERATOR TO REFILL BASIN	4.00E-02	SWN-MAN03
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
29	8.02E-12	0.39	MAIN STEAM LINE STUCK-OPEN SV INITIATING EVENT OCCURS	2.39E-03	IEV-SLB-V
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
30	7.89E-12	0.39	LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07

Table 43-6 (Sheet 62 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
31	7.50E-12	0.37	LOSS OF MFW TO ONE SG INITIATING EVENT OCCURS	1.92E-01	IEV-LMFW1
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	ADN-REC01
32	7.50E-12	0.37	LOSS OF MFW TO ONE SG INITIATING EVENT OCCURS	1.92E-01	IEV-LMFW1
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	LPM-REC01
33	6.59E-12	0.32	LOSS OF RSC FLOW INITIATING EVENT OCCURS	1.80E-02	IEV-LRCS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
34	6.28E-12	0.31	MAIN STEAM LINE STUCK-OPEN SV INITIATING EVENT OCCURS	2.39E-03	IEV-SLB-V
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07

Table 43-6 (Sheet 63 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
35	6.18E-12	0.3	LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
36	5.92E-12	0.29	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
37	5.76E-12	0.28	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			FAILURE OF AIR COMPRESSOR TRANSMITTER	5.23E-03	CANTP011RI
			FAILURE OF IRWST GUTTER DUE TO COMMON CAUSE OF AOVs	9.60E-05	PXX-AV-LA1
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5 00E-02	ADN-REC01

Table 43-6 (Sheet 64 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
38	5.76E-12	0.28	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			FAILURE OF AIR COMPRESSOR TRANSMITTER	5.23E-03	CANTP011RI
			FAILURE OF IRWST GUTTER DUE TO COMMON CAUSE OF AOVs	9.60E-05	PXX-AV-LA1
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	LPM-REC01
39	5.76E-12	0.28	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			FAILURE OF AIR COMPRESSOR TRANSMITTER	5.23E-03	CANTP011RI
			FAILURE OF PRHR DUE TO COMMON CAUSE OF AOVs	9.60E-05	PXX-AV-LA
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	ADN-REC01
40	5.76E-12	0.28	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			FAILURE OF AIR COMPRESSOR TRANSMITTER	5.23E-03	CANTP011RI
			FAILURE OF PRHR DUE TO COMMON CAUSE OF AOVs	9.60E-05	PXX-AV-LA
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	LPM-REC01

Table 43-6 (Sheet 65 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
41	5.69E-12	0.28	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
			D/G FAILS TO START & RUN OR BKR 102 FAILS TO CLOSE	2.02E-02	ZO1MOD01
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
42	5.63E-12	0.28	LOSS OF CCW/SW INITIATING EVENT OCCURS	1.44E-01	IEV-LCCW
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	ADN-REC01
43	5.63E-12	0 28	LOSS OF CCW/SW INITIATING EVENT OCCURS	1.44E-01	IEV-LCCW
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5 06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	LPM-REC01

Table 43-6 (Sheet 66 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
44	5.58E-12	0.27	LOSS OF COMPRESSED AIR INITIATING EVENT OCCURS	3.48E-02	IEV-LCAS
			MANUALLY REGULATE FLOW TO SG "A"	2.04E-01	REG-MAN00
			FAILURE OF IRWST GUTTER DUE TO COMMON CAUSE OF AOVs	9.60E-05	PXX-AV-LA1
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	ADN-REC01
45	5.58E-12	0.27	LOSS OF COMPRESSED AIR INITIATING EVENT OCCURS	3.48E-02	IEV-LCAS
			MANUALLY REGULATE FLOW TO SG "A"	2.04E-01	REG-MAN00
			FAILURE OF IRWST GUTTER DUE TO COMMON CAUSE OF AOVs	9.60E-05	PXX-AV-LA1
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	LPM-REC01

Table 43-6 (Sheet 67 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
46	5.58E-12	0.27	LOSS OF COMPRESSED AIR INITIATING EVENT OCCURS	3.48E-02	IEV-LCAS
			MANUALLY REGULATE FLOW TO SG "A"	2.04E-01	REG-MAN00
			FAILURE OF PRHR DUE TO COMMON CAUSE FAILURE OF AOVs	9.60E-05	PXX-AV-LA
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	ADN-REC01
47	5.58E-12	0.27	LOSS OF COMPRESSED AIR INITIATING EVENT OCCURS	3.48E-02	IEV-LCAS
			MANUALLY REGULATE FLOW TO SG "A"	2.04E-01	REG-MAN00
			FAILURE OF PRHR DUE TO COMMON CAUSE OF AOVs	9.60E-05	PXX-AV-LA
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	LPM-REC01
48	4.64E-12	0.23	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07

Table 43-6 (Sheet 68 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
49	4.46E-12	0.22	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
			D/G FAILS TO START & RUN OR BKR 102 FAILS TO CLOSE	2.02E-02	ZO1MOD01
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
50	4.41E-12	0.22	LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	ADN-REC01

Table 43-6 (Sheet 69 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Title: LRF Cutsets for 10CFE3C

Reduced Sum of Cutsets: 1.0000E-09

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
1	1.00E-09	100	REACTOR VESSEL RUPTURE INITIATING EVENT OCCURS	1.00E-08	IEV-RV-RP
			CFE - OCCURS	1.00E-01	CFE-OCCURS

Table 43-7 (Sheet 1 of 2)

SUMMARY OF RELEASE FREQUENCY CALCULATIONS

		2E	2L	2R	1A	1P	3A	3C	3D	6
	IC	7.70E-08	2.34E-08	4.62E-08	2.96E-09	8.55E-10	3.44E-10	8.97E-09	5.63E-08	5.41E-09
	CFE	3.22E-09	1.83E-13	1.00E-11	0.00E+00	1.48E-11	0.00E+00	9.99E-10	3.03E-09	1.86E-10
	CFI	1.82E-10	4.72E-14	5.55E-12	0.00E+00	1.15E-13	0.00E+00	1.08E-12	1.70E-13	1.09E-14
	CFV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	CFL	1.34E-13	2.35E-14	5.20E-14	9.71E-15	0.00E+00	2.42E-14	1.04E-14	8.60E-14	5.44E-15
	CI	1.32E-10	5.83E-10	7.67E-11	4.60E-12	1.32E-12	6.33E-12	2.66E-11	3.62E-10	1.40E-10
	BP	0.00E+00	0.00E+00	0.00E+00	2.04E-09	6.05E-10	4.08E-09	0.00E+00	0.00E+00	3.78E-09
	Total	8.06E-08	2.40E-08	4.63E-08	5.01E-09	1.48E-09	4.43E-09	1.00E-08	5.97E-08	9.52E-09
		2E	2L	2R	1A	1P	3A	3C	3D	6
1	IC	5.51E-08	0.000E+00	4.619E-08	2.941E-09	8.538E-10	3.364E-10	8.966E-09	0.000E+00	0.000E+00
2	CFE	0.00E+00	0.000E+00	0.000E+00	0.000E+00	1.477E-11	0.000E+00	0.000E+00	0.000E+00	0.000E+00
3	IC	1.28E-09	0.000E+00	3.718E-11	1.921E-11	7.704E-13	7.209E-12	7.249E-12	0.000E+00	0.000E+00
4	CFI	1.82E-10	0.000E+00	5.555E-12	0.000E+00	1.151E-13	0 000E+00	1.083E-12	0.000E+00	0.000E+00
5	CFI	0.00E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
6	CFE	4.75E-10	0.000E+00	1.002E-11	0.000E+00	5.055E-14	0.000E+00	1.954E-12	0.000E+00	0.000E+00
7	CFV	0.00E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
8	CFI	0.00E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
9	CFL	9.80E-14	0.000E+00	5.200E-14	9.712E-15	0.000E+00	2.419E-14	1.037E-14	0.000E+00	0.000E+00

Table 43-7 (Sheet 2 of 2)

SUMMARY OF RELEASE FREQUENCY CALCULATIONS

		2E	2L	2R	1A	1P	3A	3C	3D	6
10	CFE	0.00E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.973E-10	0.000E+00	0.000E+00
11	IC	2.01E-08	2.333E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.612E-08	5.407E-09
12	CFE	0.00E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.706E-10	0 000E+00
13	IC	6.23E-10	3.630E-11	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.309E-10	8.411E-12
14	CFI	8.11E-13	4.725E-14	0 000E+00	0.000E+00	0.000E+00	0 000E+00	0.000E+00	1.705E-13	1.095E-14
15	CFI	0.00E+00	0.000E+00	0.000E+00	0 000E+00	0.000E+00	0.000E+00	0 000E+00	0.000E+00	0.000E+00
16	CFE	8 27E-11	1.826E-13	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.704E-11	4.232E-14
17	CFV	0.00E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
18	CFI	0 00E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
19	CFL	3.57E-14	2.349E-14	0.000E+00	0 000E+00	0.000E+00	0.000E+00	0.000E+00	8.602E-14	5.443E-15
20	CFE	0.00E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
21	CFE	2.67E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.046E-09	1.860E-10
22	CI	1.32E-10	5 826E-10	7.669E-11	4.602E-12	1.324E-12	6.328E-12	2.658E-11	3.622E-10	1.396E-10
23	BP	0 00E+00	0.000E+00	0.000E+00	2.042E-09	6.052E-10	4.077E-09	0.000E+00	0.000E+00	3.783E-09
	Total	8 06E-08	2.395E-08	4.632E-08	5.007E-09	1.476E-09	4.427E-09	1.000E-08	5.965E-08	9.524E-09

Table 43-8

LRF AND CONTAINMENT EFFECTIVENESS BY ACCIDENT CLASS

	2E	2L	2R	1A	1P	3A	3C	3D	6		TOTAL	%
CDF	8.06E-08	2.40E-08	4.63E-08	5.01E-09	1.48E-09	4.43E-09	1.00E-08	5.97E-08	9.52E-09		2.41E-07	100.0%
CFE	3.22E-09	1.83E-13	1.00E-11	0.00E+00	1.48E-11	0.00E+00	9.99E-10	3.03E-09	1.86E-10		7.47E-09	38.3%
CFI	1.82E-10	4.72E-14	5.55E-12	0.00E+00	1.15E-13	0.00E+00	1.08E-12	1.70E-13	1.09E-14		1.89E-10	1.0%
CFV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.0%
CFL	1.34E-13	2.35E-14	5.20E-14	9.71E-15	0.00E+00	2.42E-14	1.04E-14	8.60E-14	5.44E-15		3.45E-13	0.0%
CI	1.32E-10	5.83E-10	7.67E-11	4.60E-12	1.32E-12	6.33E-12	2.66E-11	3.62E-10	1.40E-10		1.33E-09	6.8%
BP	0.00E+00	0.00E+00	0.00E+00	2.04E-09	6.05E-10	4 08E-09	0.00E+00	0.00E+00	3.78E-09		1.05E-08	53.9%
LRF	3.54E-09	5.83E-10	9.23E-11	2.05E-09	6.21E-10	4.08E-09	1.03E-09	3.40E-09	4.11E-09		1.95E-08	100.0%
	18.2%	3.0%	0.5%	10.5%	3.2%	20.9%	5.3%	17.4%	21.1%			
CNTM-EFF	95.6%	97.6%	99.8%	59.1%	57.9%	7.8%	89.7%	94.3%	56.9%		91.9%	

Table 43-9

SUMMARY OF AP1000 LRF QUANTIFICATION FOR INTERNAL EVENTS AT-POWER

CDF			2.41E-07/year
LRF			1.95E-08/year
Containment Effectiveness			91.9%
Dominant Accident Classes			
6	4.11E-09	21.1%	Containment Bypass by SGTR or ISLOCA
3A	4.08E-09	20.9%	High RCS Pressure and ATWS
2E	3.54E-09	18.2%	RCS Depressurized
3D	3.40E-09	17.4%	Partial RCS Depressurization
1A	2.05E-09	10.5%	High RCS Pressure (Transient or SLOCA)
3C	1.03E-09	5.3%	Vessel Failure
1P	6.21E-10	3.2%	High RCS Pressure (PRHR operating)
2L	5.83E-10	3.0%	RCS Depres.(Gravity Injection succ.; Sump Recirc. fails)
2R	9.23E-11	0.5%	RCS Depressurized (CMT and ACC fail)
Total	1.95E-08	100%	
Dominant Release Categories			
BP	1.05E-08	53.9%	Containment Bypass
CFE	7.47E-09	38.3%	Early Containment Failure
CI	1.33E-09	6.8%	Containment Isolation Failure
Total	1.93E-08	99.0%	

Table 43-10

CET EVENT TREE NODE IMPORTANCES

CET NODE	LRF (per year)	Containment Failure Prob	Containment Effectiveness	Node Failed in Following PDS
BASE LRF	1.95E-08	8.1%	91.9%	N/A
DP RCS Depressurization	2.91E-08	12.1%	87.9%	1A, 1AP, 3A, and 6 set to 1.0.
IS Containment Isolation	2.41E-07	100.0%	0.0%	all PDS set to 1.0
IR Cavity Flooding	1.58E-07	65.6%	34.4%	3BE, 3D, 6 set to 1.0
RFL Core Reflooding	1.91E-08	7.9%	92.1%	3BE set to 1.0
VF Vessel Failure	2.85E-08	11.8%	88.2%	3C set to 1.0
PC PCS Failure	2.41E-07	100.0%	0.0%	all PDS set to 1.0
IG Hydrogen Igniter Failure	6.28E-08	26.0%	74.0%	all PDS set to 1.0
DF Diffusion Flame	1.41E-07	58.3%	41.7%	3D and 1AP set to 1.0; 3BE set to 0.8535 (85% of 3BE are SI-LB events where DF may exist. Diffusion flame does not apply to other PDS.
DTE Early DDT	2.16E-08	9.0%	91.0%	all PDS set to 1.0
DFG Hydrogen Deflagration	2.17E-08	9.0%	91.0%	all PDS set to 1.0
DTI Intermediate DDT	2.17E-08	9.0%	91.0%	all PDS set to 1.0

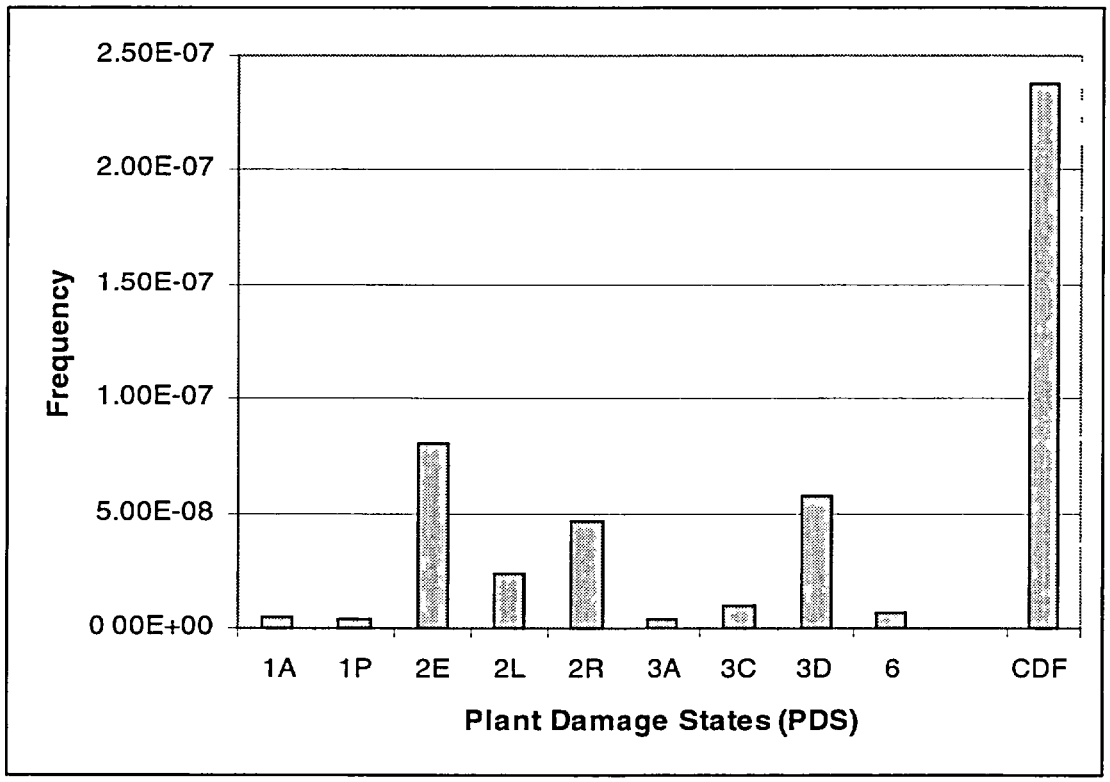


Figure 43-1

Plant Damage State Contributions to CDF

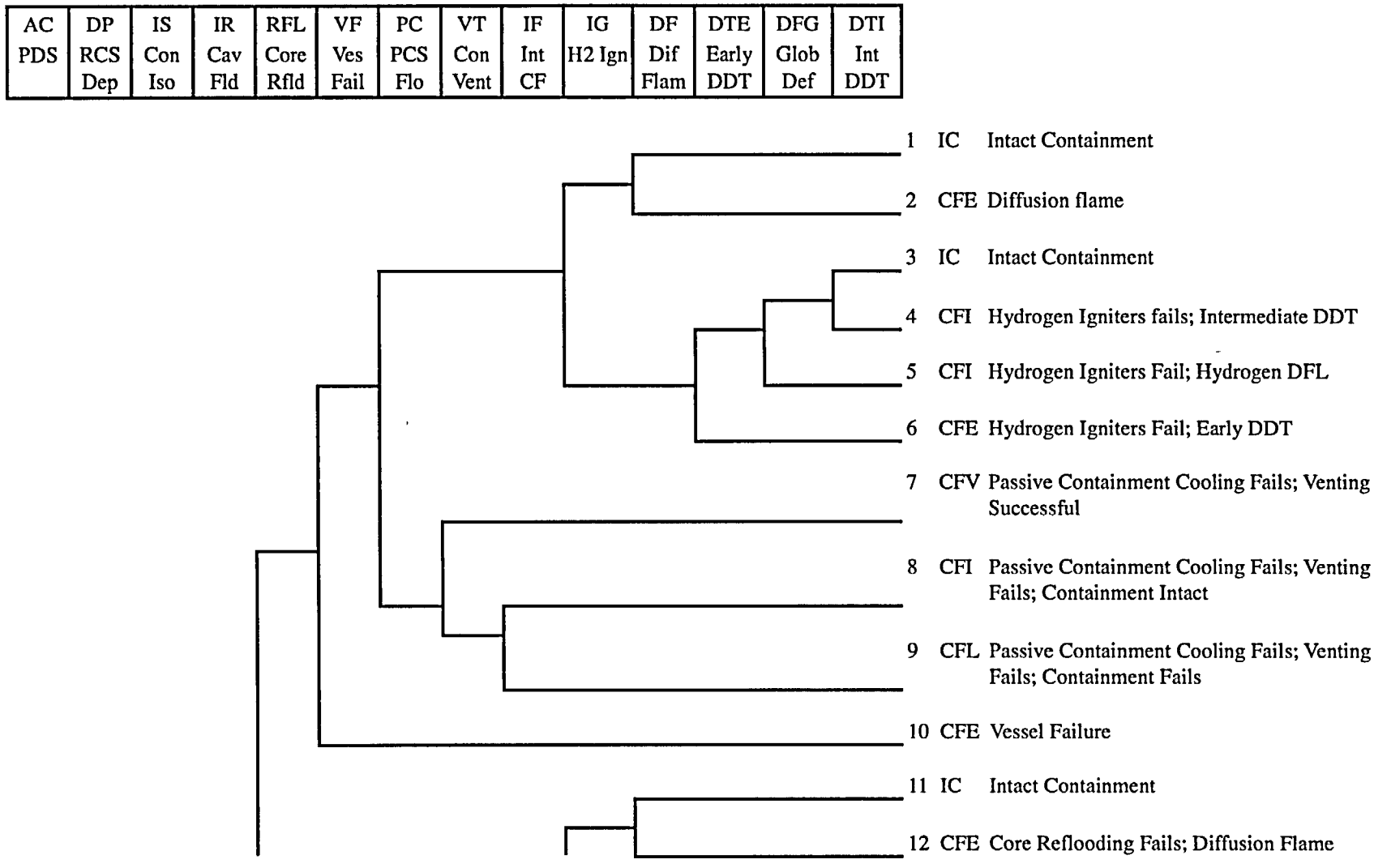


Figure 43-2 (Sheet 1 of 3)

Containment Event Tree – CET

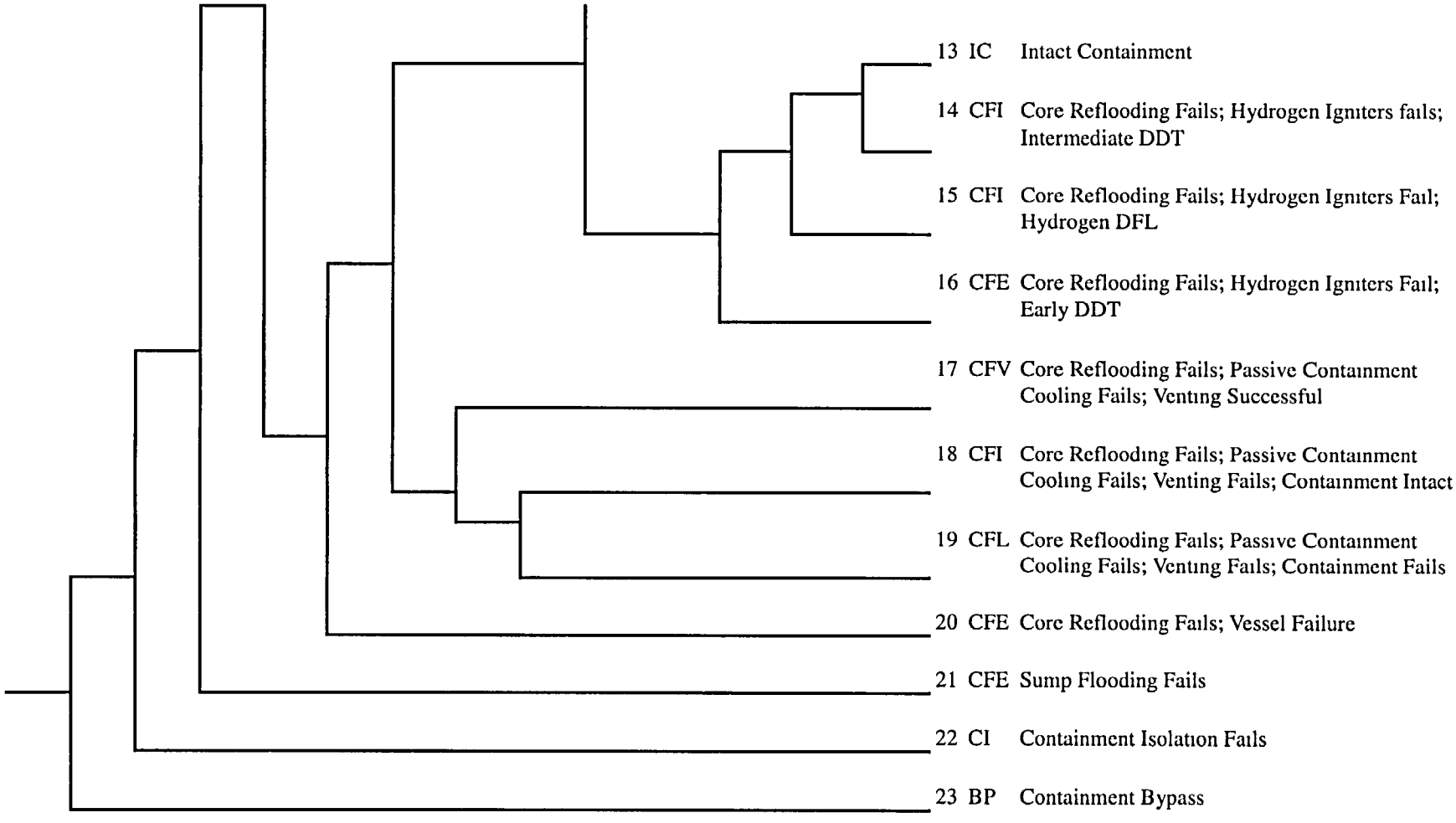
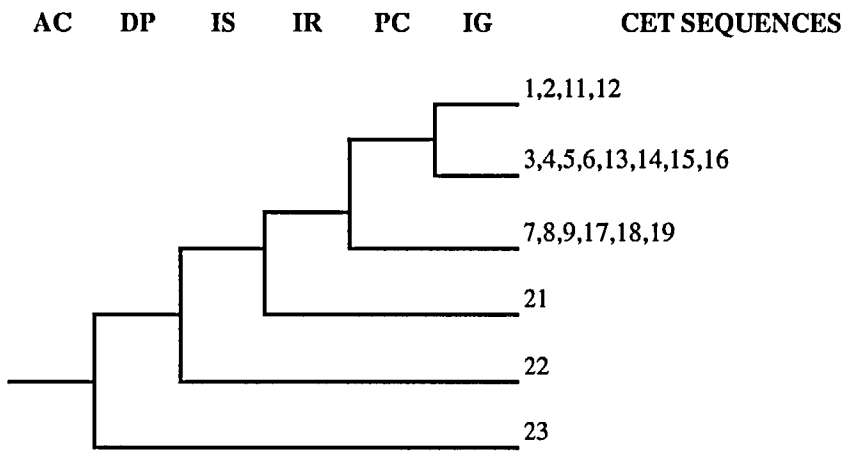


Figure 43-2 (Sheet 2 of 3)

Containment Event Tree – CET



CET sequences 10 and 20 not shown above contain success of IS, and IR nodes, but do not involve the PC and IG nodes.

Figure 43-2 (Sheet 3 of 3)

Containment Event Tree – CET

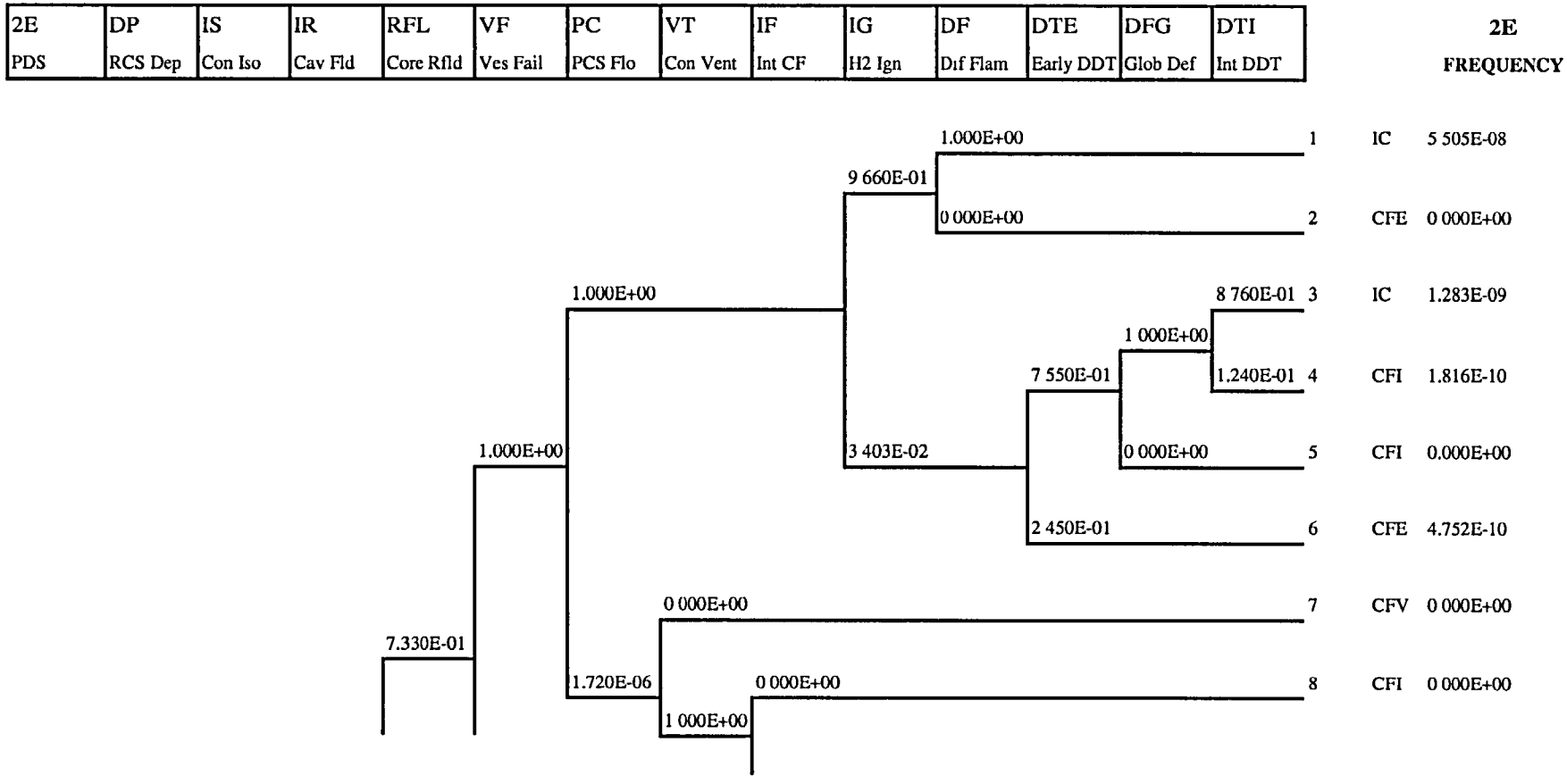


Figure 43-3 (Sheet 1 of 3)

3BE CET

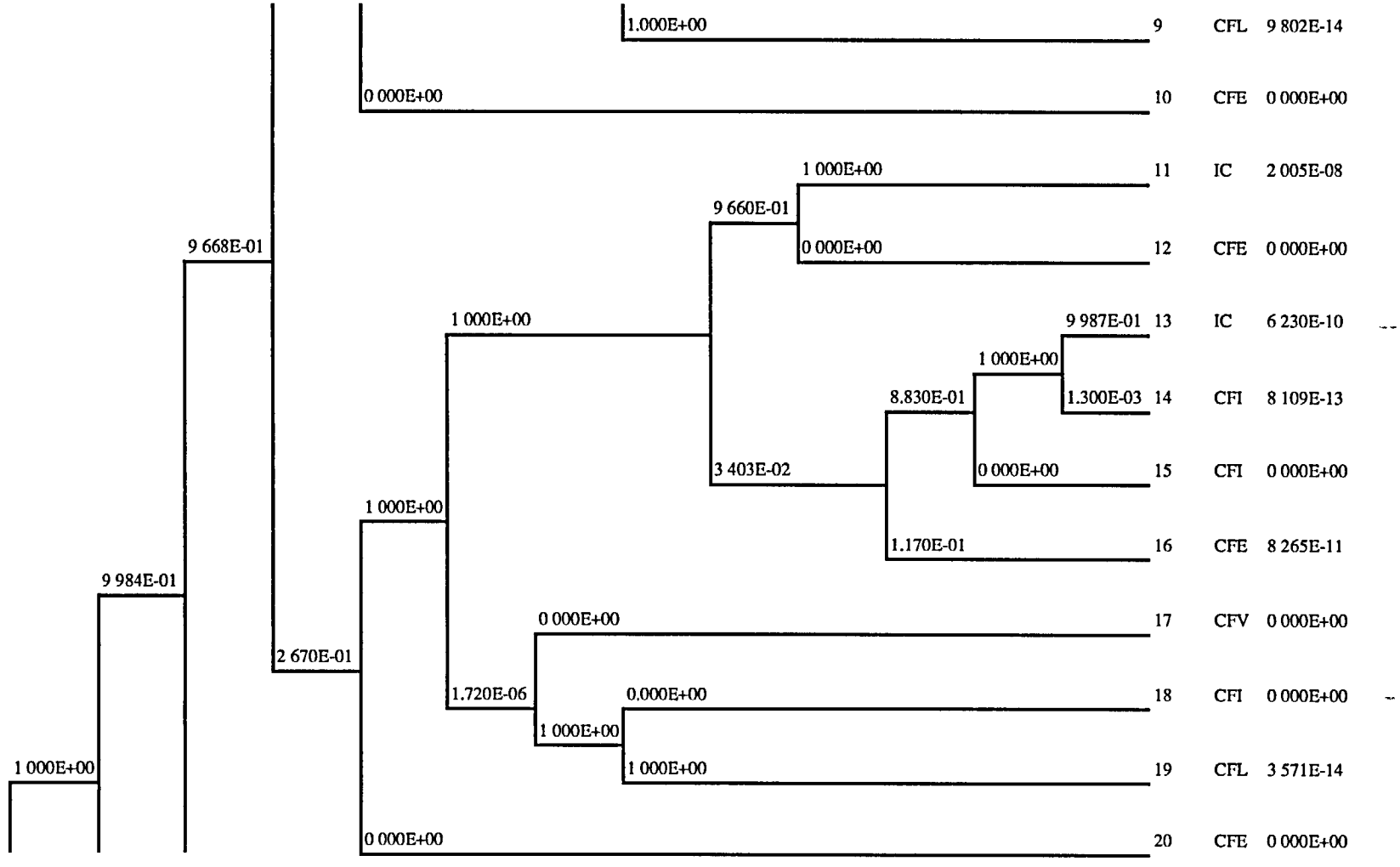
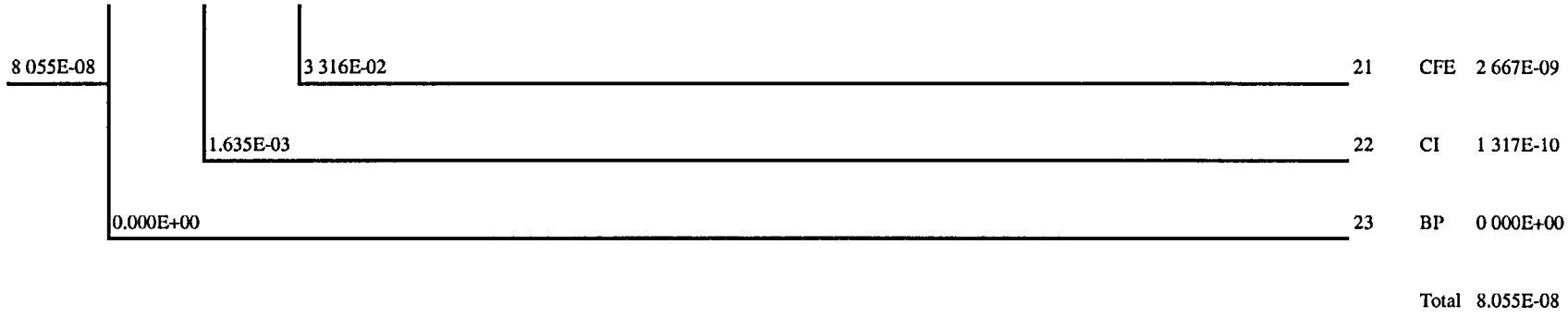


Figure 43-3 (Sheet 2 of 3)

3BE CET



Fail	2E Success		2E Rel. Cat.	Freq.	%
8.055E-08		**AC**	IC	7 701E-08	95 61%
0 000E+00	1.000E+00	**DP**	CFE	3.225E-09	4 00%
1.635E-03	9.984E-01	**IS**	CFI	1 824E-10	0 23%
3 316E-02	9 668E-01	**IR**	CFV	0 000E+00	0 00%
2 670E-01	7 330E-01	**RFL**	CFL	1 337E-13	0 00%
0.000E+00	1 000E+00	**VF**	CI	1 317E-10	0 16%
1 720E-06	1 000E+00	**PC**	BP	0 000E+00	0 00%
1 000E+00	0 000E+00	**VT**			
1.000E+00	0.000E+00	**IF**	Total	8 055E-08	100 00%
3.403E-02	9.660E-01	**IG**			
0.000E+00	1.000E+00	**DF**			
2 450E-01	7.550E-01	**DTE**			
0 000E+00	1 000E+00	**DFG**			
1 240E-01	8.760E-01	**DTI**			
1 300E-03	9.987E-01	**DTI-2**			
1.170E-01	8 830E-01	**DTE-2**			

Figure 43-3 (Sheet 3 of 3)

3BE CET

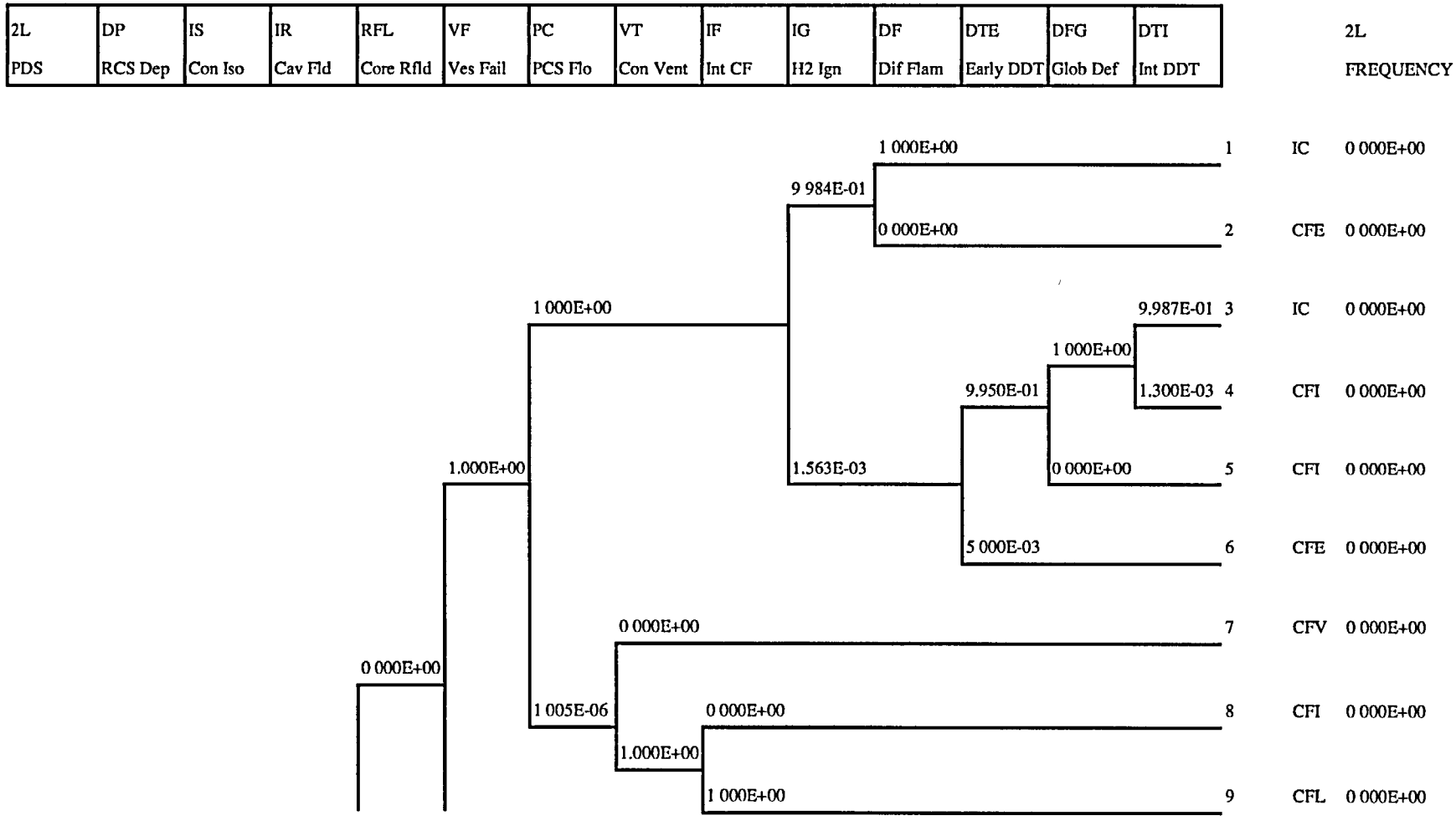


Figure 43-4 (Sheet 1 of 3)

3BL CET

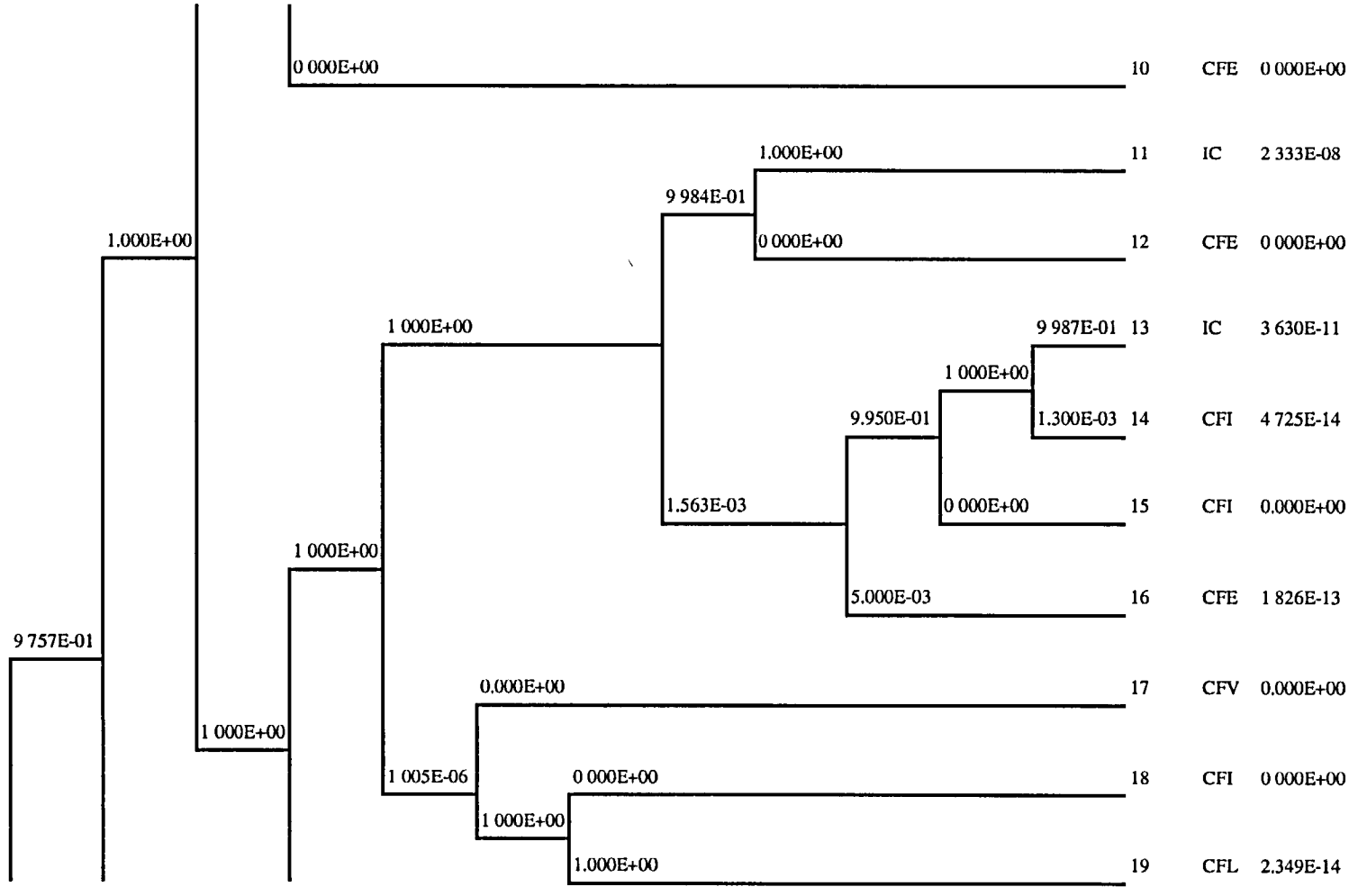
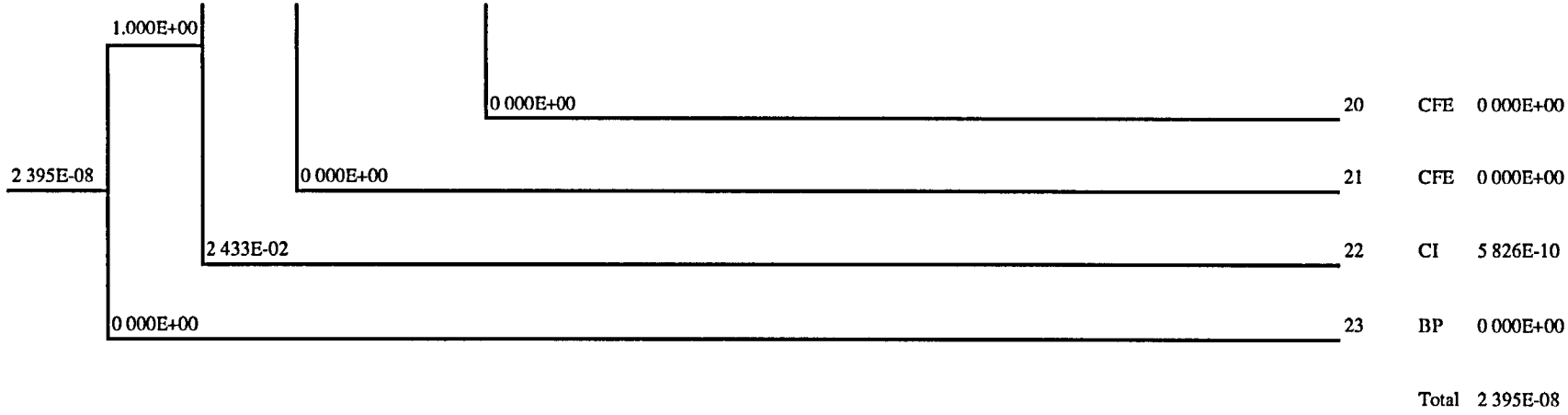


Figure 43-4 (Sheet 2 of 3)

3BL CET



Fail	2L Success		2L Rel. Cat.	Freq.	%
2 395E-08		AC	IC	2.337E-08	97.57%
0 000E+00	1 000E+00	DP	CFE	1.826E-13	0 00%
2.433E-02	9.757E-01	IS	CFI	4.725E-14	0 00%
0 000E+00	1 000E+00	IR	CFV	0 000E+00	0 00%
1 000E+00	0 000E+00	RFL	CFL	2 349E-14	0 00%
0 000E+00	1 000E+00	VF	CI	5 826E-10	2 43%
1 005E-06	1 000E+00	PC	BP	0 000E+00	0 00%
1.000E+00	0.000E+00	VT			
1 000E+00	0 000E+00	IF	Total	2.395E-08	100 00%
1.563E-03	9.984E-01	IG			
0 000E+00	1.000E+00	DF			
5 000E-03	9 950E-01	DTE			
0 000E+00	1.000E+00	DFG			
1.300E-03	9 987E-01	DTI			

Figure 43-4 (Sheet 3 of 3)

3BL CET

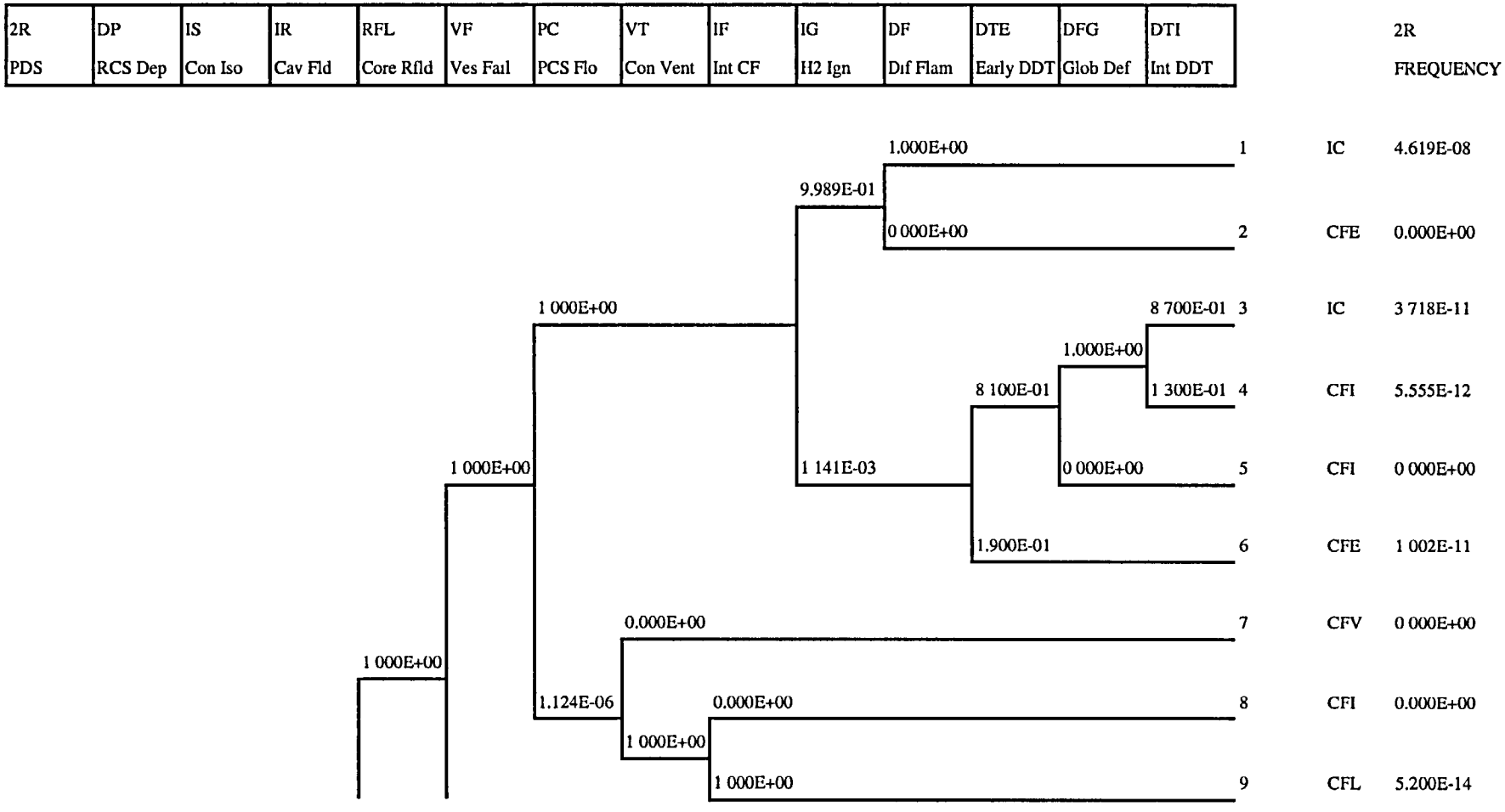


Figure 43-5 (Sheet 1 of 3)

3BR CET

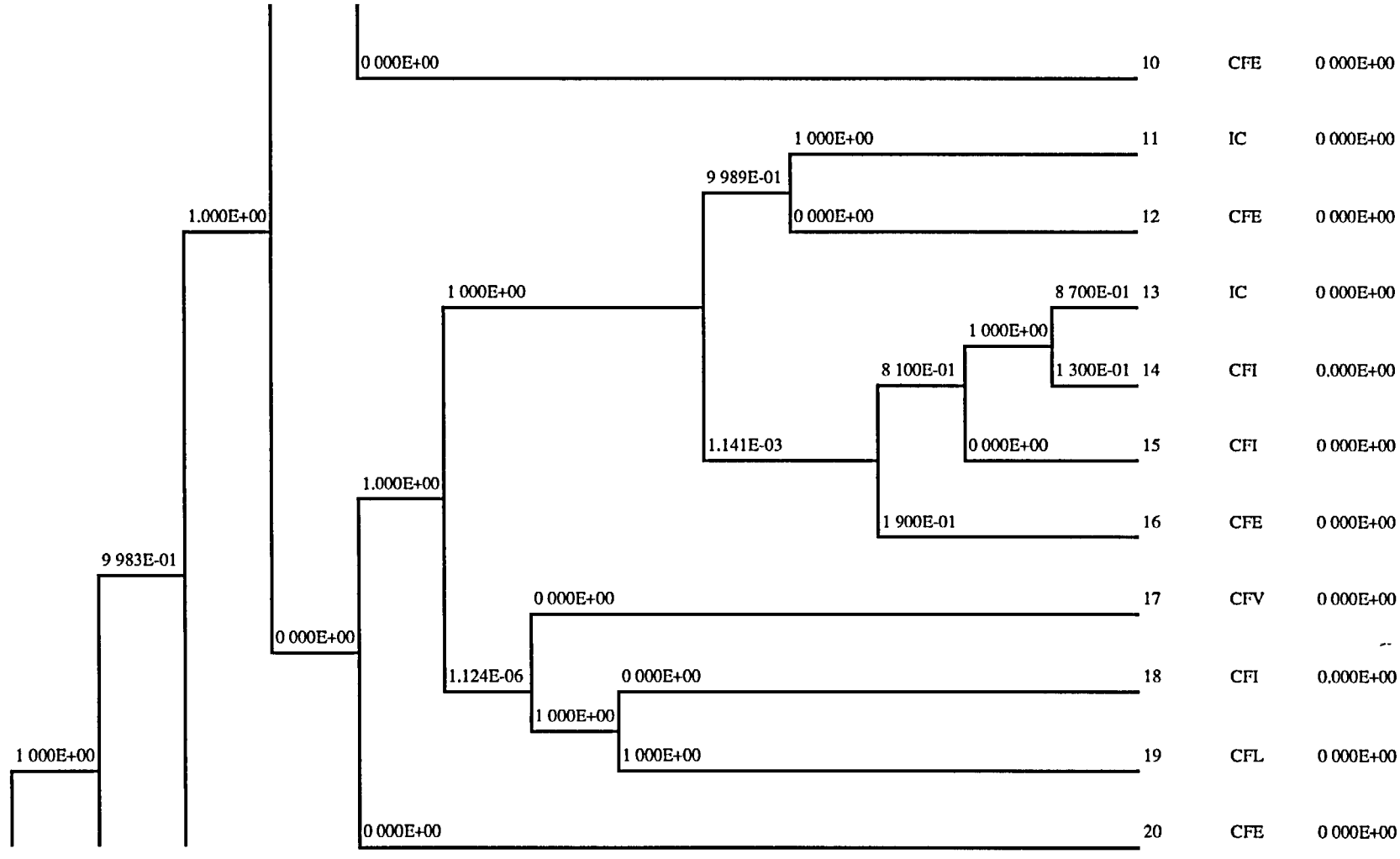
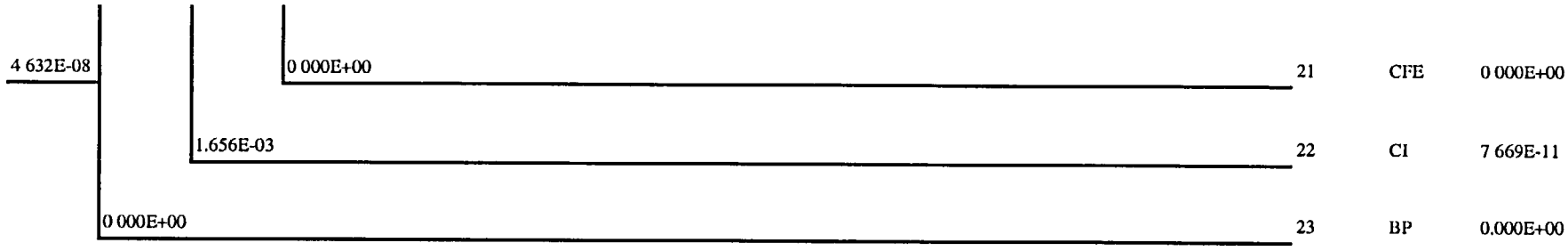


Figure 43-5 (Sheet 2 of 3)

3BR CET



Fail	2R Success		2R Rel. Cat.	Freq.	%
4.632E-08		AC	IC	4.623E-08	99 80%
0 000E+00	1 000E+00	DP	CFE	1 002E-11	0.02%
1 656E-03	9.983E-01	IS	CFI	5 555E-12	0.01%
0 000E+00	1 000E+00	IR	CFV	0.000E+00	0 00%
0 000E+00	1 000E+00	RFL	CFL	5.200E-14	0 00%
0 000E+00	1.000E+00	VF	CI	7.669E-11	0 17%
1.124E-06	1.000E+00	PC	BP	0 000E+00	0 00%
1.000E+00	0 000E+00	VT			
1 000E+00	0 000E+00	IF	Total	4 632E-08	100 00%
1.141E-03	9.989E-01	IG			
0 000E+00	1 000E+00	DF			
1 900E-01	8.100E-01	DTE			
0 000E+00	1 000E+00	DFG			
1.300E-01	8 700E-01	DTI			

Figure 43-5 (Sheet 3 of 3)

3BR CET

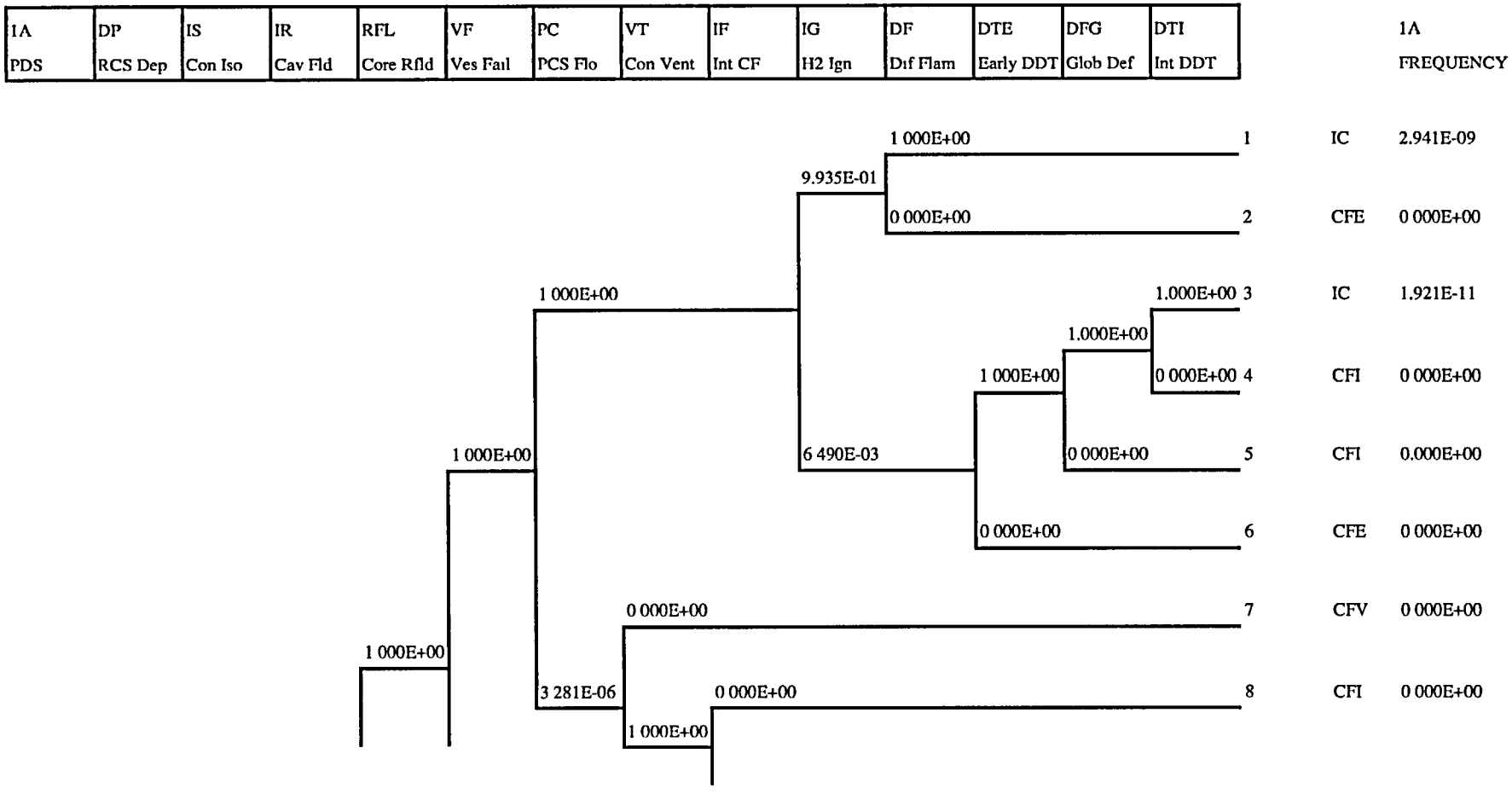


Figure 43-6 (Sheet 1 of 3)

1A CET

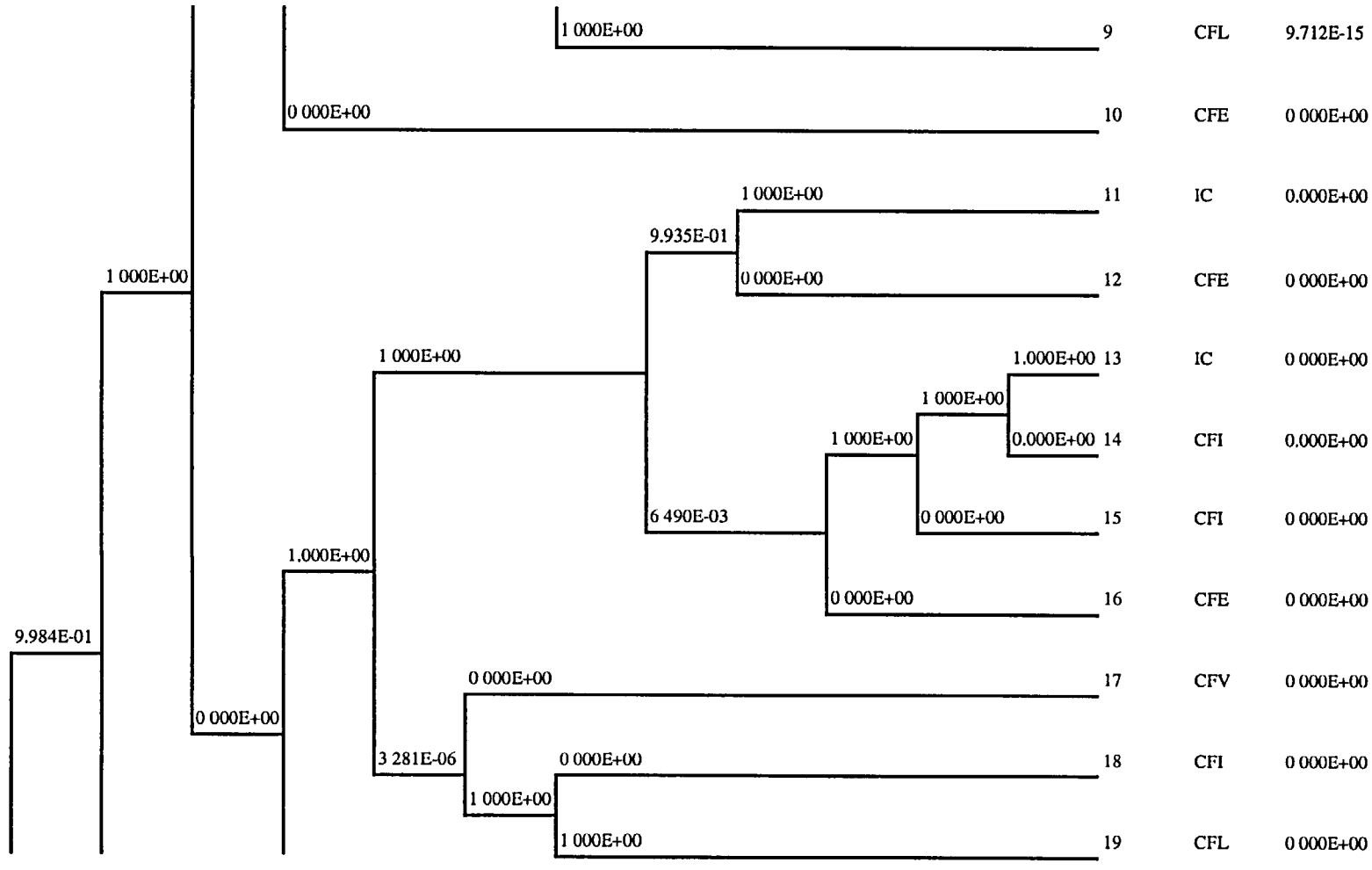
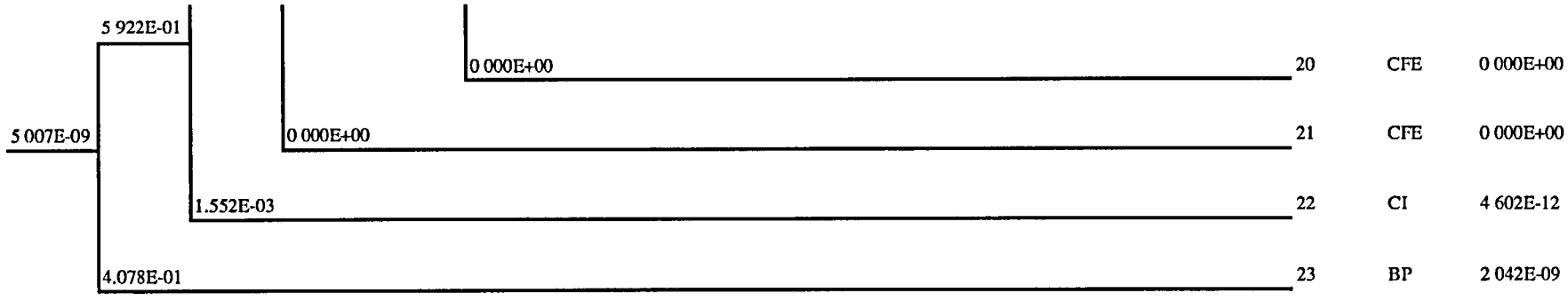


Figure 43-6 (Sheet 2 of 3)

1A CET



Fail	1A Success		1A Rel Cat	Freq	%
5 007E-09		AC	IC	2 960E-09	59 13%
4 078E-01	5 922E-01	DP	CFE	0 000E+00	0 00%
1.552E-03	9 984E-01	IS	CFI	0 000E+00	0 00%
0 000E+00	1.000E+00	IR	CFV	0 000E+00	0 00%
0 000E+00	1 000E+00	RFL	CFL	9.712E-15	0 00%
0 000E+00	1 000E+00	VF	CI	4 602E-12	0 09%
3.281E-06	1.000E+00	PC	BP	2 042E-09	40 78%
1 000E+00	0.000E+00	VT			
1.000E+00	0 000E+00	IF	Total	5.007E-09	100 00%
6 490E-03	9 935E-01	IG			
0 000E+00	1.000E+00	DF			
0 000E+00	1 000E+00	DTE			
0 000E+00	1 000E+00	DFG			
0 000E+00	1 000E+00	DTI			

Figure 43-6 (Sheet 3 of 3)

1A CET

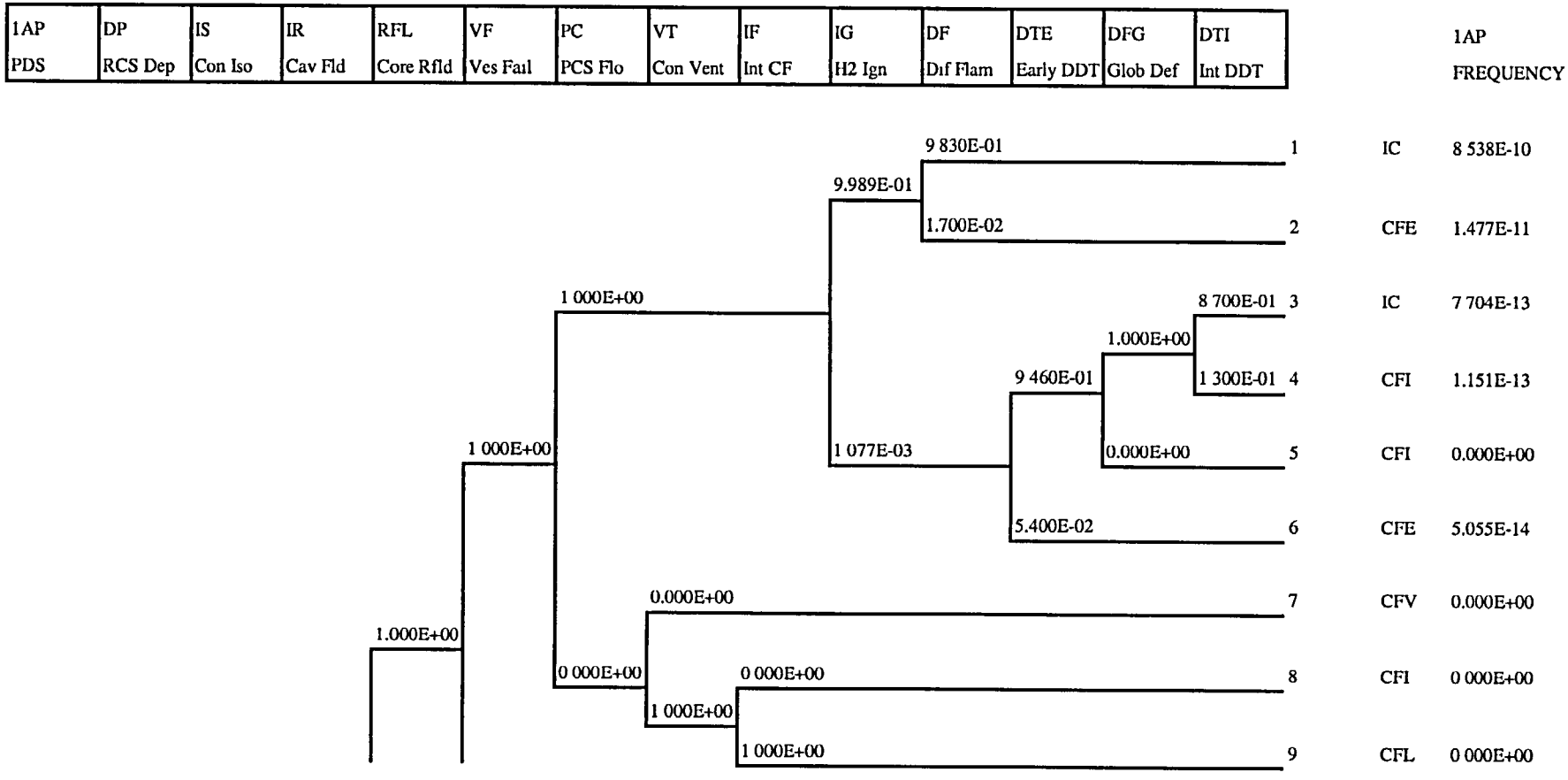


Figure 43-7 (Sheet 1 of 3)

1AP CET

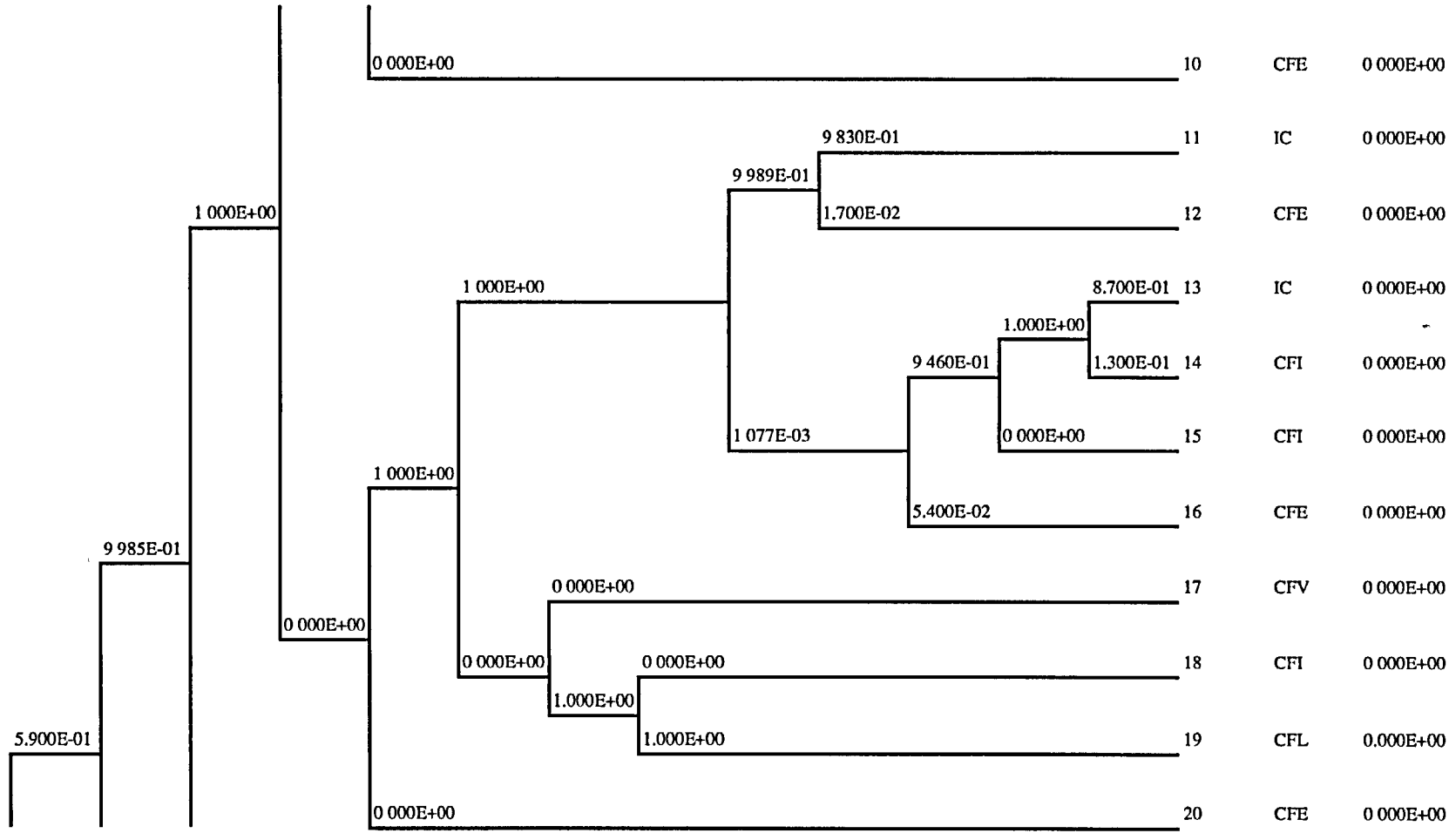
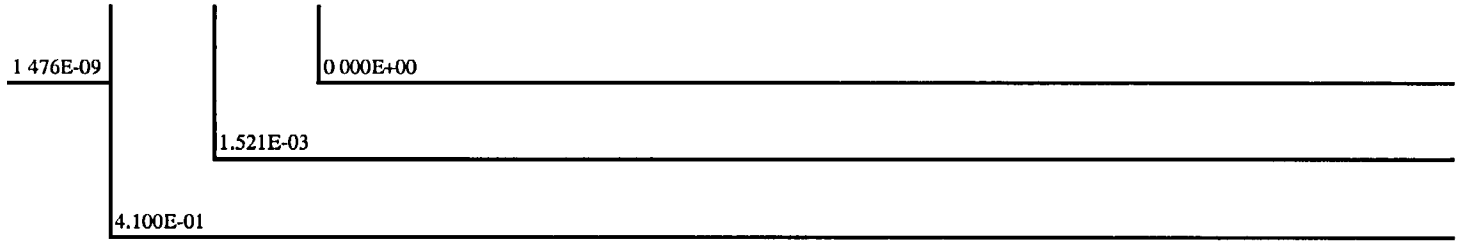


Figure 43-7 (Sheet 2 of 3)

1AP CET



CFE	0.000E+00
CI	1.324E-12
BP	6 052E-10
Total	1 476E-09

Fail	1AP Success		1AP Rel Cat	Freq	%
1.476E-09		AC	IC	8.545E-10	57.90%
4.100E-01	5.900E-01	DP	CFE	1.482E-11	1.00%
1 521E-03	9.985E-01	IS	CFI	1.151E-13	0 01%
0 000E+00	1 000E+00	IR	CFV	0 000E+00	0 00%
0 000E+00	1 000E+00	RFL	CFL	0 000E+00	0 00%
0 000E+00	1.000E+00	VF	CI	1.324E-12	0.09%
0.000E+00	1.000E+00	PC	BP	6.052E-10	41.00%
1 000E+00	0 000E+00	VT			
1 000E+00	0 000E+00	IF	Total	1.476E-09	100 00%
1 077E-03	9.989E-01	IG			
1 700E-02	9 830E-01	DF			
5.400E-02	9.460E-01	DTE			
0 000E+00	1 000E+00	DFG			
1 300E-01	8.700E-01	DTI			

Figure 43-7 (Sheet 3 of 3)

1AP CET

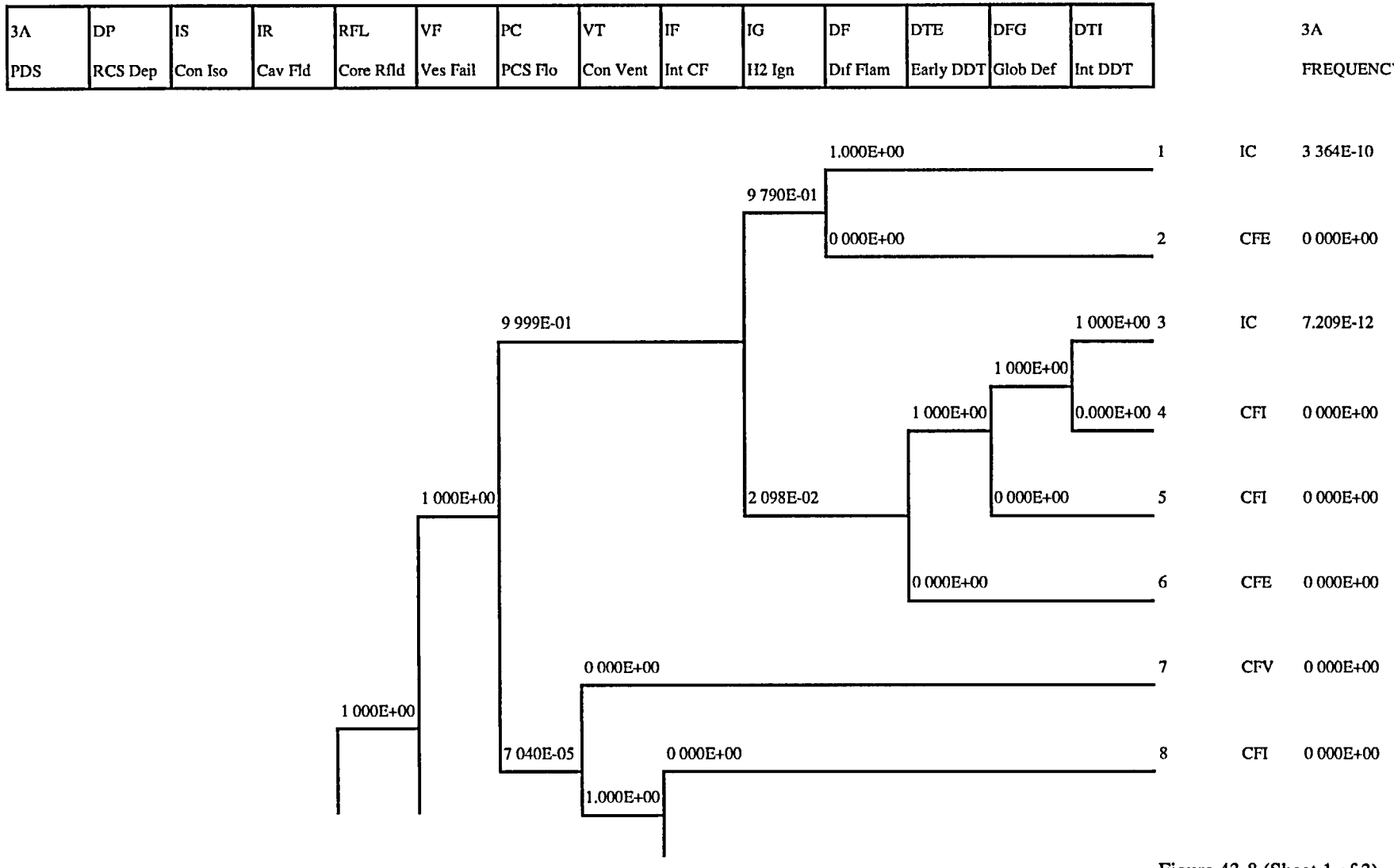


Figure 43-8 (Sheet 1 of 3)

3A CET

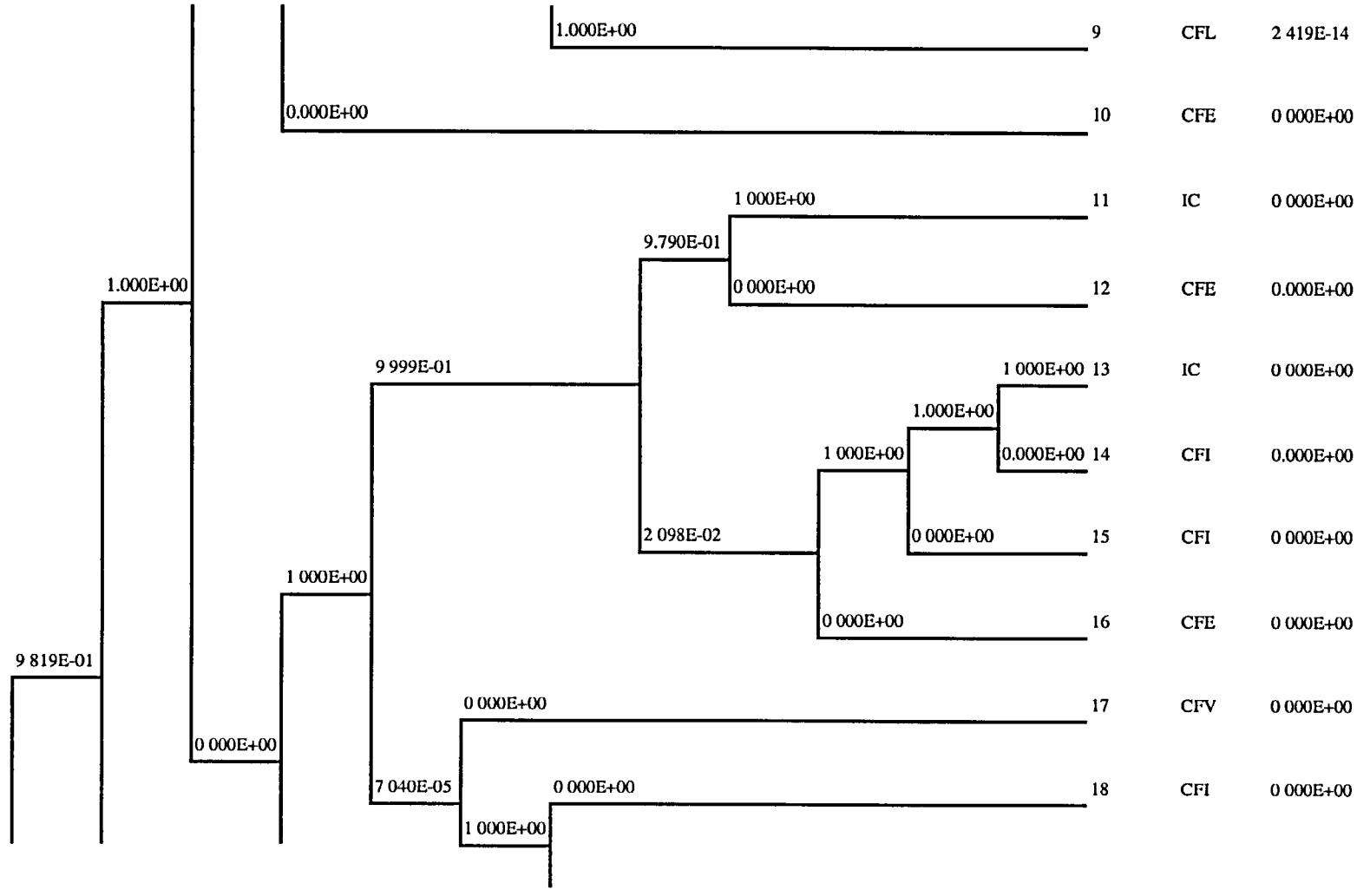
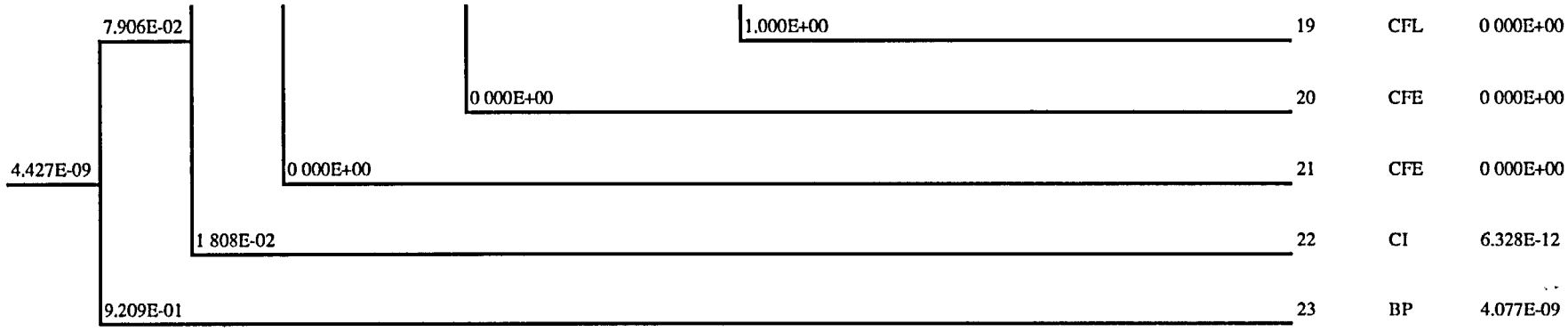


Figure 43-8 (Sheet 2 of 3)

3A CET



Fail	3A Success		3A Rel Cat.	Freq	%
4 427E-09		AC	IC	3 436E-10	7.76%
9 209E-01	7 906E-02	DP	CFE	0 000E+00	0.00%
1 808E-02	9 819E-01	IS	CFI	0 000E+00	0 00%
0 000E+00	1 000E+00	IR	CFV	0 000E+00	0 00%
0 000E+00	1 000E+00	RFL	CFL	2 419E-14	0 00%
0 000E+00	1 000E+00	VF	CI	6.328E-12	0.14%
7.040E-05	9 999E-01	PC	BP	4 077E-09	92 09%
1 000E+00	0 000E+00	VT			
1 000E+00	0 000E+00	IF	Total	4 427E-09	100 00%
2 098E-02	9.790E-01	IG			
0 000E+00	1.000E+00	DF			
0 000E+00	1 000E+00	DTE			
0 000E+00	1 000E+00	DFG			
0 000E+00	1.000E+00	DTI			

Figure 43-8 (Sheet 3 of 3)

3A CET

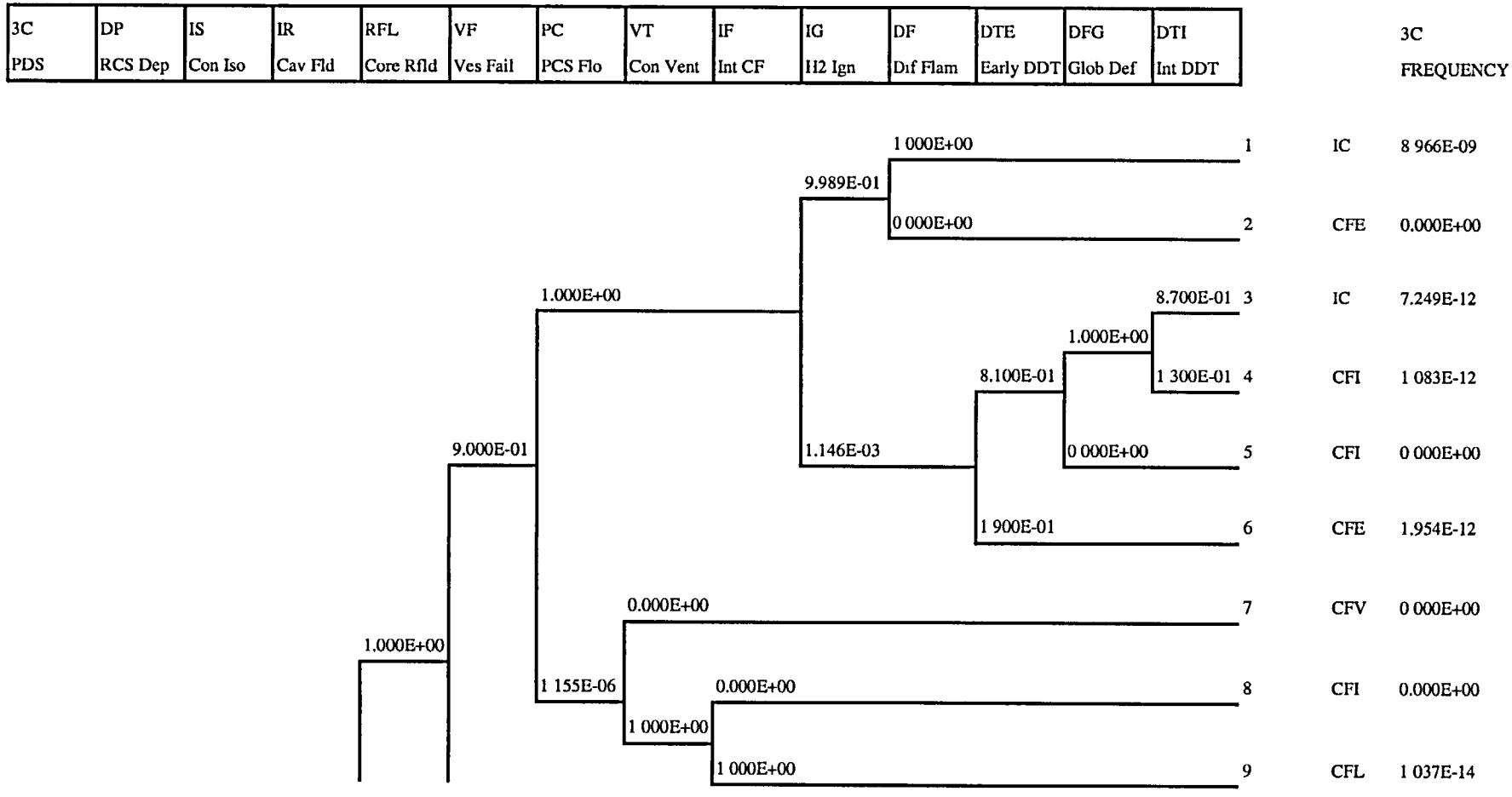


Figure 43-9 (Sheet 1 of 3)

3C CET

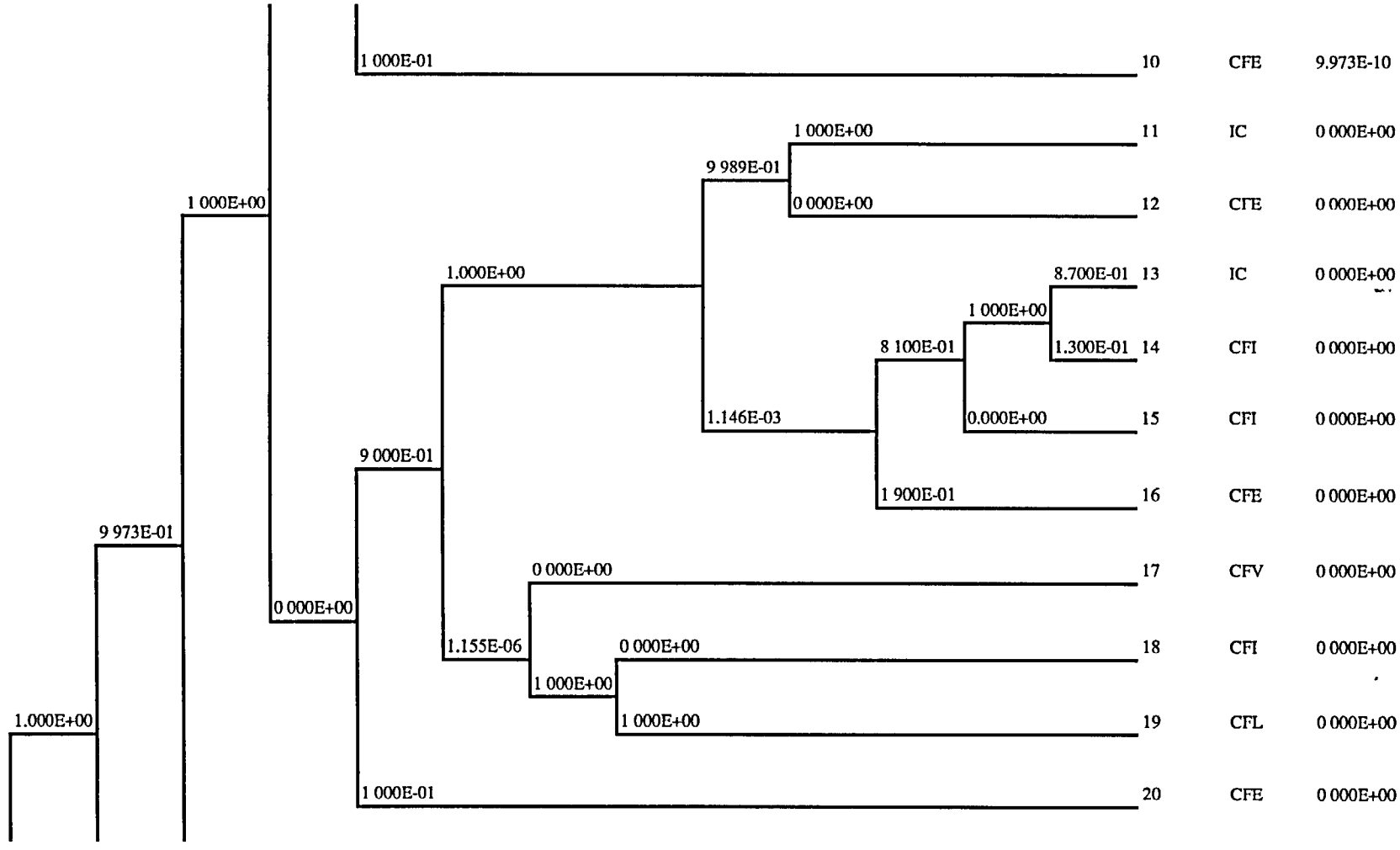
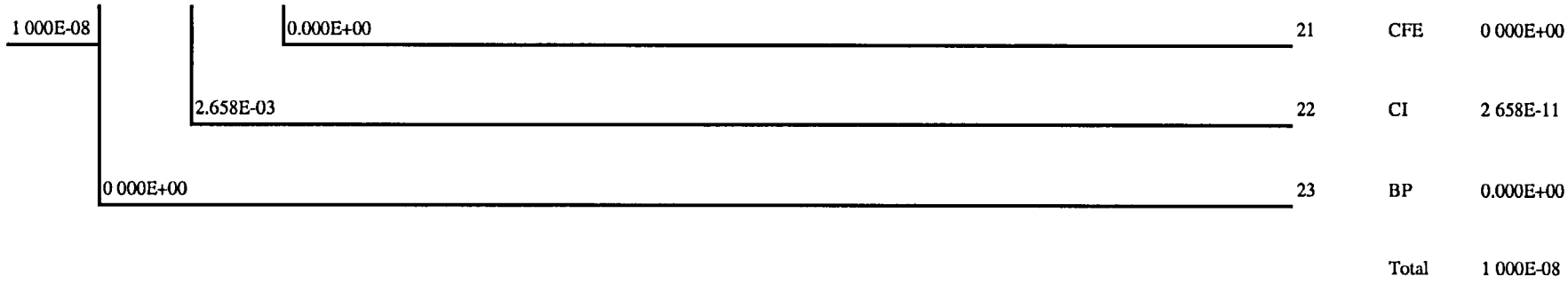


Figure 43-9 (Sheet 2 of 3)

3C CET



Fail	3C Success		3C Rel Cat.	Freq	%
1 000E-08		AC	IC	8.973E-09	89.73%
0.000E+00	1.000E+00	DP	CFE	9.993E-10	9.99%
2 658E-03	9.973E-01	IS	CFI	1 083E-12	0 01%
0 000E+00	1 000E+00	IR	CFV	0 000E+00	0 00%
0.000E+00	1.000E+00	RFL	CFL	1.037E-14	0 00%
1.000E-01	9.000E-01	VF	CI	2 658E-11	0 27%
1.155E-06	1.000E+00	PC	BP	0 000E+00	0 00%
1 000E+00	0 000E+00	VT			
1 000E+00	0 000E+00	IF	Total	1 000E-08	100 00%
1 146E-03	9.989E-01	IG			
0 000E+00	1 000E+00	DF			
1 900E-01	8.100E-01	DTE			
0 000E+00	1 000E+00	DFG			

Figure 43-9 (Sheet 3 of 3)

3C CET

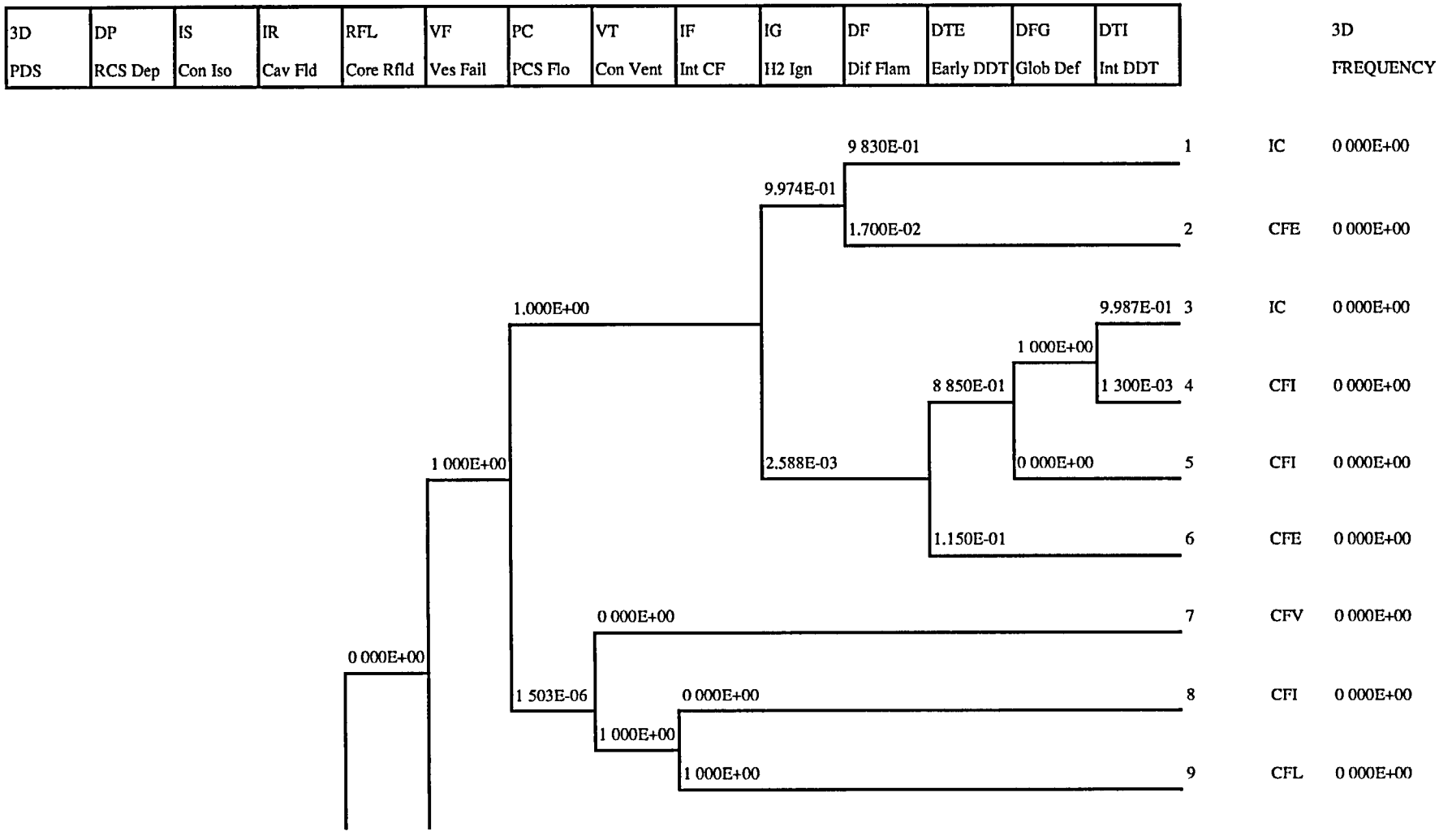


Figure 43-10 (Sheet 1 of 3)

3D CET

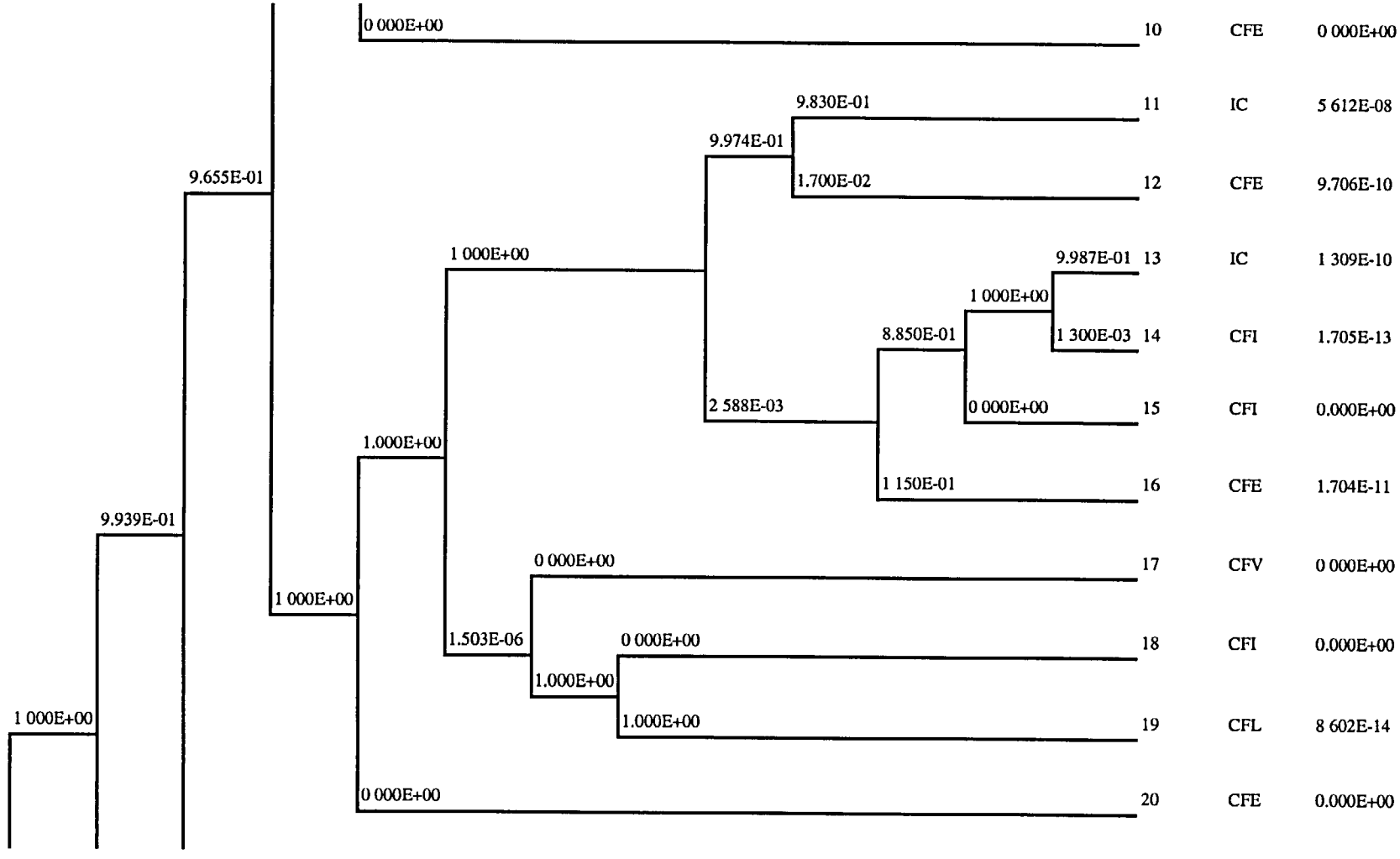
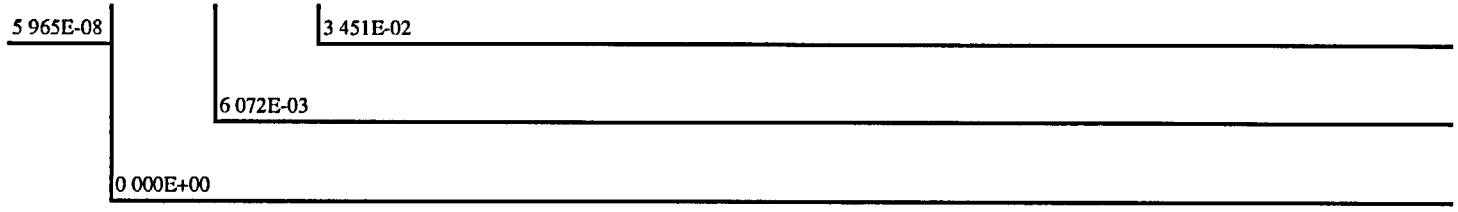


Figure 43-10 (Sheet 2 of 3)

3D CET



21	CFE	2 046E-09
22	CI	3 622E-10
23	BP	0 000E+00
	Total	5.965E-08

Fail	3D Success		3D Rel. Cat.	Freq	%
5.965E-08		AC	IC	5 625E-08	94 31%
0 000E+00	1.000E+00	DP	CFE	3 034E-09	5 09%
6 072E-03	9.939E-01	IS	CFI	1.705E-13	0 00%
3.451E-02	9.655E-01	IR	CFV	0 000E+00	0 00%
1.000E+00	0 000E+00	RFL	CFL	8 602E-14	0 00%
0 000E+00	1.000E+00	VF	CI	3 622E-10	0 61%
1.503E-06	1 000E+00	PC	BP	0 000E+00	0 00%
1 000E+00	0 000E+00	VT			
1 000E+00	0 000E+00	IF	Total	5 965E-08	100 00%
2.588E-03	9.974E-01	IG			
1.700E-02	9.830E-01	DF			
1.150E-01	8 850E-01	DTE			
0 000E+00	1 000E+00	DFG			
1.300E-03	9 987E-01	DTI			

Figure 43-10 (Sheet 3 of 3)

3D CET

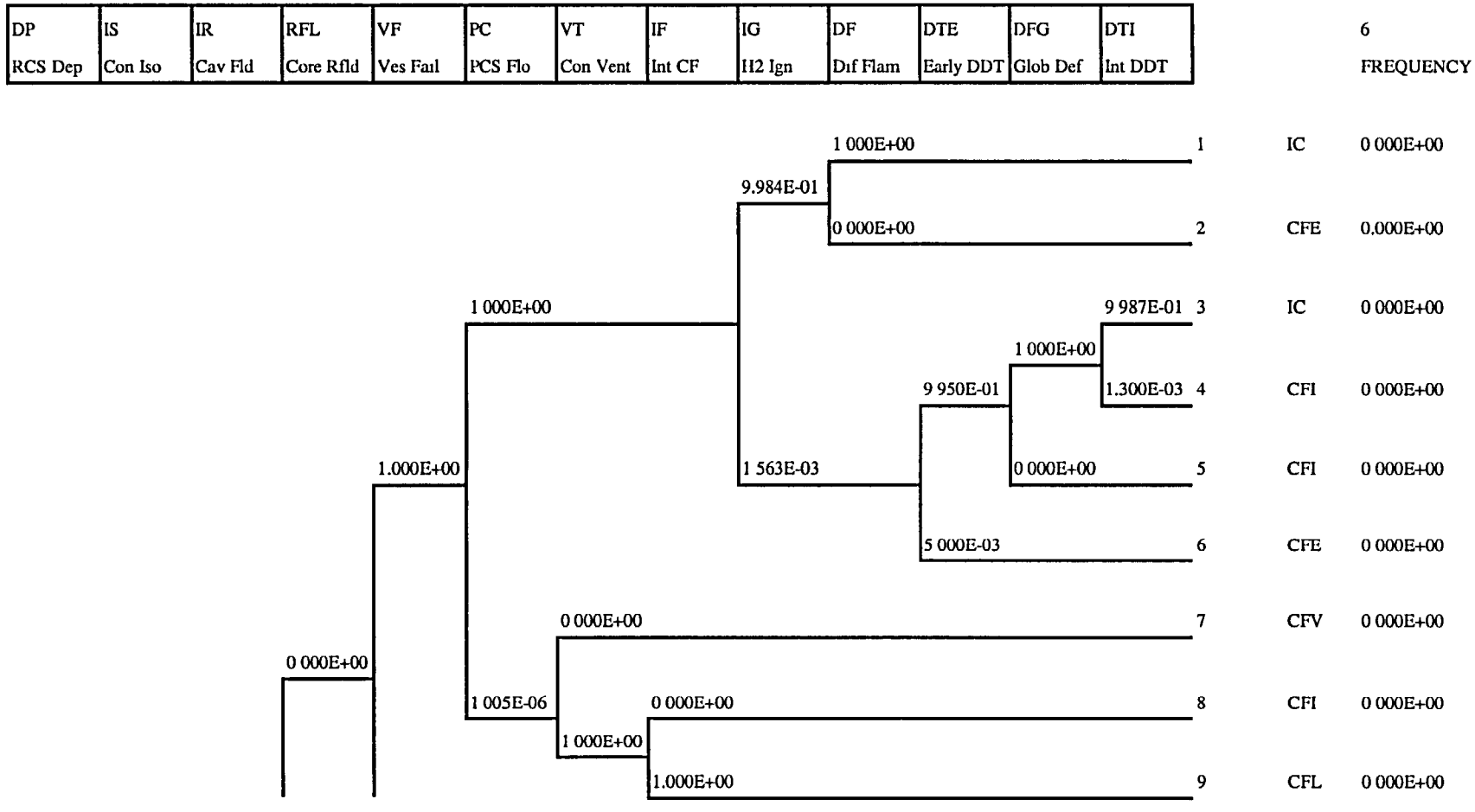


Figure 43-11 (Sheet 1 of 3)

6 CET

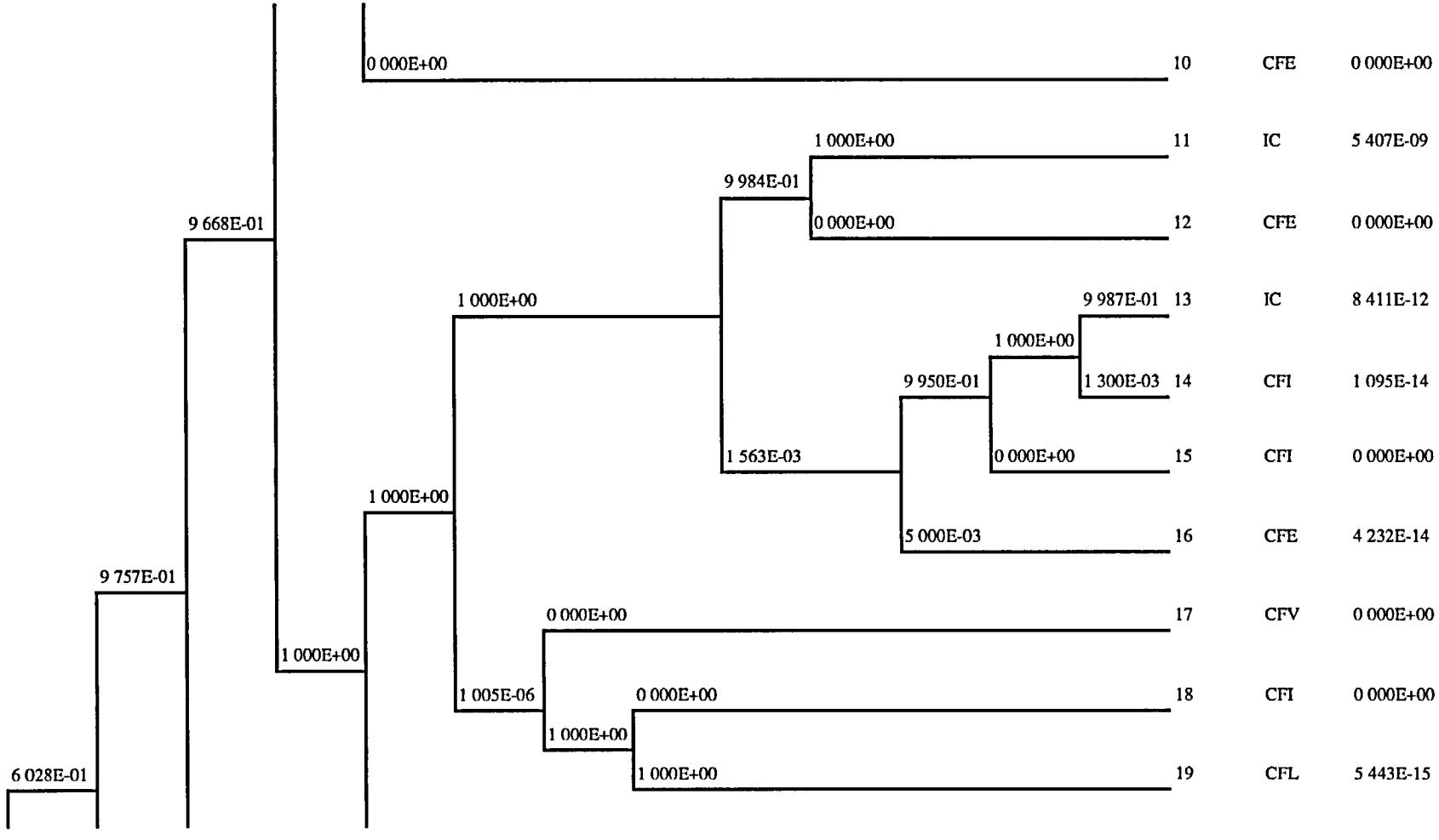
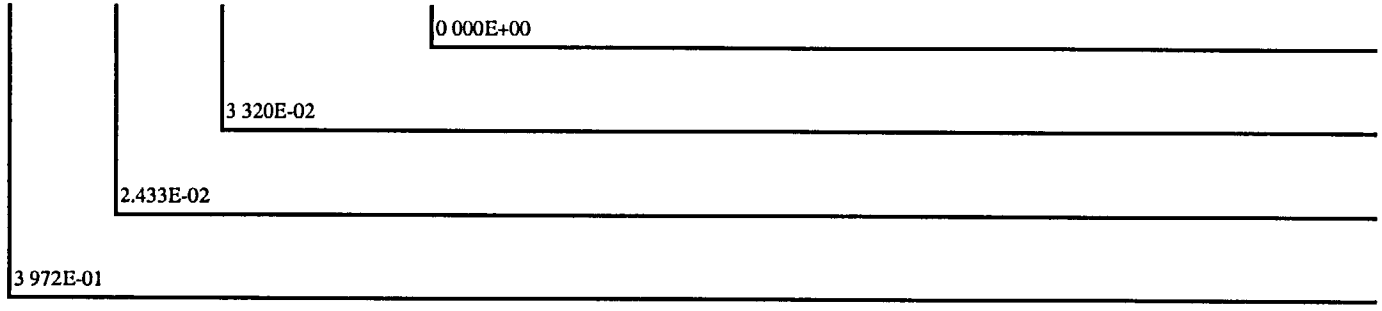


Figure 43-11 (Sheet 2 of 3)

6 CET



20	CFE	0.000E+00
21	CFE	1 860E-10
22	CI	1 396E-10
23	BP	3.783E-09
	Total	9 524E-09

6		6		
Success		Rel Cat.	Freq.	%
	AC	IC	5.415E-09	56 86%
6 028E-01	DP	CFE	1.860E-10	1.95%
9 757E-01	IS	CFI	1.095E-14	0 00%
9.668E-01	IR	CFV	0 000E+00	0 00%
0 000E+00	RFL	CFL	5.443E-15	0 00%
1 000E+00	VF	CI	1 396E-10	1 47%
1.000E+00	PC	BP	3 783E-09	39 72%
0 000E+00	VT			
0 000E+00	IF	Total	9.524E-09	100 00%
9.984E-01	IG			
1 000E+00	DF			
9.950E-01	DTE			
1 000E+00	DFG			
9.987E-01	DTI			

Figure 43-11 (Sheet 3 of 3)

6 CET

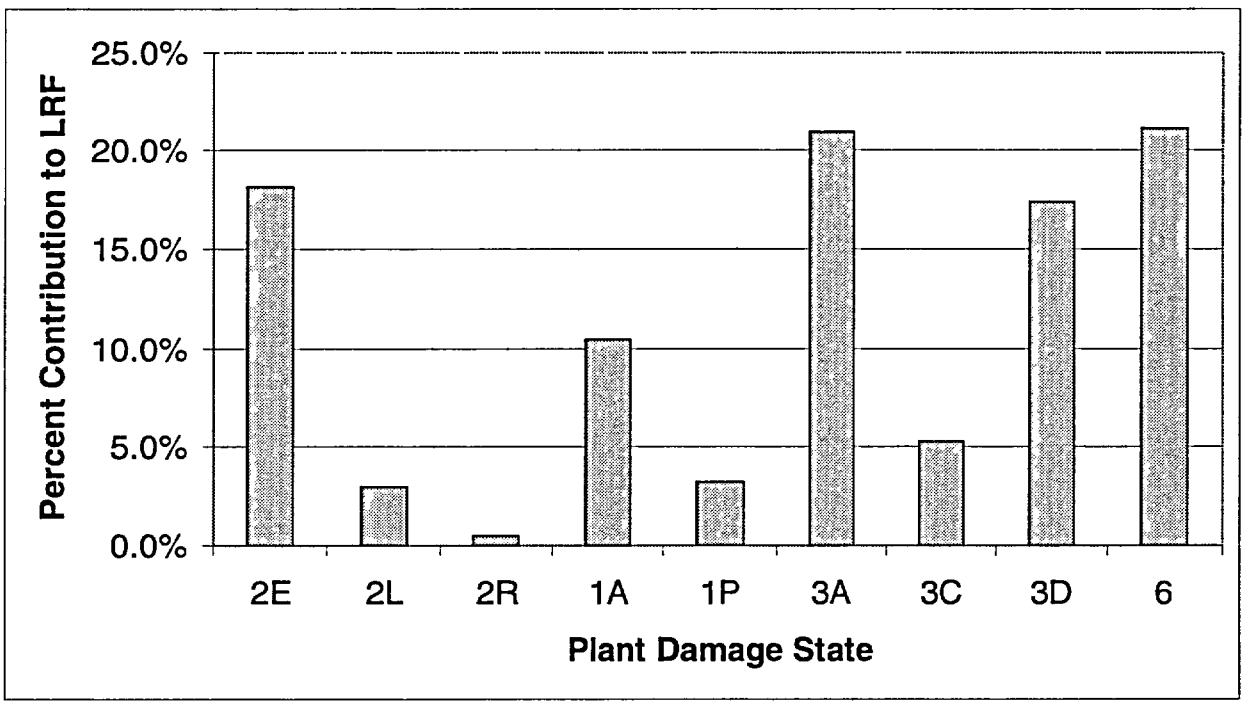


Figure 43-12

Contribution of PDS to LRF

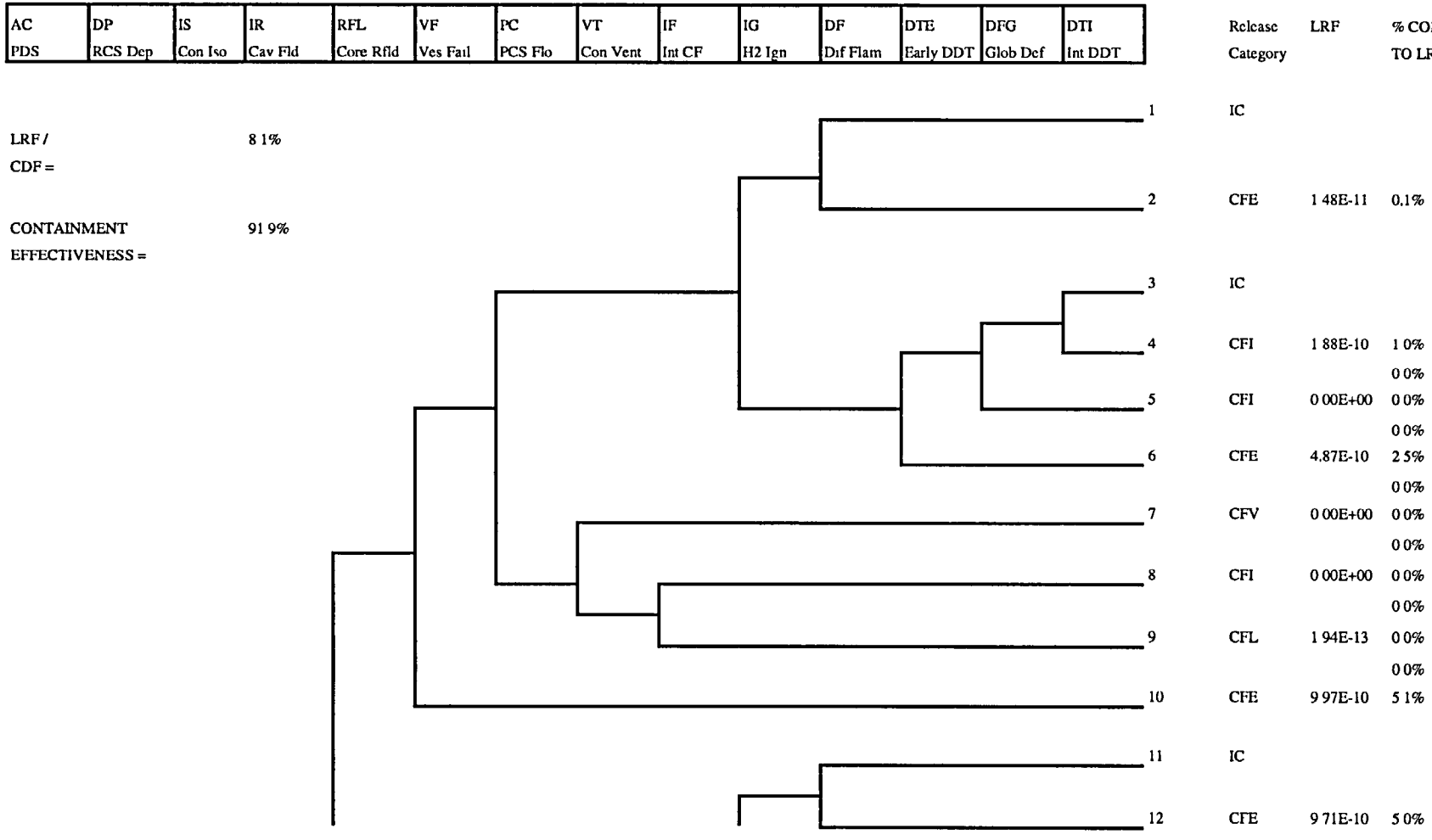
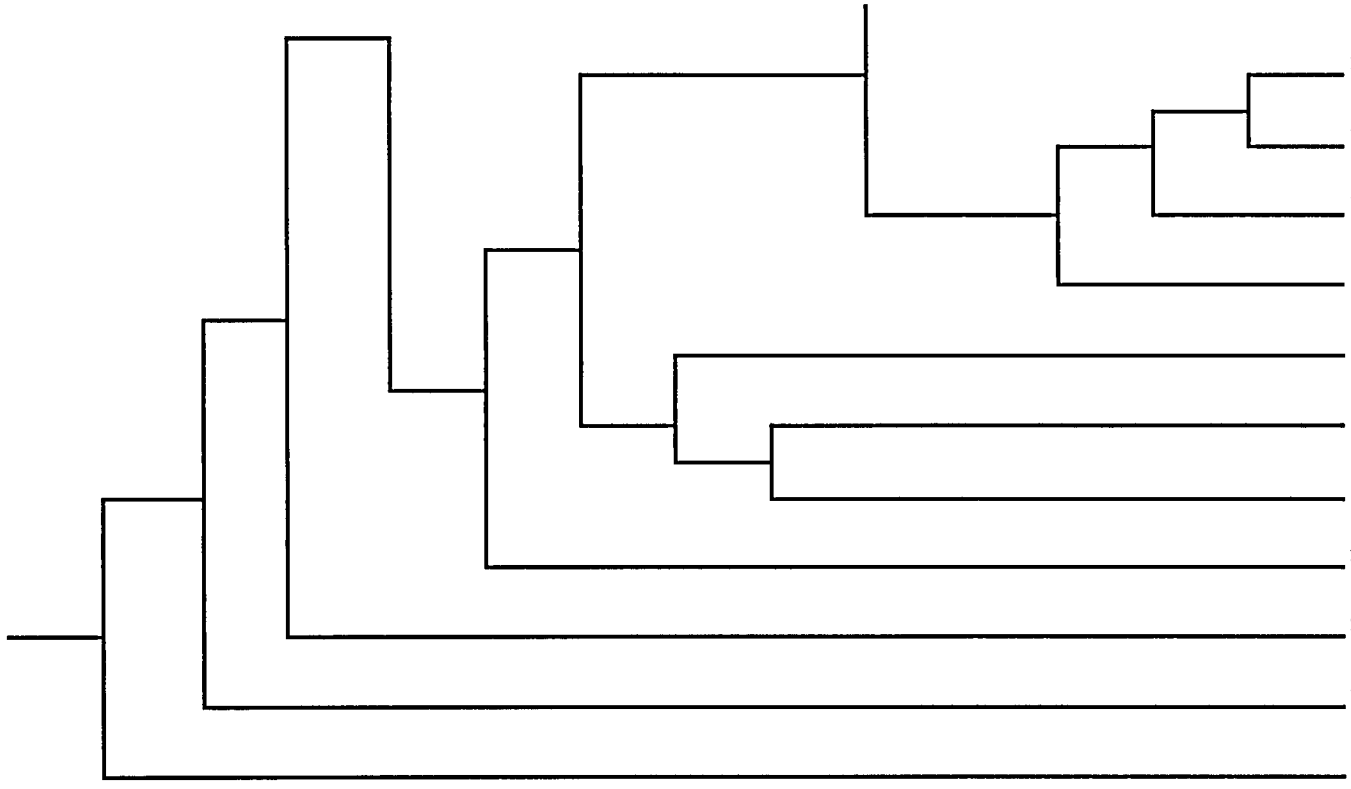


Figure 43-13 (Sheet 1 of 2)

Summary of CET Quantification



13	IC		
14	CFI	1 04E-12	0 0%
15	CFI	0 00E+00	0 0%
16	CFE	9.99E-11	0 5%
17	CFV	0 00E+00	0 0%
18	CFI	0 00E+00	0 0%
19	CFL	1 51E-13	0 0%
20	CFE	0 00E+00	0 0%
21	CFE	4 90E-09	25 1%
22	CI	1 33E-09	6 8%
23	BP	1 05E-08	53 9%
	Total	1 95E-08	100 0%

Figure 43-13 (Sheet 2 of 2)

Summary of CET Quantification

ATTACHMENT 43A

PDS CALCULATIONS

This attachment contains the results of the plant damage state frequency calculations for AP1000 PRA at-power events.

The 190 *.wlk files for the dominant accident sequences were generated when the CDF analysis of Chapter 33 was performed. These files are listed in Table 43A-1. Then, WLINK code is used to collect the CDF cutsets from accident sequences into PDS files. The input files for this purpose are named X.in, where X stands for the 2 or 1 character symbol for a PDS given above. The results of the PDS quantification are summarized in Table 43A-2.

Table 43A-1 (Sheet 1 of 6)

AP1000 PRA DOMINANT CDF SEQUENCES FOR AT-POWER EVENTS

	Frequency	Sequence ID	Cutoff Prob	Basic Ev.	Cutsets
1	6.88E-08	2esil-07.wlk	1.00E-15	120	189
2	4.26E-08	2rllo-09.wlk	1.00E-15	12	207
3	2.13E-08	3dsad-08.wlk	1.00E-15	1280	222
4	1.98E-08	3dsil-08.wlk	1.00E-15	208	189
5	1.00E-08	3crvr-02.wlk	1.00E-14	1	1
6	8.44E-09	2lslo-05.wlk	1.00E-15	38	314
7	7.35E-09	2lmlo-05.wlk	1.00E-15	38	308
8	5.11E-09	3dslo-12.wlk	1.00E-15	1487	314
9	4.46E-09	3dmlo-12.wlk	1.00E-15	1340	308
10	3.72E-09	2rsad-09.wlk	1.00E-15	23	222
11	3.67E-09	2esad-07.wlk	1.00E-15	46	222
12	3.57E-09	2lsil-03.wlk	1.00E-15	38	189
13	3.56E-09	6esgt-41.wlk	1.00E-14	330	244
14	3.31E-09	3aatw-23.wlk	1.00E-14	31	46
15	3.30E-09	2eslo-09.wlk	1.00E-15	1099	314
16	2.88E-09	2emlo-09.wlk	1.00E-15	1074	308
17	2.19E-09	6esgt-13.wlk	1.00E-14	39	244
18	1.97E-09	3dllo-08.wlk	1.00E-15	992	207
19	1.57E-09	2lcmt-05.wlk	1.00E-15	38	278
20	1.41E-09	1atra-17.wlk	2.13E-14	407	181
21	1.29E-09	3dsil-16.wlk	1.00E-15	343	189
22	1.13E-09	6lsgtc05.wlk	1.23E-13	140	153
23	9.98E-10	3dsil-17.wlk	1.00E-15	279	189
24	9.71E-10	6esgtc12.wlk	1.23E-13	498	153
25	9.51E-10	3dcmt-12.wlk	1.00E-15	868	278
26	9.45E-10	1pmlo-28.wlk	1.00E-15	299	308
27	9.11E-10	2lsad-03.wlk	1.00E-15	35	222
28	8.95E-10	1atra-32.wlk	2.13E-14	44	181
29	7.60E-10	2lmloc05.wlk	1.00E-14	45	205
30	7.45E-10	1pslo-39.wlk	1.00E-15	277	314
31	7.13E-10	3drcs-12.wlk	1.00E-13	693	148
32	7.10E-10	3aatt-26.wlk	1.00E-14	6	19
33	6.15E-10	2ecmt-09.wlk	1.00E-15	595	278
34	5.40E-10	2lsil-14.wlk	1.00E-15	692	189
35	4.96E-10	6esgtc09.wlk	1.23E-13	361	153
36	4.80E-10	1alca-16.wlk	1.18E-15	410	173

Table 43A-1 (Sheet 2 of 6)

AP1000 PRA DOMINANT CDF SEQUENCES FOR AT-POWER EVENTS

	Frequency	Sequence ID	Cutoff Prob	Basic Ev.	Cutsets
37	4.61E-10	3dmloc12.wlk	1.00E-14	376	205
38	4.60E-10	1pmlo-13.wlk	1.00E-15	30	308
39	4.48E-10	1almf-16.wlk	4.72E-15	632	206
40	4.45E-10	1pslo-13.wlk	1.00E-15	30	314
41	4.37E-10	1pcmt-28.wlk	1.00E-15	207	278
42	4.31E-10	6lsgt-05.wlk	1.00E-14	156	244
43	4.23E-10	2lrcs-05.wlk	1.00E-13	263	148
44	3.79E-10	2ercs-09.wlk	1.00E-13	527	148
45	3.40E-10	2ello-07.wlk	1.00E-15	20	207
46	3.40E-10	1aslvc30.wlk	1.00E-13	114	69
47	2.97E-10	2emloc09.wlk	1.00E-14	223	205
48	2.75E-10	6esgt-12.wlk	1.00E-14	948	244
49	2.67E-10	3dprss12.wlk	1.00E-13	146	101
50	2.16E-10	1almf-31.wlk	4.72E-15	51	206
51	1.95E-10	1alm1-17.wlk	1.00E-15	484	203
52	1.87E-10	3aatw-49.wlk	1.00E-14	41	46
53	1.67E-10	1prcs-13.wlk	1.00E-13	21	148
54	1.59E-10	1aslv-30.wlk	1.00E-15	87	108
55	1.58E-10	6esgt-09.wlk	1.00E-14	725	244
56	1.48E-10	1alsp-32.wlk	9.31E-14	95	72
57	1.47E-10	1alco-16.wlk	7.66E-15	466	163
58	1.43E-10	1alcc-13.wlk	1.00E-14	277	122
59	1.41E-10	1dtra-16.wlk	2.13E-14	283	181
60	1.24E-10	2etra-13.wlk	2.13E-14	282	181
61	1.23E-10	1alm1-32.wlk	1.00E-15	67	203
62	1.00E-10	3aats-38.wlk	1.00E-14	14	27
63	9.82E-11	1pcmt-13.wlk	1.00E-15	30	278
64	9.60E-11	6esgt-39.wlk	1.00E-14	306	244
65	9.25E-11	2eprss09.wlk	1.00E-13	101	101
66	9.19E-11	1alcc-23.wlk	1.00E-14	15	122
67	8.90E-11	1pmloc28.wlk	1.00E-14	38	205
68	8.43E-11	2lllo-03.wlk	1.00E-15	17	207
69	8.14E-11	2lprss05.wlk	1.00E-13	62	101
70	8.02E-11	3aatw-24.wlk	1.00E-14	38	46
71	7.20E-11	1alco-31.wlk	7.66E-15	21	163
72	7.02E-11	1aslvc45.wlk	1.00E-13	63	69

Table 43A-1 (Sheet 3 of 6)

AP1000 PRA DOMINANT CDF SEQUENCES FOR AT-POWER EVENTS

	Frequency	Sequence ID	Cutoff Prob	Basic Ev.	Cutsets
73	6.91E-11	2ltra-09.wlk	2.13E-14	148	181
74	6.03E-11	1pprss13.wlk	1.00E-13	6	101
75	5.00E-11	6eisl-02.wlk	1.00E-14	1	1
76	4.75E-11	1pmloc13.wlk	1.00E-14	31	205
77	4.17E-11	6esgtc41.wlk	1.23E-13	8	153
78	4.09E-11	6esgtc13.wlk	1.23E-13	54	153
79	3.50E-11	1dlmf-15.wlk	4.72E-15	372	206
80	3.29E-11	1pslo-26.wlk	1.00E-15	16	314
81	3.12E-11	3aatw-48.wlk	1.00E-14	14	46
82	3.09E-11	2elmf-12.wlk	4.72E-15	414	206
83	2.84E-11	2elcc-11.wlk	1.00E-14	167	122
84	2.71E-11	6esgt-56.wlk	1.00E-14	8	244
85	2.62E-11	1aslv-45.wlk	1.00E-15	10	108
86	2.46E-11	2llca-08.wlk	1.18E-15	98	173
87	2.45E-11	1aslu-30.wlk	1.00E-15	22	67
88	2.14E-11	2llmf-08.wlk	4.72E-15	240	206
89	2.11E-11	1dlcc-12.wlk	1.00E-14	126	122
90	2.03E-11	6lsgt-08.wlk	1.00E-14	62	244
91	1.98E-11	2rmlo-23.wlk	1.00E-15	276	308
92	1.97E-11	1prcs-39.wlk	1.00E-13	11	148
93	1.96E-11	1dlm1-16.wlk	1.00E-15	456	203
94	1.92E-11	2elsp-13.wlk	9.31E-14	88	72
95	1.81E-11	1alrc-17.wlk	1.00E-15	290	132
96	1.73E-11	2elm1-13.wlk	1.00E-15	492	203
97	1.70E-11	2ltra-25.wlk	2.13E-14	58	181
98	1.59E-11	6esgt-26.wlk	1.00E-14	118	244
99	1.56E-11	2llsp-09.wlk	9.31E-14	31	72
100	1.44E-11	2lslvc22.wlk	1.00E-13	12	69
101	1.43E-11	1alca-31.wlk	1.18E-15	30	173
102	1.40E-11	1bsbo-44.wlk	9.31E-14	52	72
103	1.14E-11	6esgt-36.wlk	1.00E-14	192	244
104	1.14E-11	1alrc-32.wlk	1.00E-15	10	132
105	1.08E-11	1dlco-15.wlk	7.66E-15	104	163
106	9.70E-12	2llm1-09.wlk	1.00E-15	272	203
107	9.38E-12	2elco-12.wlk	7.66E-15	90	163
108	9.33E-12	2elca-12.wlk	1.18E-15	392	173

Table 43A-1 (Sheet 4 of 6)

AP1000 PRA DOMINANT CDF SEQUENCES FOR AT-POWER EVENTS

	Frequency	Sequence ID	Cutoff Prob	Basic Ev.	Cutsets
109	9.16E-12	2rcmt-23.wlk	1.00E-15	159	278
110	9.15E-12	1dlsp-16.wlk	9.31E-14	38	72
111	8.16E-12	2lslv-22.wlk	1.00E-15	44	108
112	7.52E-12	2lslo-08.wlk	1.00E-15	380	314
113	7.47E-12	4esbo-43.wlk	9.31E-14	30	72
114	6.73E-12	2llcc-07.wlk	1.00E-14	62	122
115	6.68E-12	2llco-08.wlk	7.66E-15	100	163
116	6.55E-12	2lmlo-08.wlk	1.00E-15	366	308
117	6.54E-12	1dsld-46.wlk	1.00E-15	10	17
118	6.50E-12	1dlca-15.wlk	1.18E-15	310	173
119	5.68E-12	3aats-52.wlk	1.00E-14	10	27
120	4.37E-12	1apow-17.wlk	1.00E-15	125	86
121	4.14E-12	6esgt-35.wlk	1.00E-14	77	244
122	4.08E-12	5eslu-91.wlk	1.00E-15	10	67
123	4.08E-12	2llmf-24.wlk	4.72E-15	62	206
124	3.49E-12	1pslo-54.wlk	1.00E-15	8	314
125	3.42E-12	1dslvc29.wlk	1.00E-13	22	69
126	3.31E-12	6esgtc26.wlk	1.23E-13	6	153
127	3.12E-12	2lsil-06.wlk	1.00E-15	276	189
128	3.01E-12	2eslv-26.wlk	1.00E-15	198	108
129	2.87E-12	1apow-32.wlk	1.00E-15	15	86
130	2.52E-12	6lsgt-31.wlk	1.00E-14	68	244
131	2.52E-12	2llm1-25.wlk	1.00E-15	166	203
132	2.44E-12	3aatt-14.wlk	1.00E-14	2	19
133	2.27E-12	1prcs-54.wlk	1.00E-13	1	148
134	2.08E-12	3aats-13.wlk	1.00E-14	6	27
135	2.06E-12	1dslv-29.wlk	1.00E-15	160	108
136	1.95E-12	1alsp-17.wlk	9.31E-14	12	72
137	1.73E-12	3aats-39.wlk	1.00E-14	12	27
138	1.73E-12	1dlrc-16.wlk	1.00E-15	120	132
139	1.71E-12	2rmloc23.wlk	1.00E-14	15	205
140	1.50E-12	2elrc-13.wlk	1.00E-15	92	132
141	1.49E-12	2lrcs-08.wlk	1.00E-13	6	148
142	1.30E-12	2lcmt-08.wlk	1.00E-15	174	278
143	1.26E-12	2lslu-22.wlk	1.00E-15	20	67
144	1.17E-12	2llco-24.wlk	7.66E-15	18	163

Table 43A-1 (Sheet 5 of 6)

AP1000 PRA DOMINANT CDF SEQUENCES FOR AT-POWER EVENTS

	Frequency	Sequence ID	Cutoff Prob	Basic Ev.	Cutsets
145	1.14E-12	6esgtc36.wlk	1.23E-13	3	153
146	1.05E-12	2llca-24.wlk	1.18E-15	62	173
147	8.96E-13	2eslvc26.wlk	1.00E-13	8	69
148	8.49E-13	2llrc-09.wlk	1.00E-15	70	132
149	8.02E-13	1pprss54.wlk	1.00E-13	2	101
150	7.98E-13	4lsbo-39.wlk	9.31E-14	4	72
151	6.33E-13	3aats-14.wlk	1.00E-14	2	27
152	5.80E-13	1prcs-26.wlk	1.00E-13	4	148
153	5.78E-13	6esgt-25.wlk	1.00E-14	16	244
154	5.11E-13	6lsgt-18.wlk	1.00E-14	18	244
155	4.79E-13	1dlcc-22.wlk	1.00E-14	3	122
156	4.48E-13	2lsad-06.wlk	1.00E-15	95	222
157	4.29E-13	2eslu-26.wlk	1.00E-15	78	67
158	3.87E-13	1dpow-16.wlk	1.00E-15	20	86
159	3.48E-13	3dats-37.wlk	1.00E-14	9	27
160	3.36E-13	2epow-13.wlk	1.00E-15	22	86
161	3.01E-13	2lmloc08.wlk	1.00E-14	18	205
162	2.94E-13	1dslu-29.wlk	1.00E-15	54	67
163	2.74E-13	6esgt-22.wlk	1.00E-14	12	244
164	2.48E-13	2ltra-22.wlk	2.13E-14	3	181
165	2.08E-13	3aatt-25.wlk	1.00E-14	4	19
166	2.03E-13	3dlccm12.wlk	1.00E-14	12	10
167	1.94E-13	2lpow-09.wlk	1.00E-15	30	86
168	1.77E-13	1asld-31.wlk	1.00E-15	18	17
169	1.20E-13	3aatw-22.wlk	1.00E-14	6	46
170	1.08E-13	2llspm05.wlk	1.00E-14	4	9
171	8.17E-14	3datw-11.wlk	1.00E-14	4	46
172	5.94E-14	2llmf-21.wlk	4.72E-15	3	206
173	4.86E-14	5eslu-76.wlk	1.00E-15	12	67
174	4.52E-14	6esgt-51.wlk	1.00E-14	1	244
175	4.49E-14	2elccm09.wlk	1.00E-14	4	10
176	4.32E-14	3datw-12.wlk	1.00E-14	2	46
177	4.09E-14	2lpow-25.wlk	1.00E-15	3	86
178	3.71E-14	2rlca-26.wlk	1.18E-15	6	173
179	3.40E-14	2llm1-22.wlk	1.00E-15	3	203
180	1.77E-14	2lllo-06.wlk	1.00E-15	10	207

Table 43A-1 (Sheet 6 of 6)

AP1000 PRA DOMINANT CDF SEQUENCES FOR AT-POWER EVENTS

	Frequency	Sequence ID	Cutoff Prob	Basic Ev.	Cutsets
181	1.67E-14	3aatt-13.wlk	1.00E-14	1	19
182	1.64E-14	2llca-21.wlk	1.18E-15	6	173
183	1.63E-14	3dcmt-26.wlk	1.00E-15	1	278
184	1.38E-14	3aats-26.wlk	1.00E-14	1	27
185	1.24E-14	3dats-12.wlk	1.00E-14	1	27
186	1.22E-14	2rlm1-27.wlk	1.00E-15	9	203
187	9.77E-15	2lslv-40.wlk	1.00E-15	2	108
188	9.10E-15	1dlm1-30.wlk	1.00E-15	7	203
189	7.88E-15	2rslo-49.wlk	1.00E-15	3	314
190	1.11E-15	1aslv-17.wlk	1.00E-15	1	108
	2.41E-07	Sum			30337

Table 43A-2

AP1000 PRA PDS FREQUENCIES FOR AT-POWER EVENTS

Frequency	Sequence ID	Cutoff Prob	Basic Ev.	Cutsets
5.01E-09	1a.wlk	1.00E-14	2749	193
1.48E-09	1p.wlk	1.00E-14	270	86
8.06E-08	2e.wlk	1.00E-14	3294	262
2.40E-08	2l.wlk	1.00E-14	2066	241
4.63E-08	2r.wlk	1.00E-14	180	51
4.43E-09	3a.wlk	1.00E-14	188	52
1.00E-08	3c.wlk	1.00E-14	1	1
5.97E-08	3d.wlk	1.00E-14	6448	393
9.52E-09	6.wlk	1.00E-14	4147	278
2.41E-07	Sum			1557

Note:
The four 1p sequences for MLO and CMT-LB events are grouped with 3d since RCS is expected to be at least partially depressurized by the nature of the initiating event.

ATTACHMENT 43B

DP NODE PROBABILITY FOR PDS

An examination of PDS 6 core damage cutsets show that passive residual heat removal (PRHR) is available in most of the dominant cutsets. In these event sequences (cutsets), the RCS pressure will drop and the RCS loss through the break will diminish, such that operators will have a long time period (on the order of hours) to actuate the ADS, if they failed to actuate it initially. In that case, even if core damage were postulated very conservatively, the fission product release would be mostly contained, or attenuated in the water inventory of the faulted steam generator.

The following process is performed to calculate the failure of the DP node in the CET event tree for PDS 6:

1. The 6L accident sequences are removed from the calculation since ADS is successful in these sequences. What is left is labeled as 6e.* (such as 6e.in, 6e.wlk files)

2. SGTR event tree sequences 9, 35, and 36 that show up in the PDS 6 event sequence list are removed since ADS is successful. The ISLOCA contribution is also removed. The remaining sequences are subject to DP node failure. They are stored in file 6f.in and quantified to calculate their failure frequency.

3. The sequences where PRHR failed are removed from the list, leaving the following sequences in file 6sprhr.in. The removed sequences are stored in 6fprhr.in.

   6ESGT-12
   6ESGT-13
   6ESGT-39
   6ESGT-41
   6ESGTC12
   6ESGTC13
   6ESGTC36
   6ESGTC41

4. The 6sprhr sequences are quantified. The dominant cutsets are examined. Those cutsets where ADS failed due to operator action failure human error probability are deemed to be recoverable due to availability of long time periods; a screening human error probability (HEP) of 0.1 is used (1-HEP = 0.90). The calculations are shown in Table 44B-1. The cutsets are shown in their standard output format, with the first column added to collect "recoverable" frequencies.

   Recoverable frequency = (1-HEP) * failure frequency = 0.90 * failure frequency.

Result

The failure probability of the DP node is calculated to be 0.397 for PDS 6 (see Table 43B-1).

Table 43B-1 (Sheet 1 of 7)

CALCULATION OF FAILURE PROBABILITY OF DP FOR PDS 6

6spds.wlk		**Calculation of Failure Probability of DP for PDS 6**							
	6.wlk	278	4147	9.52E-09					
	6e.wlk	240	3703	7.94E-09					
	6f.wlk	222	2345	7.22E-09					
	6fprhr.wlk	89	161	4.72E-11					
	6sprhr.wlk	199	2186	7.18E-09					
	Failure Probability of DP for PDS 6			=	CDF(6f.wlk)-Recoverable Sum)/CDF(6.wlk)				
				=	3.97E-01				
Recoverable									
6.82E-10	1	7.58E-10	5	IEV-SGTR	CIB-MAN00	RPX-CB-GO	REC-MANDASC	LPM-MAN01C	
6.82E-10	2	7.58E-10	5	IEV-SGTR	CIB-MAN00	RPX-CB-GO	REC-MANDASC	ADN-MAN01C	
5.75E-10	3	6.39E-10	6	IEV-SGTR	CVN-MAN00	ADF-MAN01	RPX-CB-GO	REC-MANDASC	ADN-MAN01C
4.97E-10	4	5.52E-10	5	IEV-SGTR	CIB-MAN01	RPX-CB-GO	REC-MANDASC	LPM-MAN01C	
	5	4.95E-10	3	IEV-SGTR	CCX-PMXMOD1-SW	REC-MANDAS			
	6	4.27E-10	3	IEV-SGTR	CCX-PMXMOD1-SW	MDAS			
	7	3.88E-10	3	IEV-SGTR	CCX-EP-SAM	REC-MANDAS			
	8	3.34E-10	3	IEV-SGTR	CCX-EP-SAM	MDAS			
1.67E-10	9	1.86E-10	5	IEV-SGTR	CIB-MAN00	REC-MANDASC	CCX-INPUT-LOGIC	ADN-MAN01C	

Table 43B-1 (Sheet 2 of 7)

CALCULATION OF FAILURE PROBABILITY OF DP FOR PDS 6

1.67E-10	10	1.86E-10	5	IEV-SGTR	CIB-MAN00	REC-MANDASC	CCX-INPUT-LOGIC	LPM-MAN01C	
1.01E-10	11	1.12E-10	5	IEV-SGTR	CIB-MAN00	CCX-AV-LA	REC-MANDASC	ADN-MAN01C	
8.51E-11	12	9.46E-11	6	IEV-SGTR	CVN-MAN00	ADF-MAN01	CCX-AV-LA	REC-MANDASC	ADN-MAN01C
8.32E-11	13	9.24E-11	5	IEV-SGTR	CIB-MAN00	CMX-CV-GO	REC-MANDASC	ADN-MAN01C	
6.96E-11	14	7.73E-11	6	IEV-SGTR	CVN-MAN00	ADF-MAN01	CMX-CV-GO	REC-MANDASC	ADN-MAN01C
	15	7.12E-11	3	IEV-SGTR	CCX-XMTR	CMX-VS-FA			
	16	5.40E-11	3	IEV-SGTR	CCX-SFTW	REC-MANDAS			
	17	4.66E-11	3	IEV-SGTR	CCX-SFTW	MDAS			
3.23E-11	18	3.59E-11	6	IEV-SGTR	CVMOD05	ADF-MAN01	RPX-CB-GO	REC-MANDASC	ADN-MAN01
3.04E-11	19	3.38E-11	6	IEV-SGTR	CVMOD07	ADF-MAN01	RPX-CB-GO	REC-MANDASC	ADN-MAN01
	20	2.45E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	EC1BS001TM	ADX-EV-SA2	
	21	2.45E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	EC1BS012TM	ADX-EV-SA2	
	22	1.96E-11	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA2	RN55MOD1	
	23	1.96E-11	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA2	RN11MOD3	
	24	1.96E-11	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA2	RN22MOD4	
	25	1.96E-11	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA2	RN23MOD5	
	26	1.95E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	EC1BS001TM	CCX-BY-PN	
	27	1.95E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	EC1BS012TM	CCX-BY-PN	
	28	1.95E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	CCX-BY-PN	EC2BS002TM	
	29	1.95E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	CCX-BY-PN	EC2BS022TM	
	30	1.95E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	CCX-BY-PN	EC2BS221TM	
1.43E-11	31	1.59E-11	6	IEV-SGTR	CVMOD05	ADF-MAN01	RPX-CB-GO	REC-MANDASC	LPM-MAN01
1.36E-11	32	1.51E-11	6	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	RPX-CB-GO	REC-MANDASC	ADN-MAN01
1.35E-11	33	1.50E-11	5	IEV-SGTR	CIB-MAN00	RPX-CB-GO	MDAS	ADN-MAN01C	
1.35E-11	34	1.50E-11	5	IEV-SGTR	CIB-MAN00	RPX-CB-GO	MDAS	LPM-MAN01C	

Table 43B-1 (Sheet 3 of 7)

CALCULATION OF FAILURE PROBABILITY OF DP FOR PDS 6

1.35E-11	35	1.50E-11	6	IEV-SGTR	CVMOD07	ADF-MAN01	RPX-CB-GO	REC-MANDASC	LPM-MAN01
	36	1.47E-11	6	OTH-SGTR	IEV-LOSP	OTH-R05	OTH-SLSOV1	ADX-EV-SA2	RN55MOD1
	37	1.47E-11	6	OTH-SGTR	IEV-LOSP	OTH-R05	OTH-SLSOV1	ADX-EV-SA2	RN11MOD3
	38	1.47E-11	6	OTH-SGTR	IEV-LOSP	OTH-R05	OTH-SLSOV1	ADX-EV-SA2	RN22MOD4
	39	1.47E-11	6	OTH-SGTR	IEV-LOSP	OTH-R05	OTH-SLSOV1	ADX-EV-SA2	RN23MOD5
	40	1.39E-11	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA2	CLP-UNAVAILABLE	
	41	1.39E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	IDDBSDS1TM	IDBBSDS1TM	
	42	1.39E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	IDDBSDS1TM	IDBBSDD1TM	
	43	1.39E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	IDDBSDD1TM	IDBBSDS1TM	
	44	1.39E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	IDDBSDD1TM	IDBBSDD1TM	
1.17E-11	45	1.30E-11	5	IEV-SGTR	CANTP011RI	RPX-CB-GO	REC-MANDASC	ADN-MAN01	
1.14E-11	46	1.27E-11	5	IEV-SGTR	EC0MOD01	RPX-CB-GO	REC-MANDASC	ADN-MAN01	
1.13E-11	47	1.26E-11	6	IEV-SGTR	CVN-MAN00	ADF-MAN01	RPX-CB-GO	MDAS	ADN-MAN01C
	48	1.25E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	EC1BS001TM	ADX-EV-SA	
	49	1.25E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	EC1BS012TM	ADX-EV-SA	
1.02E-11	50	1.13E-11	7	OTH-SGTR	IEV-LOSP	OTH-R05	OTH-SLSOV1	RPX-CB-GO	REC-MANDASC ADN-MAN01
	51	1.12E-11	5	OTH-SGTR	IEV-LMFW	OTH-SLSOV1	EC1BS001TM	ADX-EV-SA2	
	52	1.12E-11	5	OTH-SGTR	IEV-LMFW	OTH-SLSOV1	EC1BS012TM	ADX-EV-SA2	
9.81E-12	53	1.09E-11	5	IEV-SGTR	CIB-MAN01	RPX-CB-GO	MDAS	LPM-MAN01C	
	54	1.04E-11	6	OTH-SGTR	IEV-LOSP	OTH-R05	OTH-SLSOV1	ADX-EV-SA2	CLP-UNAVAILABLE
	55	1.01E-11	4	IEV-SLB-V	OTH-SGTR	ADX-EV-SA2	RN55MOD1		
	56	1.01E-11	4	IEV-SLB-V	OTH-SGTR	ADX-EV-SA2	RN11MOD3		
	57	1.01E-11	4	IEV-SLB-V	OTH-SGTR	ADX-EV-SA2	RN22MOD4		
	58	1.01E-11	4	IEV-SLB-V	OTH-SGTR	ADX-EV-SA2	RN23MOD5		

Table 43B-1 (Sheet 4 of 7)

CALCULATION OF FAILURE PROBABILITY OF DP FOR PDS 6

	59	9.95E-12	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA	RN55MOD1	
	60	9.95E-12	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA	RN11MOD3	
	61	9.95E-12	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA	RN22MOD4	
	62	9.95E-12	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA	RN23MOD5	
	63	8.93E-12	5	OTH-SGTR	IEV-LMFW	OTH-SLSOV1	EC1BS001TM	CCX-BY-PN	
	64	8.93E-12	5	OTH-SGTR	IEV-LMFW	OTH-SLSOV1	EC1BS012TM	CCX-BY-PN	
6.98E-12	65	7.76E-12	5	IEV-SLB-V	OTH-SGTR	RPX-CB-GO	REC-MANDASC	ADN-MAN01	
6.71E-12	66	7.46E-12	5	IEV-SGTR	IDBBSDS1TM	RC1CB063GO	REC-MANDASC	ADN-MAN01	
6.71E-12	67	7.46E-12	5	IEV-SGTR	IDBBSDS1TM	RC1CB061GO	REC-MANDASC	ADN-MAN01	
6.71E-12	68	7.46E-12	5	IEV-SGTR	IDBBSDS1TM	RC1CB053GO	REC-MANDASC	ADN-MAN01	
6.71E-12	69	7.46E-12	5	IEV-SGTR	IDBBSDS1TM	RC1CB051GO	REC-MANDASC	ADN-MAN01	
6.71E-12	70	7.46E-12	5	IEV-SGTR	IDBBSDD1TM	RC1CB063GO	REC-MANDASC	ADN-MAN01	
6.71E-12	71	7.46E-12	5	IEV-SGTR	IDBBSDD1TM	RC1CB061GO	REC-MANDASC	ADN-MAN01	
6.71E-12	72	7.46E-12	5	IEV-SGTR	IDBBSDD1TM	RC1CB053GO	REC-MANDASC	ADN-MAN01	
6.71E-12	73	7.46E-12	5	IEV-SGTR	IDBBSDD1TM	RC1CB051GO	REC-MANDASC	ADN-MAN01	
	74	7.46E-12	6	OTH-SGTR	IEV-LOSP	OTH-R05	OTH-SLSOV1	ADX-EV-SA	RN55MOD1
	75	7.46E-12	6	OTH-SGTR	IEV-LOSP	OTH-R05	OTH-SLSOV1	ADX-EV-SA	RN11MOD3
	76	7.46E-12	6	OTH-SGTR	IEV-LOSP	OTH-R05	OTH-SLSOV1	ADX-EV-SA	RN22MOD4
	77	7.46E-12	6	OTH-SGTR	IEV-LOSP	OTH-R05	OTH-SLSOV1	ADX-EV-SA	RN23MOD5
	78	7.14E-12	4	IEV-SLB-V	OTH-SGTR	ADX-EV-SA2	CLP-UNAVAILABLE		
	79	7.06E-12	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA	CLP-UNAVAILABLE	
	80	6.80E-12	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA2	RNX-KV1-GO	
6.05E-12	81	6.72E-12	5	IEV-SGTR	EC1BS001TM	RPX-CB-GO	REC-MANDASC	ADN-MAN01	
6.05E-12	82	6.72E-12	5	IEV-SGTR	EC1BS012TM	RPX-CB-GO	REC-MANDASC	ADN-MAN01	

Table 43B-1 (Sheet 5 of 7)

CALCULATION OF FAILURE PROBABILITY OF DP FOR PDS 6

6.05E-12	83	6.72E-12	6	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	RPX-CB-GO	REC-MANDASC	LPM-MAN01
	84	6.42E-12	5	OTH-SGTR	IEV-LMFW1	OTH-SLSOV1	EC1BS001TM	ADX-EV-SA2	
	85	6.42E-12	5	OTH-SGTR	IEV-LMFW1	OTH-SLSOV1	EC1BS012TM	ADX-EV-SA2	
	86	5.94E-12	4	IEV-SGTR	CIB-MAN00	ADX-EV-SA2	RN55MOD1		
	87	5.94E-12	4	IEV-SGTR	CIB-MAN00	ADX-EV-SA2	RN11MOD3		
	88	5.94E-12	4	IEV-SGTR	CIB-MAN00	ADX-EV-SA2	RN22MOD4		
	89	5.94E-12	4	IEV-SGTR	CIB-MAN00	ADX-EV-SA2	RN23MOD5		
5.18E-12	90	5.76E-12	5	IEV-SGTR	CANTP011RI	RPX-CB-GO	REC-MANDASC	LPM-MAN01	
5.18E-12	91	5.76E-12	5	IEV-SGTR	MSX-AV2-FA	RPX-CB-GO	REC-MANDASC	ADN-MAN01	
	92	5.70E-12	5	OTH-SGTR	IEV-LMFW	OTH-SLSOV1	EC1BS001TM	ADX-EV-SA	
	93	5.70E-12	5	OTH-SGTR	IEV-LMFW	OTH-SLSOV1	EC1BS012TM	ADX-EV-SA	
5.07E-12	94	5.63E-12	5	IEV-SGTR	EC0MOD01	RPX-CB-GO	REC-MANDASC	LPM-MAN01	
	95	5.29E-12	6	OTH-SGTR	IEV-LOSP	OTH-R05	OTH-SLSOV1	ADX-EV-SA	CLP-UNAVAILABLE
4.75E-12	96	5.28E-12	6	IEV-SGTR	CVMOD05	ADF-MAN01	CCX-AV-LA	REC-MANDASC	ADN-MAN01
	97	5.12E-12	4	IEV-SLB-V	OTH-SGTR	ADX-EV-SA	RN55MOD1		
	98	5.12E-12	4	IEV-SLB-V	OTH-SGTR	ADX-EV-SA	RN11MOD3		
	99	5.12E-12	4	IEV-SLB-V	OTH-SGTR	ADX-EV-SA	RN22MOD4		
	100	5.12E-12	4	IEV-SLB-V	OTH-SGTR	ADX-EV-SA	RN23MOD5		
	101	5.12E-12	5	OTH-SGTR	IEV-LMFW1	OTH-SLSOV1	EC1BS001TM	CCX-BY-PN	
	102	5.12E-12	5	OTH-SGTR	IEV-LMFW1	OTH-SLSOV1	EC1BS012TM	CCX-BY-PN	
	103	5.10E-12	6	OTH-SGTR	IEV-LOSP	OTH-R05	OTH-SLSOV1	ADX-EV-SA2	RNX-KV1-GO
4.47E-12	104	4.97E-12	6	IEV-SGTR	CVMOD07	ADF-MAN01	CCX-AV-LA	REC-MANDASC	ADN-MAN01

Table 43B-1 (Sheet 6 of 7)

CALCULATION OF FAILURE PROBABILITY OF DP FOR PDS 6

3.92E-12	105	4.35E-12	6	IEV-SGTR	CVMOD05	ADF-MAN01	CMX-CV-GO	REC-MANDASC	ADN-MAN01
	106	4.33E-12	4	IEV-SGTR	CIB-MAN01	ADX-EV-SA2	RN55MOD1		
	107	4.33E-12	4	IEV-SGTR	CIB-MAN01	ADX-EV-SA2	RN11MOD3		
	108	4.33E-12	4	IEV-SGTR	CIB-MAN01	ADX-EV-SA2	RN22MOD4		
	109	4.33E-12	4	IEV-SGTR	CIB-MAN01	ADX-EV-SA2	RN23MOD5		
	110	4.21E-12	4	IEV-SGTR	CIB-MAN00	ADX-EV-SA2	CLP-UNAVAILABLE		
3.69E-12	111	4.10E-12	6	IEV-SGTR	CVMOD07	ADF-MAN01	CMX-CV-GO	REC-MANDASC	ADN-MAN01
	112	4.02E-12	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA2	RHN-MAN01	
	113	3.75E-12	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA2	EC1BS001TM	
	114	3.75E-12	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA2	EC1BS012TM	
	115	3.75E-12	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA2	EC1BS122TM	
3.31E-12	116	3.68E-12	5	IEV-SGTR	CIB-MAN00	MDAS	CCX-INPUT-LOGIC	ADN-MAN01C	
	117	3.63E-12	4	IEV-SLB-V	OTH-SGTR	ADX-EV-SA	CLP-UNAVAILABLE		
	118	3.63E-12	5	OTH-SGTR	IEV-LMFW1	OTH-SLSOV1	IDDBSDS1TM	IDBBSDS1TM	
	119	3.63E-12	5	OTH-SGTR	IEV-LMFW1	OTH-SLSOV1	IDDBSDS1TM	IDBBSDD1TM	
	120	3.63E-12	5	OTH-SGTR	IEV-LMFW1	OTH-SLSOV1	IDDBSDD1TM	IDBBSDS1TM	
	121	3.63E-12	5	OTH-SGTR	IEV-LMFW1	OTH-SLSOV1	IDDBSDD1TM	IDBBSDD1TM	
	122	3.57E-12	6	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA2	RNAMOD09	RNBMOD10
	123	3.52E-12	4	IEV-SGTR	SGBAV040LA	ADX-EV-SA2	RN55MOD1		
	124	3.52E-12	4	IEV-SGTR	SGBAV040LA	ADX-EV-SA2	RN11MOD3		
	125	3.52E-12	4	IEV-SGTR	SGBAV040LA	ADX-EV-SA2	RN22MOD4		
	126	3.52E-12	4	IEV-SGTR	SGBAV040LA	ADX-EV-SA2	RN23MOD5		
	127	3.50E-12	4	IEV-SLB-V	OTH-SGTR	ADX-EV-SA2	RNX-KV1-GO		
	128	3.46E-12	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA	RNX-KV1-GO	

Table 43B-1 (Sheet 7 of 7)

CALCULATION OF FAILURE PROBABILITY OF DP FOR PDS 6

	129	3.34E-12	4	IEV-SGTR	EC1BS001TM	OTH-SLSOV3	ADX-EV-SA2		
	130	3.34E-12	4	IEV-SGTR	EC1BS012TM	OTH-SLSOV3	ADX-EV-SA2		
3.01E-12	131	3.34E-12	5	IEV-SGTR	CIB-MAN01	RPX-CB-GO	REC-MANDASC	ADN-MAN01	
2.99E-12	132	3.32E-12	5	IEV-SGTR	IDBBSDS1TM	RC1CB063GO	REC-MANDASC	LPM-MAN01	
2.99E-12	133	3.32E-12	5	IEV-SGTR	IDBBSDS1TM	RC1CB061GO	REC-MANDASC	LPM-MAN01	
2.99E-12	134	3.32E-12	5	IEV-SGTR	IDBBSDS1TM	RC1CB053GO	REC-MANDASC	LPM-MAN01	
2.99E-12	135	3.32E-12	5	IEV-SGTR	IDBBSDS1TM	RC1CB051GO	REC-MANDASC	LPM-MAN01	
2.99E-12	136	3.32E-12	5	IEV-SGTR	IDBBSDD1TM	RC1CB063GO	REC-MANDASC	LPM-MAN01	
2.99E-12	137	3.32E-12	5	IEV-SGTR	IDBBSDD1TM	RC1CB061GO	REC-MANDASC	LPM-MAN01	
2.99E-12	138	3.32E-12	5	IEV-SGTR	IDBBSDD1TM	RC1CB053GO	REC-MANDASC	LPM-MAN01	
2.99E-12	139	3.32E-12	5	IEV-SGTR	IDBBSDD1TM	RC1CB051GO	REC-MANDASC	LPM-MAN01	
2.96E-12	140	3.29E-12	5	IEV-SGTR	DUMP-MAN01	RPX-CB-GO	REC-MANDASC	ADN-MAN01	
	141	3.27E-12	5	OTH-SGTR	IEV-LMFW1	OTH-SLSOV1	EC1BS001TM	ADX-EV-SA	
3.44E-09	Sum								

ATTACHMENT 43C

EVALUATION OF OPERATOR ACTIONS

The operator actions pertinent to the CET event tree nodes are listed in Table 43C-1. A comparison with the operator actions modeled in the AP600 PRA indicates that all but one operator action still have the same performance shaping factors and time windows except one, REN-MAN03.

The REN-MAN03 time window is estimated to be shorter for the AP1000 design since higher water levels are needed in the reactor cavity, thus a longer flooding time. To compensate for the shorter time window, the action to open valves has been moved to the first step of Emergency Response Guideline (ERG) AFR.C-1. With this revision it is estimated that the A600 HEP of 3.4E-03 for this operator action is maintained for AP1000. However, two sensitivity analyses are made to study the effect of this operator action HEP being higher, namely 3.4E-02 or 0.1. The operator action affects the IWF fault tree cutsets, and thus the probabilities q2 and q20 calculated for use in the CET. The calculations are stored in sec-44iwf folder.

The results are summarized in the following table:

REN-MAN03 HEP =	3.4E-03	3.4E-02	0.1
Q2	2.671E-09	5.088E-09	1.029E-08
Q20	2.059E-09	3.851E-09	7.712E-09
LRF	1.95E-08	2.62E-08	3.5E-08
Ceff	91.9%	89.1	85.5%

If the REN-MAN03 failure probability was two orders of magnitude higher than the base case, the plant LRF would have been doubled, which shows that the results are somewhat sensitive to this operator action.

Table 43C-1

EVALUATION OF CET-RELATED OPERATOR ACTIONS

SUMMARY OF OPERATOR ACTIONS FOR CONTAINMENT EVENT TREE NODES

Top Event	Description of Operator Error	Event ID	Cue(s)	Time Window	AP600 Tw/Ta/Stress	AP600 HEP/Cond HEP	AP1000 HEP	Comments
DP	Failure to recognize need for post-core-uncovery RCS depress during small LOCA or transient with loss of PRHR	LPM-REC01	core-exit T/C > 1200°F (ERG AFR.C-1)	30 minutes	20/15/H	1.34E-03/ 5.0E-02	1.34E-03/ 5.0E-02	
	Failure to complete ADS as recovery from failure of automatic actuation or manual actuation after core damage	ADN-REC01	core-exit T/C > 1200°F (ERG AFR.C-1)	30 minutes	5/3/H	3.02E-03/ 5.0E-02	3.02E-03/ 5.0E-02	
IS	Failure to recognize need and failure to isolate the containment, given core damage following an accident	CIC-MAN01	high containment pressure, or temperature, or radiation (ERG E-0)	30 minutes	60/30/H	5.71E-03/ N/A	5.71E-03/ N/A	
IR	Failure to recognize need and failure to open recirculation valves to flood reactor cavity after core damage	REN-MAN03	core-exit temperature > 1200°F (ERG AFR.C-1)	5 minutes	20/10/H	3.4E-03/0 15	3.4E-03/0.15	See sensitivity analyses
PC	Failure to recognize need and failure to open PCS water valves to drain cooling water on containment shell	PCN-MAN01	high containment pressure (ERG E-0)	60 minutes	300/120/H	1.48E-04/ N/A	1.48E-04/ N/A	
VNT	Failure to recognize need and failure to open containment vent to reduce containment pressure	VNT-MAN01	high containment pressure (SAMG)	60 minutes	N/A		1.0	Not credited
IG	Failure to recognize need and failure to actuate hydrogen control system, given core damage following an accident	VLN-MAN01	core-exit T/C > 1200°F (ERG AFR.C-1)	10 minutes	15/10/H	1.28E-03/0.5	1.28E-03/0.5	
DP	Failure to perform ADS as recovery from failure of automatic actuation or manual actuation in later phases of SGTR event	PDS6-MANADS	Late Recovery	Hours available	0.1		0.1	Screening valve

CHAPTER 44

MAAP4 CODE DESCRIPTION AND AP1000 MODELING

44.0 MAAP Background

The Modular Accident Analysis Program (MAAP) is a computer code that simulates the response of nuclear power plants to postulated accident scenarios. Since this chapter applies to the AP1000, a pressurized water reactor, this code description focuses on the pressurized water reactor version of the MAAP code.

MAAP uses phenomenological models in the simulation of postulated nuclear plant accidents and has undergone significant updating through the years as the understanding of severe accident phenomena has improved. MAAP is used extensively for probabilistic risk assessment and individual plant evaluation in generating success criteria, analyzing plant response to severe accident phenomena, and evaluating the fission-product source terms to the environment for severe accident consequence analysis.

44.1 MAAP4

MAAP, version 4.0.4 (Reference 44-1) has the capability to model in-vessel recovery of severe accidents for the development of accident management strategies and for assessing severe accident risk as part of the design process for advanced light water reactors. MAAP4 is a fully integrated, severe accident code and includes models for important thermal-hydraulic and fission-product phenomena which may occur during a postulated accident in a pressurized water reactor plant.

The underlying models for MAAP4 address the following phenomena:

- Reactor coolant system (RCS) thermal-hydraulics
- Cladding water reaction
- Reactor core heatup, melting and relocation
- Containment thermal-hydraulics
- Fuel coolant interactions
- Molten core-concrete interactions
- Hydrogen combustion
- Fission-product release, transport and deposition

MAAP4 has capability to model the following in-vessel recovery and advanced reactor systems:

- Modeling of core melting and relocation; and separately tracking uranium dioxide, Zircaloy, zirconium dioxide, and control rod materials

- Pressurizer and surge line thermodynamic calculations for modeling the large valves used in the AP1000 automatic depressurization systems (ADS)

- Reactor vessel cooling by containment water surrounding the vessel
- Reactor vessel lower head creep rupture
- Generalized containment model
- Passive safety system models, including passive residual heat removal (PRHR) heat exchanger, core makeup tanks (CMT), and passive containment cooling
- Generalized user-defined event codes

MAAP4 solves a set of lumped parameter, nonlinear, first order, coupled, ordinary differential equations in time. These equations generally express the conservation of mass and energy. Momentum balances in MAAP are assumed to be quasi-steady. MAAP4 then calculates thermal-hydraulic and fission-product variables at each time step.

The modeling of regions, components, and phenomena is fully integrated into the code. For example, thermal-hydraulic and fission-product models are generally applicable to all major regions (reactor coolant system, pressurizer, containment nodes) treated in the code. The thermal-hydraulic parameters are calculated in each time step, and the fission-product parameters are overlaid on the thermal-hydraulic models. This feedback permits full interaction between the models. In addition, all of the models are run in parallel. The integrated reactor coolant system and containment modeling is ideal for the passive plant application.

The execution of the MAAP4 code requires the development of two input files: a parameter file and a sequence file. The parameter file describes the non-variant, plant-specific data including geometry, performance data, and system setpoints. The sequence file describes the severe accident sequence to be analyzed including the initiating event, system operability status, and operator actions. MAAP4 automatically initiates system operation, based on system availability described in the sequence file and setpoints described in the parameter file. Similarly, operator actions can be modeled in the sequence file by employing the user-defined event codes to describe the timing and implementation of emergency actions.

The results of the MAAP4 analysis describe the severe accident progression and fission-product releases associated with accident sequences analyzed. Specifically, MAAP4 evaluates the following details of the severe accident:

- Time histories of the important state parameters, such as pressure, temperature, and inventories in each control volume of the reactor coolant system and containment models
- Timing of engineered safety system initiation and termination
- Timing and magnitude of severe accident phenomena predicted to occur in an accident sequence

- Time history for fission-product locations and states, including fission-product releases to the environment

The information calculated by MAAP4 is available in tabular form at user-specified intervals and in plot files of user-specified parameters.

44.2 The AP1000 MAAP4 Modeling

This section provides an overview of the AP1000 MAAP4 modeling used for the severe accident source term analysis.

The AP1000 reactor coolant system includes the reactor vessel, two coolant loops, a pressurizer, and two steam generators. Each loop has one hot leg and two cold legs. The MAAP4 code models each loop separately and lumps the two cold legs in each loop together. The main coolant pumps are attached to the outlet plenums of the steam generators, so there are no pump bowls or intermediate legs to allow water to collect and block gas flow through the loops in post-accident scenarios.

The passive residual heat removal heat exchanger is modeled as a heat sink in the reactor coolant system. The heat exchanger transfers heat from the RCS to the water in the in-containment refueling water storage tank (IRWST) node in the containment. The passive residual heat removal heat exchanger is normally off, and a series of user-defined event codes is used to initiate the model. The passive residual heat removal heat exchanger model calculates heat removal when the reactor coolant system is water and steam filled. Water passing through the passive residual heat removal heat exchanger can either be pumped by the reactor coolant pumps or can be driven by natural circulation. Steam from the reactor coolant system hot leg node is condensed in the passive residual heat removal heat exchanger. The condensate is returned to the reactor coolant system node containing the steam generator lower plenum.

The core makeup tanks are modeled as water sources that are attached to the reactor coolant system via a balance line from the cold leg in each loop to the core makeup tank. The normally closed drain line discharges into the reactor vessel downcomer node. The core makeup tank is actuated by a series of user-defined event codes which model the core makeup tank setpoints. When the proper conditions are met, an action is taken to open the cold leg balance and core makeup tank drain lines. Each CMT is modeled individually.

The automatic depressurization system is modeled as a single pressurizer relief valve for the first through third stages and as openings in the hot leg pipes for the fourth stage. As each of the first through third automatic depressurization system stages is opened, the area of the pressurizer relief valve is increased. Generalized openings between the MAAP4 reactor coolant system model and the containment model are used to model the fourth stage of the automatic depressurization system. ADS is actuated by a user-defined event based on the water level in the core makeup tank. As the core makeup tank water level drops below a specified level, the event becomes true. MAAP4 executes an action to increase the pressurizer relief valve area and to direct the flow to the in-containment refueling water storage tank node in the containment model. Or, in the case of the fourth stage, it opens a hole in the hot leg, directing the flow to the steam generator compartment. In the event that the automatic

depressurization system, or stages of the automatic depressurization system, are not operational for a given sequence, each failed stage can be deactivated separately in the code input.

The in-containment refueling water storage tank injection into the reactor coolant system is modeled by a generalized opening between the reactor coolant system and the containment node that models the in-containment refueling water storage tank compartment. The check valve on the in-containment refueling water storage tank drain line is modeled by specifying that the generalized opening can only flow into the reactor coolant system. The pressure of the water at the boundary between the in-containment refueling water storage tank and the containment is calculated considering the containment pressure, the elevation head of water in the tank and pressure in the RCS. If available, the gravity injection is initiated when Stage 4 ADS is activated. Gravity recirculation is modeled with the same generalized opening by opening a junction between the loop compartment node and the IRWST node.

MAAP4 has an external reactor vessel cooling model and a lower head creep rupture model to allow the timing of the reactor vessel failure to be predicted by the code. The model considers the reactor coolant system pressure and the weight of the debris in determining the load on the lower head steel. Reactor vessel shell thinning, temperature, material properties, and heat transfer through the lower head wall to the cavity gas or water are used to predict the timing of the loss of strength of the reactor vessel shell. The initial failure area is specified by the user, and the code predicts the ablation of the steel as debris is ejected. However, success of in-vessel retention of molten debris is justified in Chapter 39, independent of MAAP4 analyses.

Creep rupture of reactor coolant system hot leg nozzles, surge line, and steam generator tubes is considered during high reactor coolant system pressure severe accident analyses. A user-specified wall temperature is used to determine the timing of the failure, and a user-specified break area is opened in the rupture pipe.

The AP1000 containment is modeled using 12 control volume nodes and 29 junctions in the MAAP4 generalized containment model. Nine nodes are used inside the containment pressure boundary and three nodes are used outside as the annulus between the primary and secondary containment structures. Figure 44-1 presents a graphical representation of the AP1000 MAAP4 containment model.

Two nodes are used to represent the two steam generator compartments. One node represents each of the upper compartment, the core makeup tank room, the chemical volume and control system room, and two passive injection system compartments. Two more nodes are used to represent the reactor cavity and the in-containment refueling water storage tank, which is initially mostly filled with water. A junction with check valves is used to represent the dampers which allow gas flow from the in-containment refueling water storage tank to the upper containment cylinder and annulus.

Three nodes outside the containment pressure boundary model the passive containment cooling system downcomer, riser, and dome.

The passive containment cooling system is modeled as a set of heat sinks that communicates with the upper compartment node inside the containment, and two PCS nodes outside the containment boundary. The MAAP4 model allows water to be placed onto the outside of the heat sinks at a specified rate. An evaporation model calculates the heat and mass transfer to the annulus gas flowing through the outside containment nodes. Any remaining water flows down to the next passive containment cooling system heat sink. Two heat sinks are used to model the passive containment cooling system dome and shell.

Inside the containment, the condensate that forms on the passive containment cooling system wall is treated similarly to the water flow outside the shell, flowing down from one heat sink to the next until it reaches a water pool. The water condensed on the shell inside the containment is returned to the in-containment refueling water storage tank in the MAAP4 model.

The nodes in the containment are modeled to represent the water pools and water flow paths in the AP1000 containment. MAAP4 provides a user-specified table of nodal water volumes as a function of height. Water spills into another node when the pool elevation reaches a junction connecting two nodes.

When the AP1000 in-containment refueling water storage tank node water level reaches its overflow elevation, it spills water into the refueling canal. The in-containment refueling water storage tank water can be drained into the cavity via an operator action to open a motor-operated valve and a squib valve that drains the in-containment refueling water storage tank water into the lower containment, allowing water to spill to the cavity. The operator action is assumed to be queued on high core exit temperature.

Hydrogen combustion can occur in any of the MAAP4 containment nodes, and hydrogen igniters are modeled in the AP1000 MAAP4 containment. The number and location of the igniters are discussed in detail in DCD Chapter 6. The igniters may be disabled for specific sequences.

Containment failure is modeled in the AP1000 MAAP4 parameter file as a threshold pressure.

44.3 Benchmarking

The goal in the development of the MAAP code is to provide a tool that can be used with confidence in analyses that determine the progression and consequences of a severe accident. Toward this end, benchmarking activities have been pursued throughout the evolution of MAAP.

The benchmarking activities are performed in two separate areas: individual benchmarks of specific phenomenological models and integrated benchmarks of overall code predictions where two or more competing phenomenological processes are occurring simultaneously. Consequently, for each of the major processes in the code, individual benchmarks are performed to demonstrate that the models are consistent with available data. In addition, integral benchmarks of the overall performance of the code are performed where applicable information is available.

The available data base for the benchmarking comparisons includes (Reference 44-1):

- Industrial testing
- Experiments performed in out-of-reactor test apparatus
- In-reactor tests
- Theoretical calculations
- Comparisons with predictions from other codes

The available data is evaluated in terms of its applicability to the prediction of severe accident phenomena, progression, or consequences. The criteria for determining the applicability of the data base include (Reference 44-1):

- Scalability of experimental data
- Applicability of experimental conditions to the prototypical conditions
- Conservatism in analytical conditions

A summary of benchmarks performed for the MAAP code is presented as Table 44-1. Additional detailed benchmarking for tests such as HDR and CORA is available in Reference 44-1.

The table shows that most models are benchmarked with several comparisons to experiments and other computer codes. One of the more important phenomena modeled by MAAP4, debris coolability and quenching, benchmarked with good agreement with several international tests including the Sandia National Laboratories SWISS Test.

In addition to the benchmarking listed in Table 44-1, the following passive-plant-specific models were benchmarked by Westinghouse during the AP600 Probabilistic Risk Assessment (Reference 44-2):

- Core makeup tank model comparison to design/performance calculations

- Passive residual heat removal model comparison to design/performance calculations and to Westinghouse passive steam condenser testing and correlation

- Passive containment cooling system model comparison to Westinghouse passive containment cooling system small scale integral testing

44.4 Summary and Conclusions

The MAAP code is a computational tool for evaluating nuclear plant response to severe accidents and predicting fission-product releases to the environment for offsite consequence analyses. It is used extensively for probabilistic risk assessment and individual plant examination applications. MAAP4 has the capability of modeling accident management strategies, including in-vessel recovery of the core and modeling advanced light water reactor passive systems and containments.

An AP1000 model is developed for the MAAP4 code and is used for the AP1000 probabilistic risk assessment. The passive safety system models, generalized containment, and user-defined event codes are implemented extensively in the AP1000 model.

Westinghouse has benchmarked MAAP4 and finds it appropriate for use in the AP1000 probabilistic risk assessment.

44.5 References

44-1 MAAP 4.04 User Guidance, EPRI, May 1994.

44-2 GW-GL-022, AP600 Probabilistic Risk Assessment, August 1998.

Table 44-1 (Sheet 1 of 4)

MAAP MODEL BENCHMARKS

Physical Process	Experiment/ Code	Type of Comparison						Documentation			
		Separate Effects Exps.		Integral Experiments							
		Small Scale	Large Scale	Out-of-Reactor	In-Reactor	Industry Experiences	Detailed Analysis	Open Literature	IDCOR Reports	MAAP User's Manual	EPRI Reports
Core Heatup	PBF-SFD tests			X					X		
	LOFT FP-2			X							X
	TMI-2					X		X	X		X
	BWR heatup code						X	X	X	X	
	PWR heatup code						X	X	X	X	
Clad Oxidation	Numerous exps.	X						X	X		
	LOFT FP-2				X						X
	TMI-2					X			X		X
	BWR heatup code						X	X	X	X	
	PWR heatup code						X	X	X	X	
Fission-Product Release	ORNL experiments	X						X	X	X	
	SASCHA exps.	X						X	X	X	
	PBF-SFD tests				X				X		
	LOFT FP-2				X						X
	TMI-2					X			X	X	

Table 44-1 (Sheet 2 of 4)

MAAP MODEL BENCHMARKS

Physical Process	Experiment/ Code	Type of Comparison						Documentation			
		Separate Effects Exps.		Integral Experiments		Industry Experiences	Detailed Analysis	Open Literature	IDCOR Reports	MAAP User's Manual	EPRI Reports
		Small Scale	Large Scale	Out-of-Reactor	In-Reactor						
Aerosol Transport and Deposition	ABCOVE tests		X						X	X	
	ORNL (NSPP) tests		X						X		
	Al tests		X						X	X	
	MARVIKEN tests			X					X		
	JAERI (Japan) tests	X							X	X	
	CEA (France) tests		X						X		
	CSE tests		X						X	X	
	EPRI tests	X							X		
	DEMONA tests			X					X		
	Gillespie and Langstroth	X							X		
Hydrogen Combustion	Westinghouse data		X					X	X	X	
Complete	Thermodynamic analysis						X	X	X	X	
	TMI-2					X			X		
Incomplete	Whiteshell tests		X					X	X	X	
	EPRI tests		X					X	X		
	EPRI/FMC model						X		X	X	
	SNL VGES tests		X						X		
	EPRI Nevada tests		X						X		

Table 44-1 (Sheet 3 of 4)

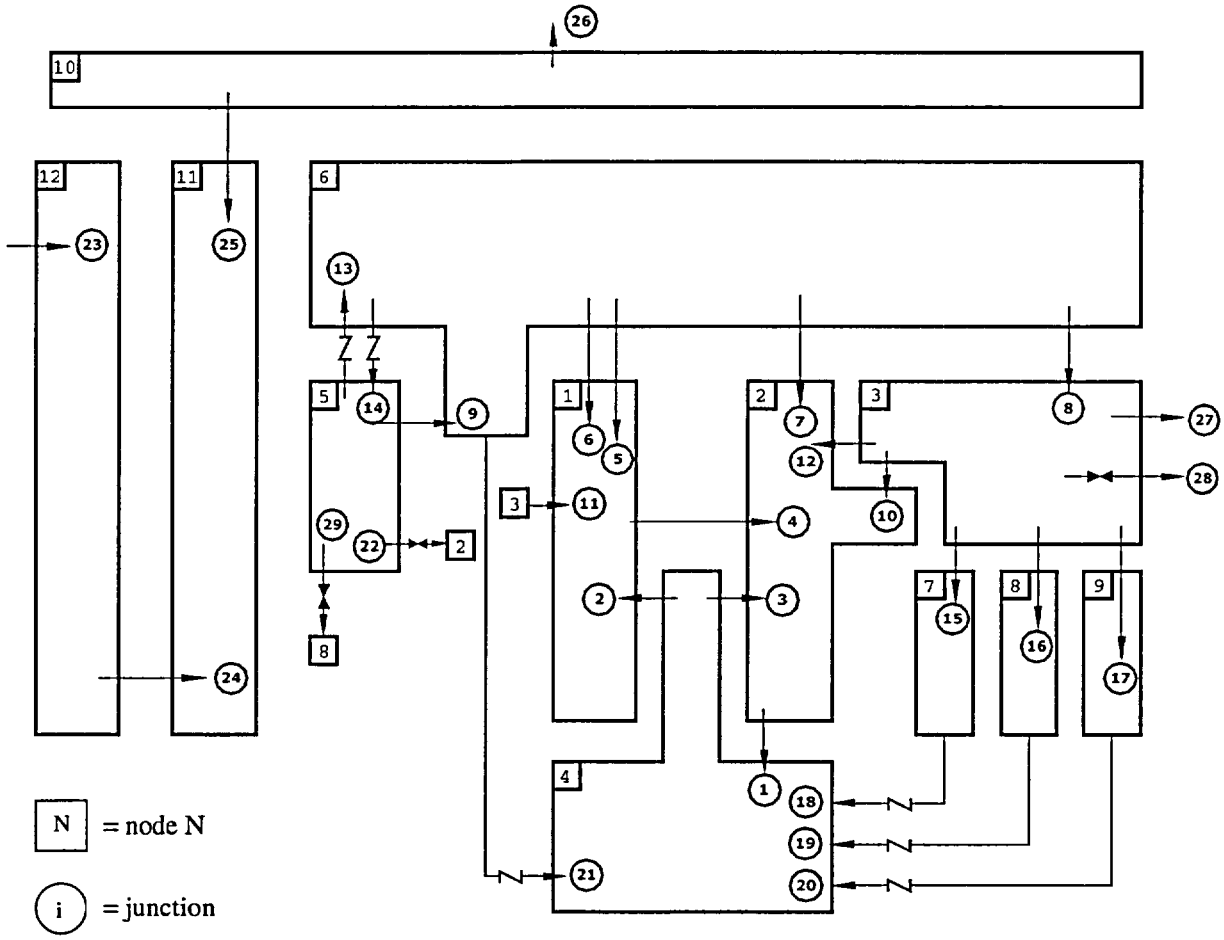
MAAP MODEL BENCHMARKS

Physical Process	Experiment/ Code	Type of Comparison						Documentation			
		Separate Effects Exps.		Integral Experiments							
		Small Scale	Large Scale	Out-of-Reactor	In-Reactor	Industry Experiences	Detailed Analysis	Open Literature	IDCOR Reports	MAAP User's Manual	EPRI Reports
Debris Fragmentation	Sandia tests	X						X	X		
	ISPRA tests	X						X	X		
	Niggins exps.	X						X	X		
	ALCOA tests	X						X	X		
	Buxton, et al.	X						X	X		
	LNG experiments		X					X	X		
Debris Dispersal	ANL experiments			X					X		
	Sandia Exps.			X							
Debris Coolability	1st SNL steel-concrete exp			X							
	UK experiments	X						X	X	X	
	Kfk experiments	X						X	X	X	
	EPRI experiments	X						X	X	X	
	ANL particle bed exps.	X						X	X	X	
	ANL HYP tests	X									
	ANL CWCI tests	X									
	ANL SHOTDROP tests	X									
	SNL SWISS exps.			X							
	TMI-2					X					
	USBM Burro exps.		X								
	Purdue exps.	X									
	Lava quenching		X								

Table 44-1 (Sheet 4 of 4)

MAAP MODEL BENCHMARKS

Physical Process	Experiment/ Code	Type of Comparison						Documentation			
		Separate Effects Exps.		Integral Experiments		Industry Experiences	Detailed Analysis	Open Literature	IDCOR Reports	MAAP User's Manual	EPRI Reports
		Small Scale	Large Scale	Out-of-Reactor	In-Reactor						
Core-Concrete Attack	1st SNL steel-concrete exp.			X							
	WECHSL analysis						X	X	X	X	
	SNL SWISS exps.	X		X				X	X	X	
	SNL TURC exps	X		X							
	Lava quenching	X						X	X	X	
Reflective Insulation	EPRI experiments	X									
Wall Ablation	Closed form solution						X				
Revaporation	Preliminary ANL results	X									
Primary System T/N	DBA analysis					X	X	X	X		
	RELAP 5 SBO analysis					X	X				
	Davis-Bosse LOFA					X					
	Browns Ferry					X		X			
Primary System Natural Circulation	Westinghouse exps.			X					X	X	
	SIAM code						X				
Containment Natural Circulation	HEDL He		X								
	Mixing exps.										X
	FAI brine-water exps.	X									X



Node 1	SG Compt #1 & Pzr Doghouse	Node 7	PXS-A Compt
Node 2	SG Compt #2 & Vert. Access Tunnel	Node 8	PXS-B Compt
Node 3	CMT Compt	Node 9	CVS Compt
Node 4	Reactor Cavity	Node 10	PCS Dome
Node 5	IRWST Compt	Node 11	PCS Annulus
Node 6	Upper Compt	Node 12	PCS Downcomer
		Node 13	Environment

Figure 44-1

MAAP4 AP1000 Containment Nodalization

Figure 44-1 Notes:

MAAP4 AP1000 Containment Model Flow Links

1. Reactor Cavity to Vertical Access (SG Compt #2)
2. Reactor Cavity to SG Compt #1 through Loop Holes
3. Reactor Cavity to SG Compt #2 through Loop Holes
4. SG Compt #1 to SG Compt #2 through Vertical Access Tunnel
5. SG Compt #1 to Upper Compt through SG Doghouse
6. SG Compt #1 to Upper Compt through Pressurizer Doghouse
7. SG Compt #2 to Upper Compt through SG Doghouse
8. Upper Compt to CMT Room
9. IRWST Overflow to Refueling Canal (Upper Compt)
10. Vertical Access Tunnel (SG Compt #2) to CMT Room
11. CMT Room to SG Compt #1
12. CMT Room to SG Compt #2
13. IRWST Vents to Upper Compt
14. IRWST Back Vents (Upper Compt to IRWST)
15. CMT Room to PXS-A
16. CMT Room to PXS-B
17. CMT Room to CVS Room
18. PXS-A Room Drain to Sump (Check Valve)
19. PXS-B Room Drain to Sump (Check Valve)
20. CVS Room Drain to Sump (Check Valve)
21. Refueling Canal Drain to Sump (Check Valve)
22. IRWST Drain to SG Compt #2 (recirculation line/cavity flooding)
23. PCS Inlet to PCS Downcomer
24. PCS Downcomer to PCS Annulus
25. PCS Annulus to PCS Dome
26. PCS Outlet to Environment
27. Containment Leakage
28. Containment Failure / Containment Isolation Failure
29. IRWST to PXS (DVI Line Break)

CHAPTER 45

FISSION-PRODUCT SOURCE TERMS

This chapter discusses the fission-product source terms that are used in the offsite dose analysis (Chapter 49) for each of the release categories, or end states, of the containment event tree, as discussed in Chapter 35. The source terms are taken from the MAAP4 analyses results presented in Chapter 34. They are used as the input to the offsite dose analysis presented in Chapter 49.

45.1 Summary of AP1000 Release Categories

The release categories group similar fission-product source terms from the Level 2 analysis to bound the offsite consequences and reduce the number of sequences to be analyzed. The AP1000 prevents large releases with design features of the containment that provide redundant, diverse mitigation of challenging phenomena in the unlikely event of a severe accident. These features include the reactor coolant automatic depressurization system (ADS), the ability to flood the reactor vessel cavity, hydrogen igniters in the large dry containment, and the passive containment cooling system (PCS). The design features act to maintain reactor coolant system (RCS) integrity, prevent containment overpressurization from hydrogen detonation or deflagration, and remove heat from the containment. The mitigation features maintain the potential for fission-product release from the AP1000 containment very low.

Given a severe accident, a release of fission products occurs through normal containment leakage, a breach of the containment or a bypass of the containment.

A large pre-existing opening, or containment isolation failure, produces containment leakage beyond the design basis. The failure of a large purge line isolation valve is assumed for containment isolation failure.

A breach of the containment shell is assumed to occur based on the containment pressure and the conditional containment failure probability discussed in Chapter 42. The containment is also assumed to fail if hydrogen detonation occurs.

Containment bypass in the AP1000 is typically caused by steam generator tube rupture initiated events that progress to severe accident or by steam generator tube ruptures induced by high pressure and temperature core damage events.

The containment release categories are described in Section 35.6. For each of these categories, the release fractions are determined over a 72-hour period following the onset of core damage. For all containment failure release categories, the release is assumed to be directly from the containment to the environment at ground level. For the intact containment (IC) category, a decontamination factor (DF) of three is applied (Reference 45-2) due to deposition in the auxiliary building.

For each of the release categories, a representative source term is used to complete the Level 3 analysis. This representative source term was identified as the bounding release for the accident sequences in the specific release category.

The release fractions at 24 and 72 hours for each fission-product group are presented in Tables 45-1 and 45-2, respectively.

45.2 Release Category Source Terms

45.2.1 Release Category IC

Release Category IC represents the release of fission products from an intact containment during a severe accident. Normal containment leakage accounts for the fission-product releases to the environment. The likely normal leakage release pathway is via containment penetration leakage into the auxiliary building.

The fission product release fractions from an accident class 3BE sequence with cavity flooding, hydrogen control, and passive containment cooling are used to represent the IC release. A decontamination factor of 3 is applied to the aerosol-release fractions to model deposition in the auxiliary building. A direct release sensitivity analysis to the decontamination factor is discussed in section 45.3.

The source term releases for Release Category IC are presented in Figures 45-1 through 45-12.

45.2.2 Release Category BP

Release category BP represents containment bypass releases to the environment. Fission products are released from the reactor coolant system via failed steam generator tubes to the secondary system and to the environment through a stuck-open safety valve. Release category BP contributes to the large, early release frequency (LERF) of the AP1000. The fission product release fractions from a steam generator tube rupture induced by high pressure core damage in accident class 1A are used to represent the BP release.

The source term releases for Release Category BP are presented in Figures 45-13 through 45-24.

45.2.3 Release Category CI

Release category CI represents fission product releases to the environment from an unisolated containment. Fission products are released from the reactor coolant system to the containment; however, the containment is not isolated from the environment from the beginning of the accident. Release category CI contributes to the LERF of the AP1000.

The fission product release fractions from an accident class 3C sequence with the failure of containment isolation are used to represent the CI release category.

The source term releases for Release Category CI are presented in Figures 45-25 through 45-36.

45.2.4 Release Category CFE

Release category CFE represents fission product releases to the environment from containment failure induced by severe accident phenomena that may occur during the core melting and

relocation phase of the accident sequence. Fission products are released from the reactor coolant system to the containment. Before significant deposition of the aerosol fission products, the containment fails due to a high-energy event (i.e. hydrogen combustion or steam explosion). Release category CFE contributes to the LERF of the AP1000.

The fission product release fractions from an accident class 3D sequence with early containment failure induced by hydrogen detonation were used to represent release category CFE.

The source term releases for Release Category CFE are presented in Figures 45-37 through 45-48.

45.2.5 Release Category CFI

Release category CFI represents fission product releases to the environment from containment failure that may occur after the melting and relocation phenomena and within 24 hours after the onset of core damage. Fission products are released from the reactor coolant system to the containment. The containment atmosphere is well-mixed and significant aerosol deposition has begun when the containment fails due to severe accident phenomena (i.e. hydrogen combustion or long-term containment pressurization from decay heat). Release category CFI contributes to the large release frequency of the AP1000, but is not an early release contributing to LERF.

The fission product release fractions from an accident class 3BE sequence with intermediate containment failure induced by hydrogen detonation were used to represent release category CFI.

The source term releases for Release Category CFI are presented in Figures 45-49 through 45-60.

45.2.6 Release Category CFL

Release category CFL represents fission product releases to the environment from containment failure that may occur after 24 hours. Fission products are released from the reactor coolant system to the containment. The containment atmosphere is pressurized with steam from decay heat. Significant aerosol deposition occurs over the long term of the accident. Containment fails from overpressure due to loss of containment cooling. Release category CFL contributes to large release frequency, but is not an early release contributing to LERF.

The fission product releases from an accident class 3BE sequence and containment failure induced by long-term containment pressurization is used to represent release category CFL.

The source term releases for Release Category CFL are presented in Figures 45-61 through 45-72.

45.2.7 Release Category CFV

Release category CFV represents fission product releases to the environment from containment venting, which occurs after 24 hours. Fission products are released to the containment. The

containment atmosphere is pressurized with steam from decay heat. Significant aerosol deposition occurs over the long term of the accident. The operator vents the containment at a pressure well below the failure pressure of the containment. No filtering is assumed. Release category CFV contributes to large release frequency, but is not an early release contributing to LERF.

Release category CFV did not exist for the AP600 PRA (Reference 45-1). The failure frequency for successful operator venting in the containment event tree analysis is unity. Therefore, the frequency of CFV in the AP1000 PRA is zero occurrences per reactor year. No source term is calculated for this release category.

45.3 Direct-Release Sensitivity Case

For release category IC, the leakage from the containment is assumed to pass through the middle annulus of the auxiliary building. This room has restricted leakage to the environment. Thus, the fission products have long residence times. Significant deposition occurs in the middle annulus, attenuating the release of fission products to the environment. A decontamination factor of three is credited for the aerosol fission products because of this deposition.

To account for uncertainty in the probability of the fission products bypassing the middle annulus decontamination effect, the release is assumed, in the IC direct-release sensitivity case, to be released directly to the environment at the design leak rate.

The source term releases for the Direct Release Sensitivity Case are presented in Figures 45-73 through 45-84.

45.4 Summary

The AP1000 release categories and associated source terms over the first 24 and 72 hours after core damage are summarized in Tables 45-1 and 45-2, respectively.

A fission-product release source term (direct) is also developed to address the sensitivity assuming that the IC source term from the containment is released directly to the environment with no holdup or decontamination in the auxiliary building. The sensitivity release fractions also represent source terms for consequence analysis, as discussed in Chapter 49.

45.5 References

45-1 GW-GL-022, AP600 Probabilistic Risk Assessment, August 1998.

45-2 EPRI Letter to James Wilson, USNRC, dated April 30, 1993, attachment titled, "Passive ALWR Secondary Building Mixing and Leak Rate Monitoring."

Table 45-1

ENVIRONMENTAL RELEASE FRACTIONS AT 24 HOURS AFTER CORE DAMAGE PER RELEASE CATEGORY

Release Cat.	Environmental Release Fractions at 24 Hours After Core Damage											
	Xe, Kr	CsI	TeO_2	SrO	MoO_2	CsOH	BaO	La_2O_3	CeO_2	Sb	Te_2	UO_2
IC	1.0E-3	1.2E-5	9.5E-6	1.1E-5	1.3E-5	1.1E-5	1.2E-5	1.3E-6	1.5E-6	1.3E-5	0.0E0	0.0E0
BP	6.3E-1	1.2E-2	1.9E-2	3.0E-4	5.0E-3	1.1E-2	7.9E-4	1.2E-5	3.5E-5	5.5E-2	0.0E0	0.0E0
CI	6.4E-1	4.6E-2	2.1E-2	2.0E-2	4.0E-2	1.8E-2	3.2E-2	2.4E-4	7.4E-4	2.7E-2	0.0E0	0.0E0
CFE	8.1E-1	5.7E-2	3.2E-2	3.5E-3	1.4E-2	5.5E-2	5.3E-3	6.5E-5	2.5E-4	2.3E-2	0.0E0	0.0E0
CFI	7.5E-1	8.6E-3	1.3E-2	1.42E-2	1.7E-2	8.6E-3	1.7E-2	1.2E-3	1.2E-3	1.5E-2	0.0E0	0.0E0
CFL	8.7E-1	3.7E-2	4.4E-2	2.0E-3	1.0E-2	2.8E-2	2.0E-3	2.3E-5	1.6E-4	2.9E-2	0.0E0	0.0E0
DIRECT	3.0E-3	3.6E-5	2.9E-5	3.3E-5	3.9E-5	3.3E-5	2.8E-5	3.9E-6	4.5E-6	3.9E-5	0.0E0	0.0E0

Table 45-2

ENVIRONMENTAL RELEASE FRACTIONS AT 72 HOURS AFTER CORE DAMAGE PER RELEASE CATEGORY

Release Cat.	Environmental Release Fractions at 72 Hours After Core Damage											
	Xe, Kr	CsI	TeO_2	SrO	MoO_2	CsOH	BaO	La_2O_3	CeO_2	Sb	Te_2	UO_2
IC	2.6E-3	1.2E-5	9.5E-6	1.1E-5	1.3E-5	1.1E-5	1.2E-5	1.4E-6	1.5E-6	1.3E-5	0.0E0	0.0E0
BP	6.3E-1	1.2E-2	1.9E-2	3.0E-4	5.0E-3	1.1E-2	7.9E-4	1.2E-5	3.5E-5	5.5E-2	0.0E0	0.0E0
CI	7.8E-1	4.6E-2	2.1E-2	2.0E-2	4.0E-2	1.8E-2	2.2E-2	2.4E-4	7.4E-4	2.9E-2	0.0E0	0.0E0
CFE	9.6E-1	5.7E-2	3.2E-2	3.5E-3	1.4E-2	5.5E-2	5.3E-3	6.5E-5	2.5E-4	2.3E-2	0.0E0	0.0E0
CFI	8.5E-1	8.6E-3	1.3E-2	1.5E-2	1.7E-2	8.6E-3	1.8E-2	2.1E-3	2.2E-3	1.5E-2	0.0E0	0.0E0
CFL	4.7E-1	3.7E-2	4.4E-2	2.0E-3	1.0E-2	2.8E-2	3.0E-3	3.3E-5	1.6E-4	2.9E-2	0.0E0	0.0E0
DIRECT	7.8E-3	3.6E-5	2.9E-5	3.3E-5	3.9E-5	3.3E-5	3.6E-5	4.2E-6	4.5E-6	3.9E-5	0.0E0	0.0E0

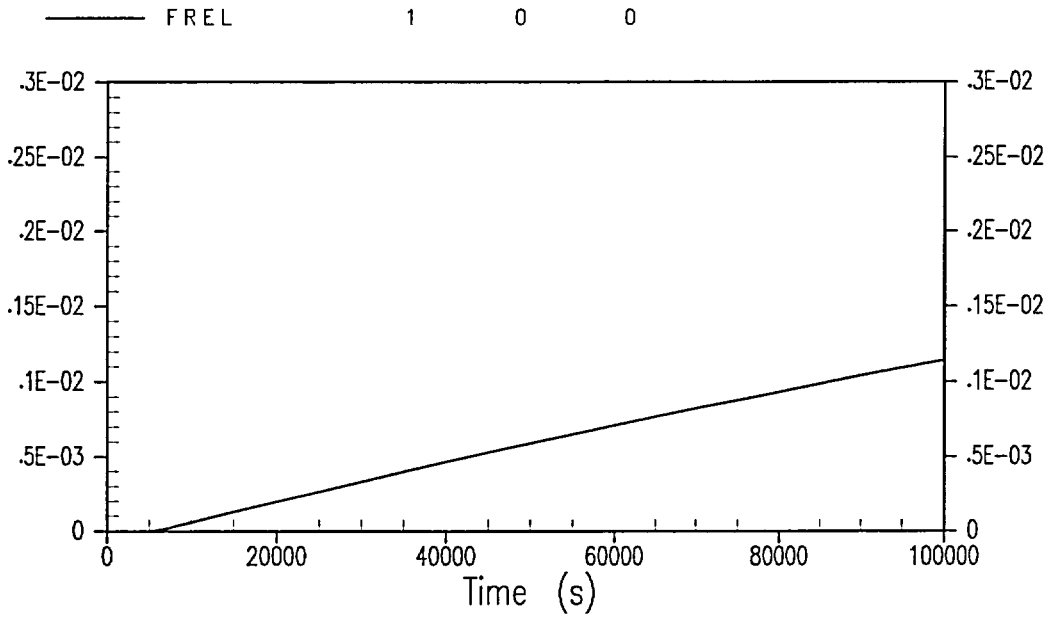


Figure 45-1

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection: Release Fraction of Noble Gases

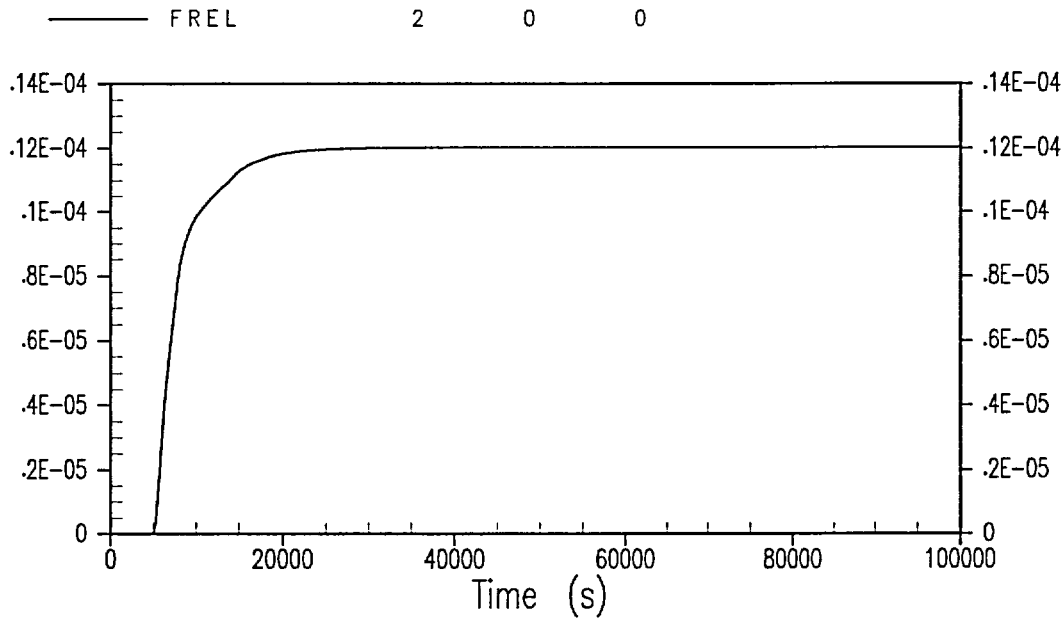


Figure 45-2

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection: Release Fraction of Cesium Iodide

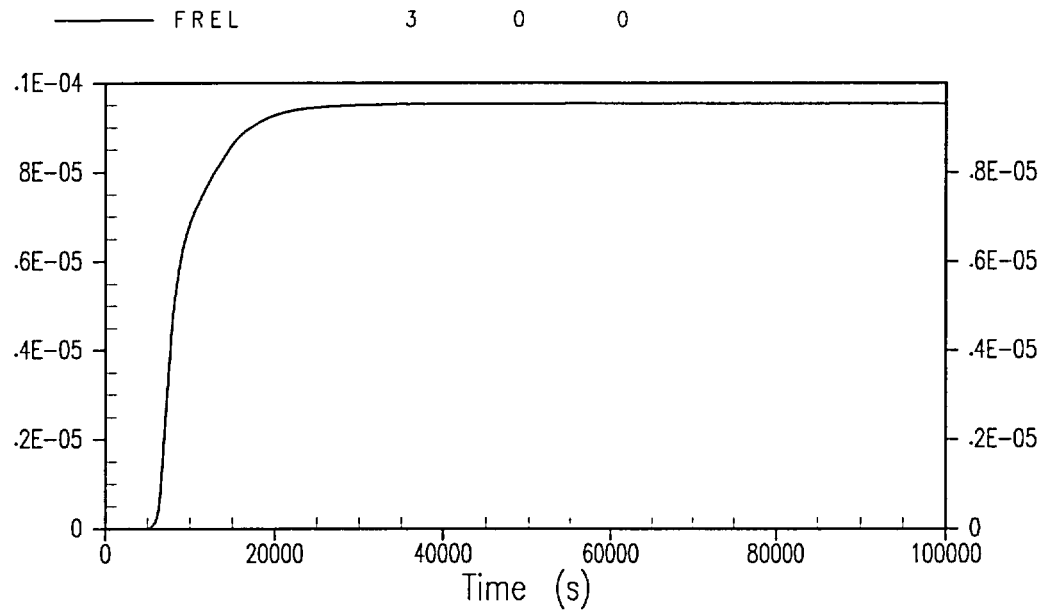


Figure 45-3

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection: Release Fraction of Tellurium Dioxide

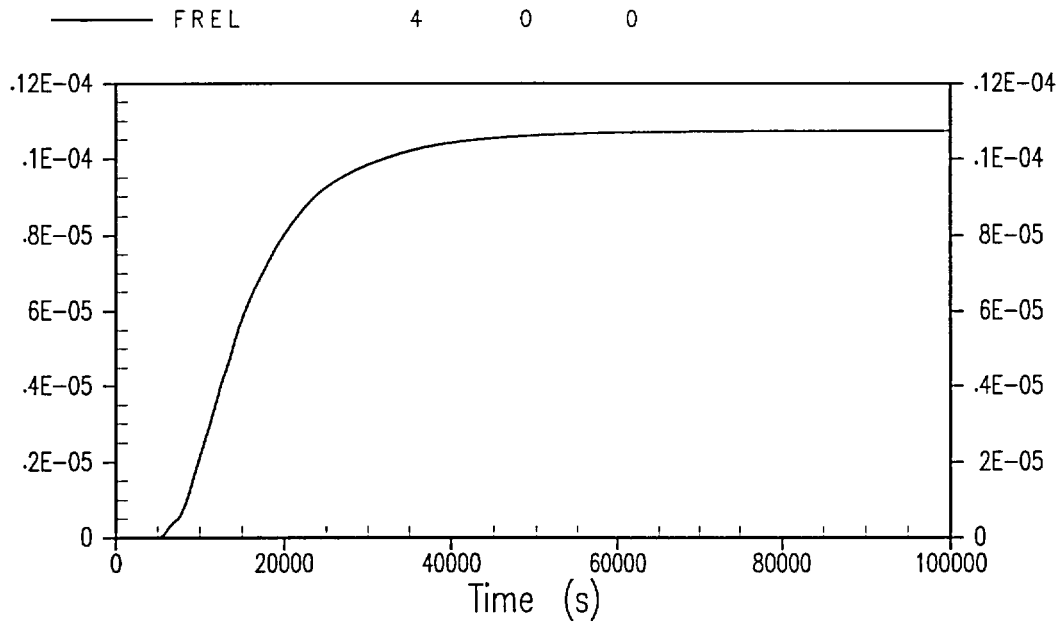


Figure 45-4

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection: Release Fraction of Strontium Oxide

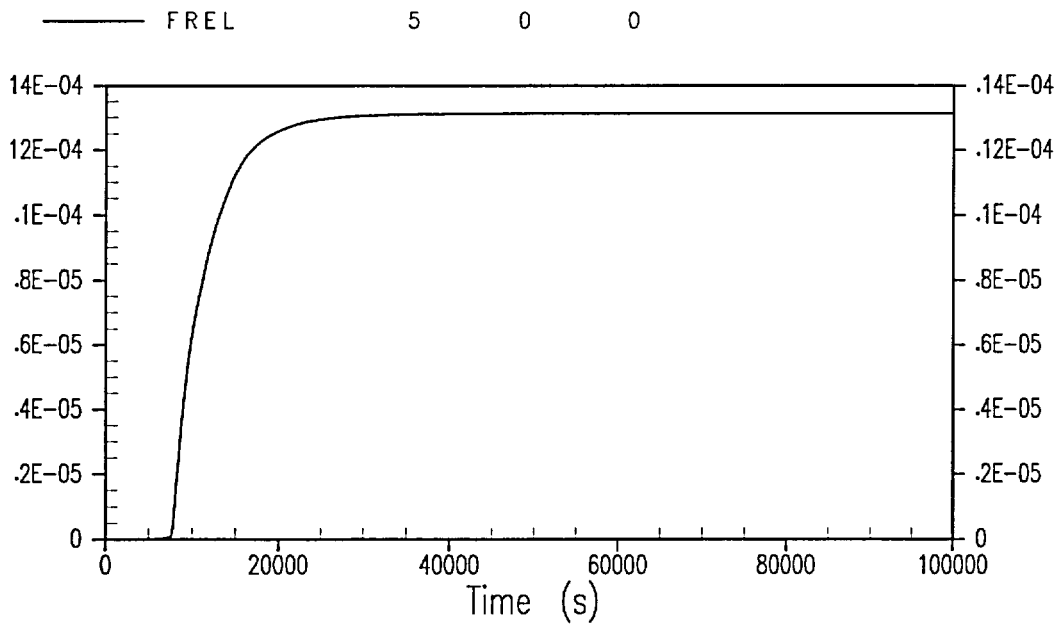


Figure 45-5

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection: Release Fraction of Molybdenum Dioxide

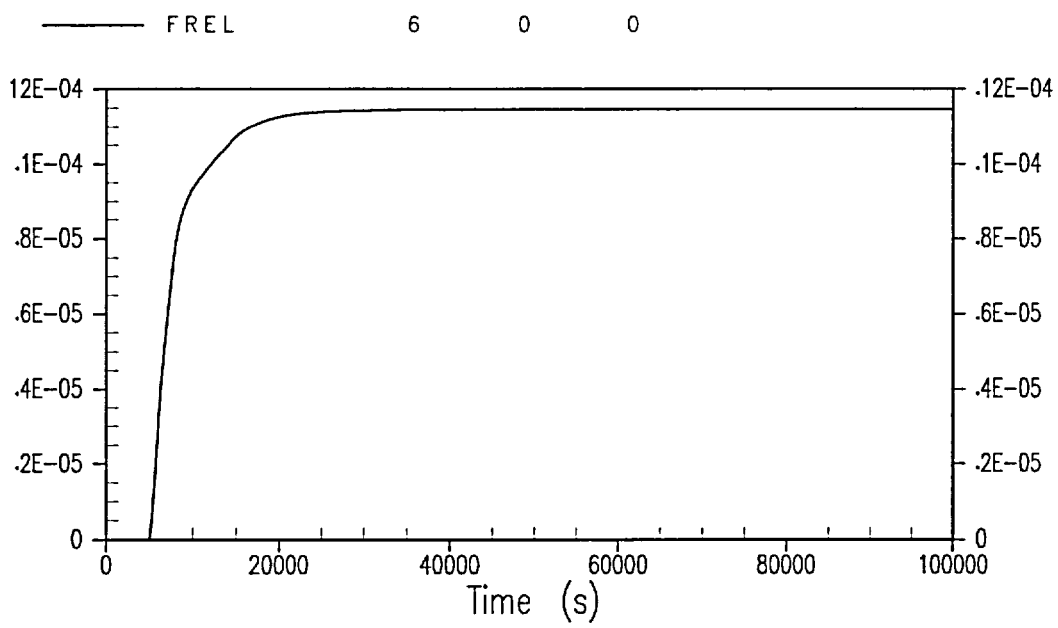


Figure 45-6

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection: Release Fraction of Cesium Hydroxide

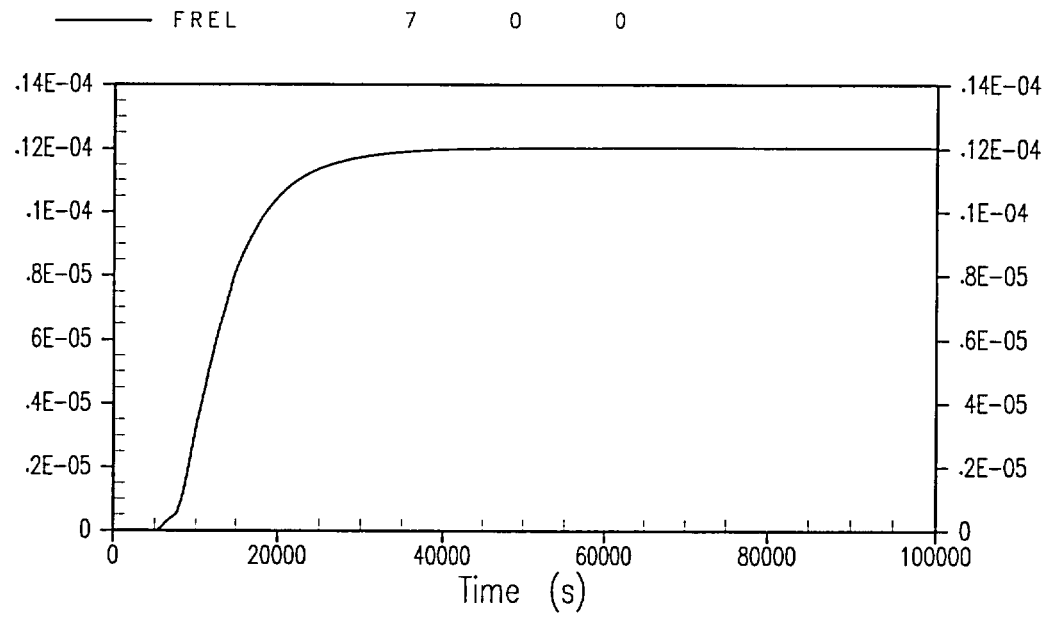


Figure 45-7

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection: Release Fraction of Barium Oxide

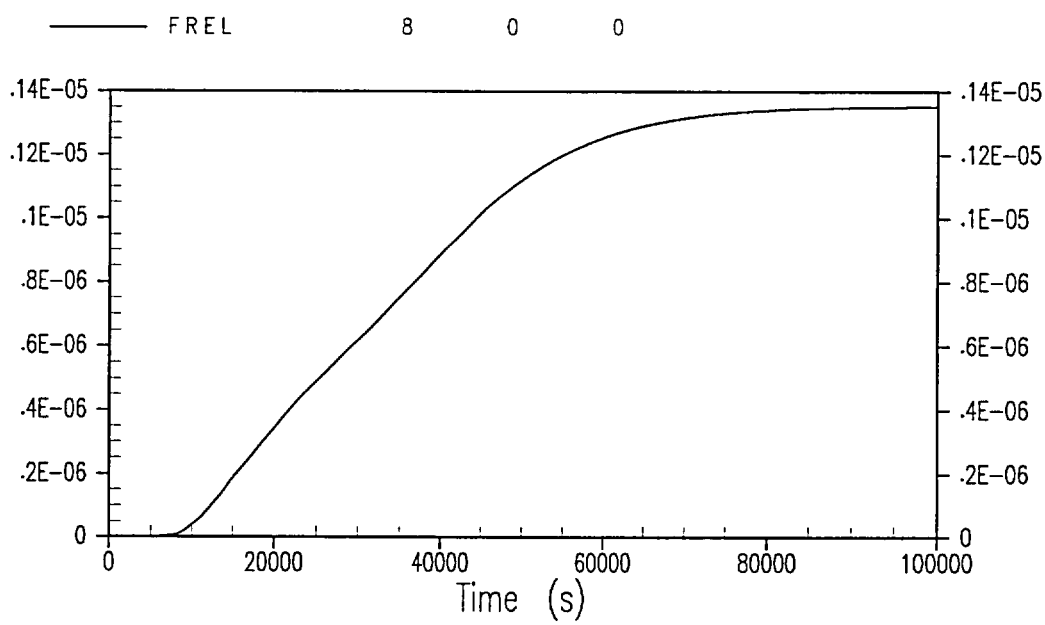


Figure 45-8

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection: Release Fraction of Dilanthanum Trioxide

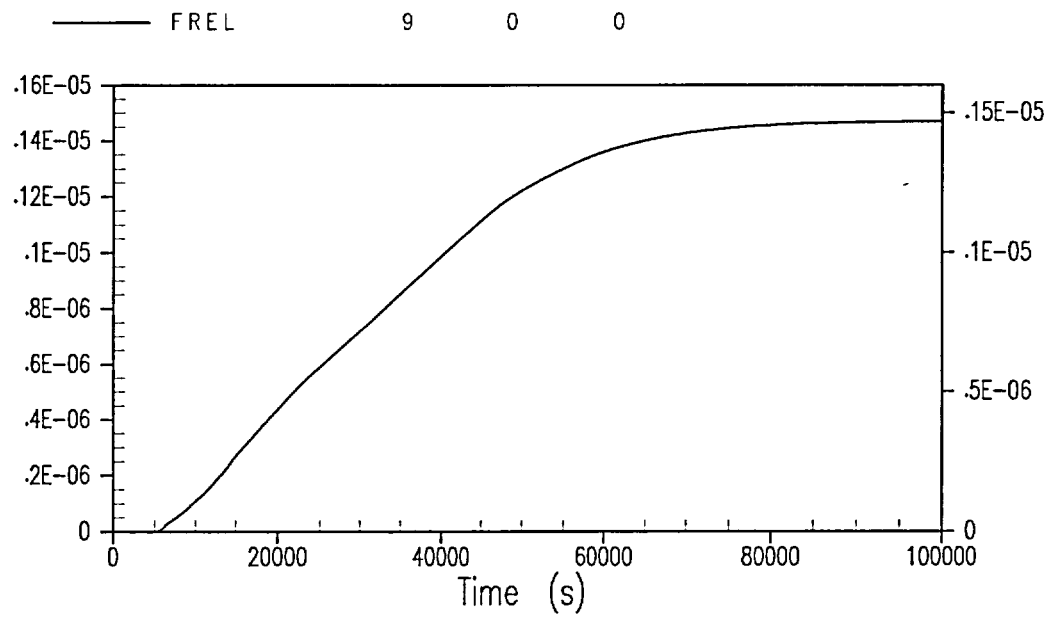


Figure 45-9

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection: Release Fraction of Cerium Dioxide

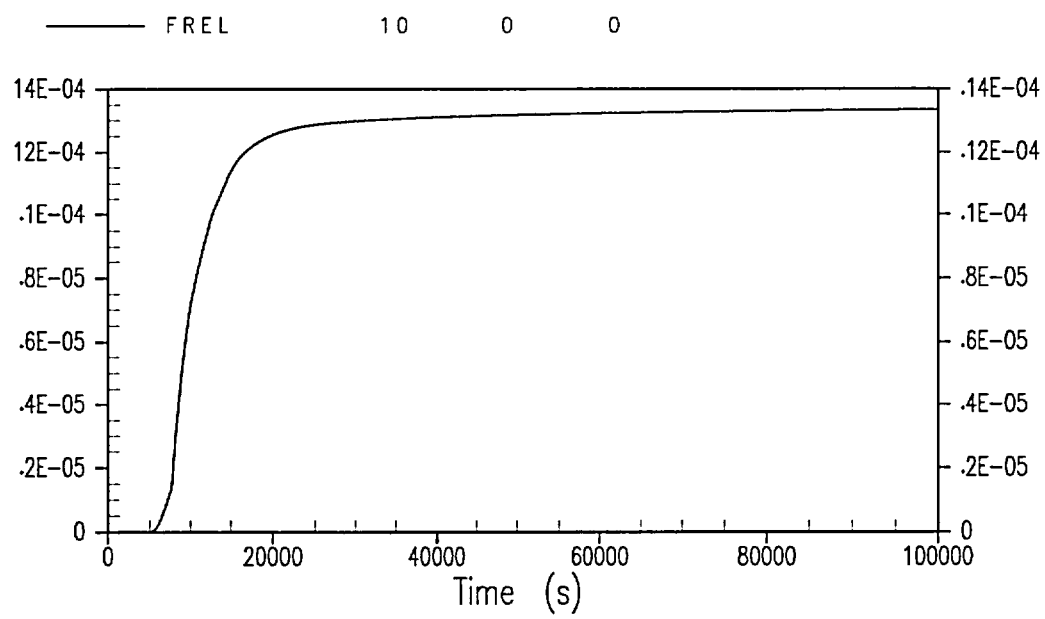


Figure 45-10

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection: Release Fraction of Tin

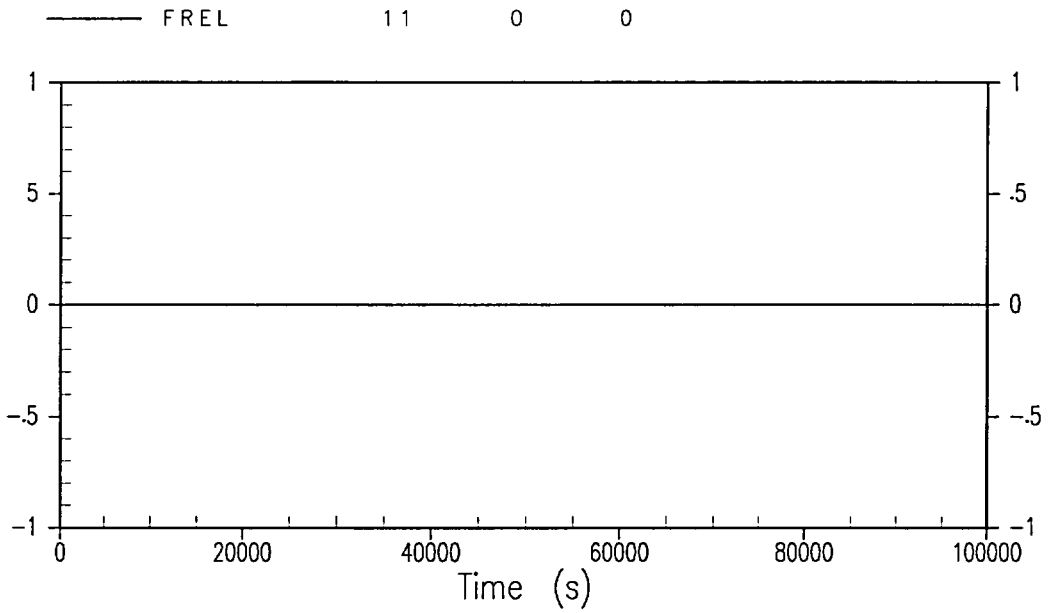


Figure 45-11

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection: Release Fraction of Tellurium

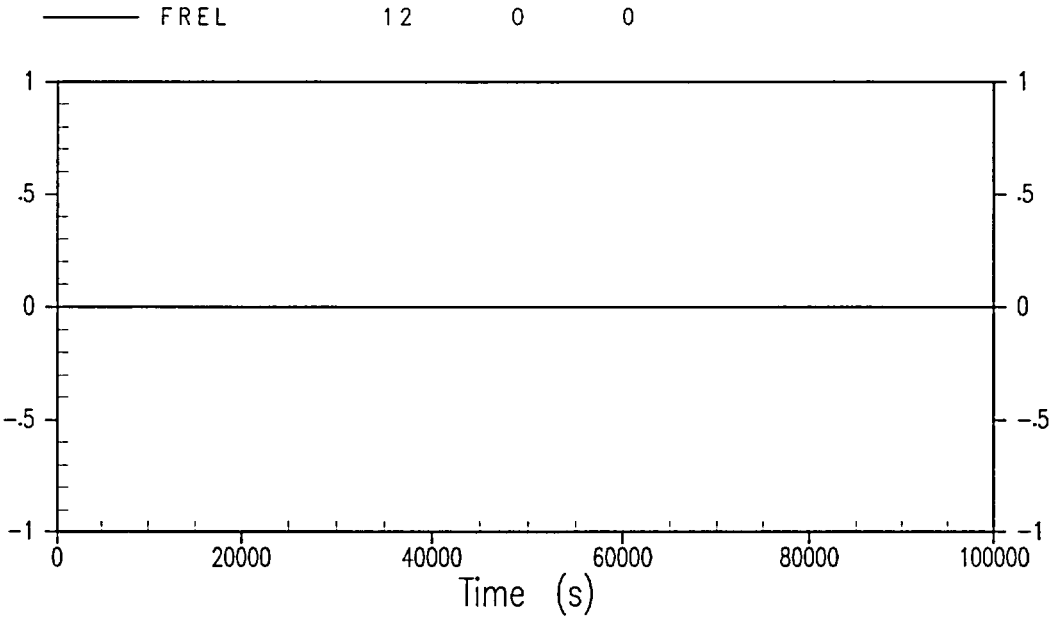


Figure 45-12

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection: Release Fraction of Uranium Dioxide

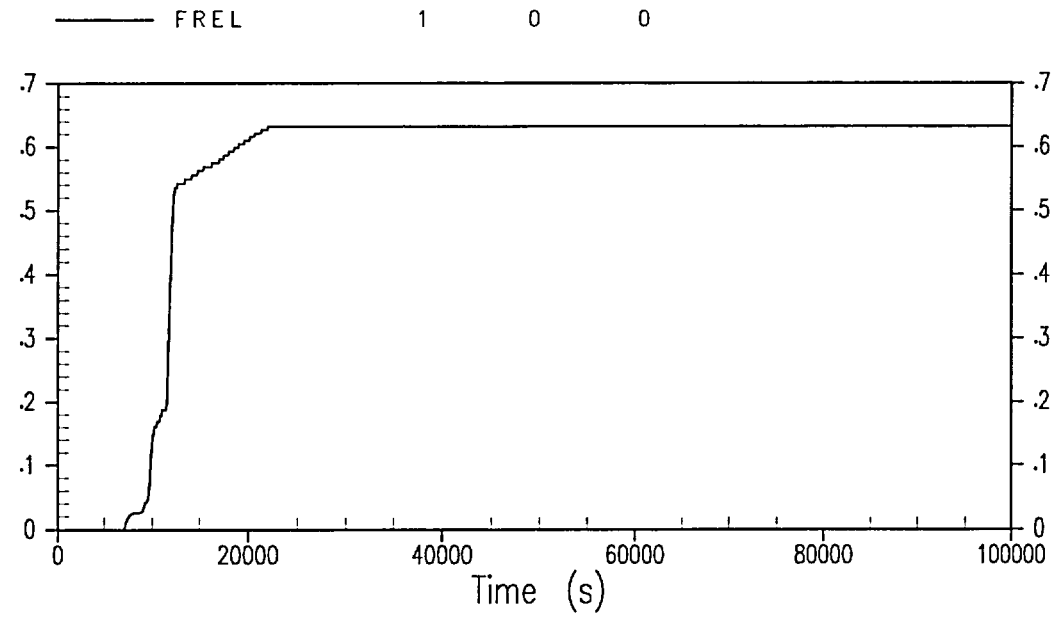


Figure 45-13

Release Category BP, Case 1A-2 – FW Failure with Creep of SG Tubes: Release Fraction of Noble Gases

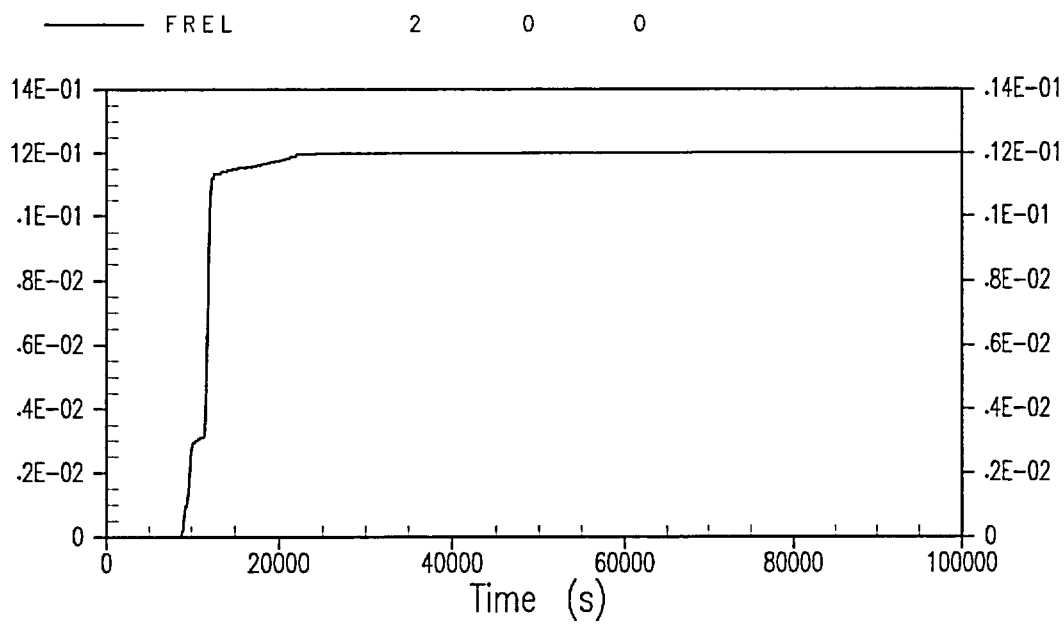


Figure 45-14

Release Category BP, Case 1A-2 – FW Failure with Creep of SG Tubes: Release Fraction of Cesium Iodide

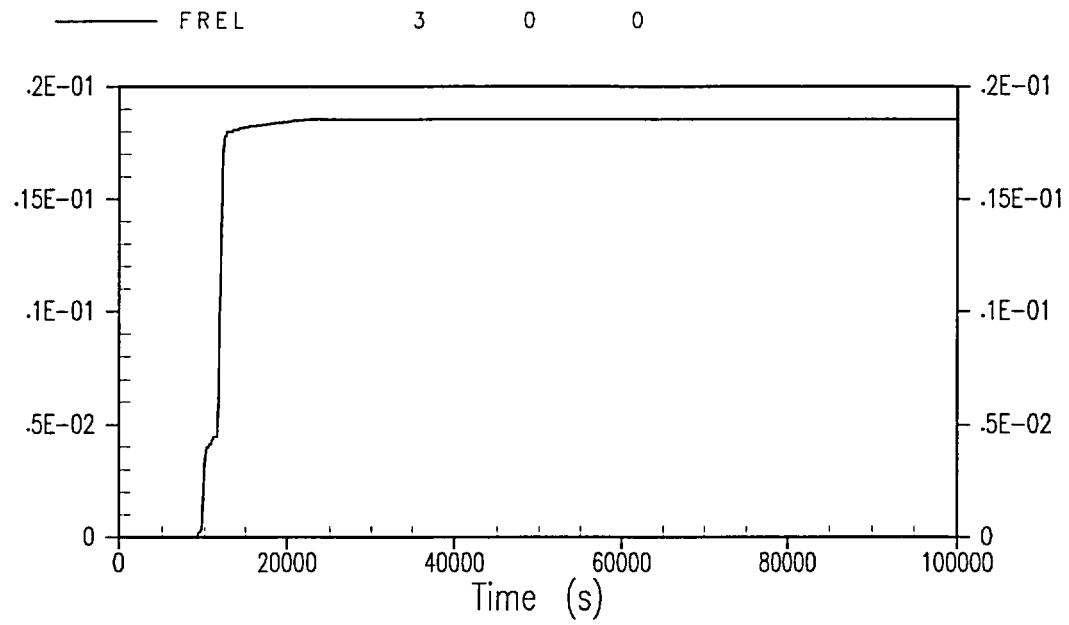


Figure 45-15

Release Category BP, Case 1A-2 – FW Failure with Creep of SG Tubes: Release Fraction of Tellurium Dioxide

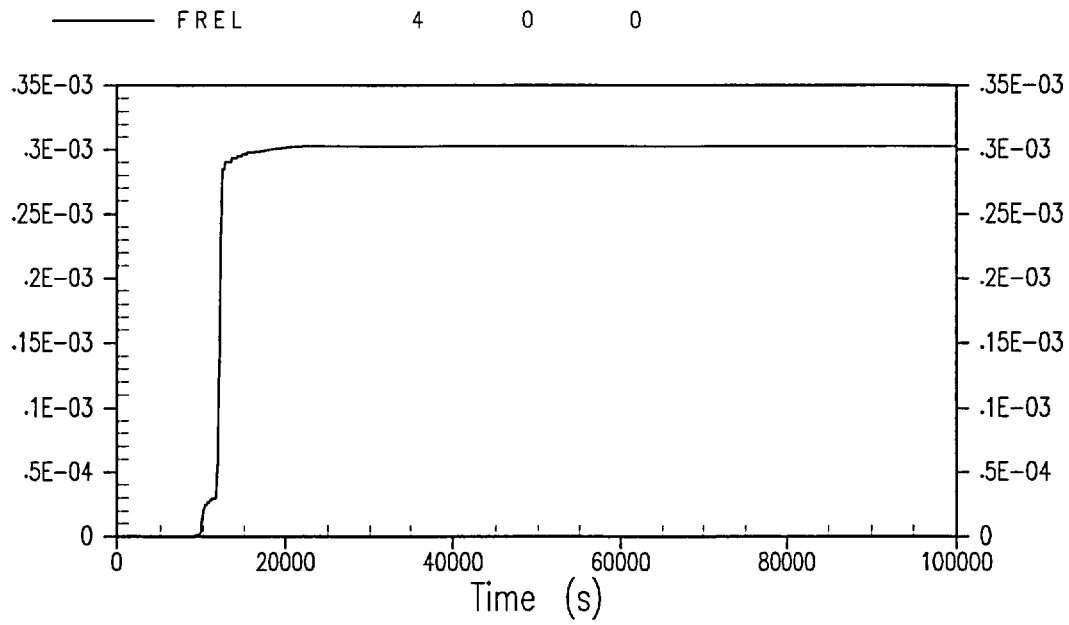


Figure 45-16

Release Category BP, Case 1A-2 – FW Failure with Creep of SG Tubes: Release Fraction of Strontium Oxide

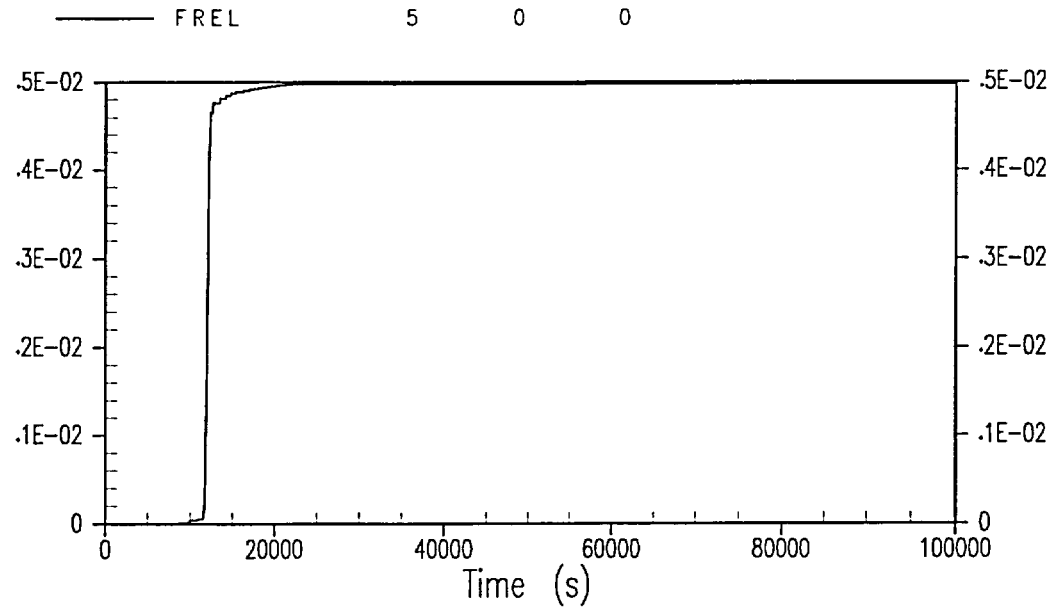


Figure 45-17

Release Category BP, Case 1A-2 – FW Failure with Creep of SG Tubes: Release Fraction of Molybdenum Dioxide

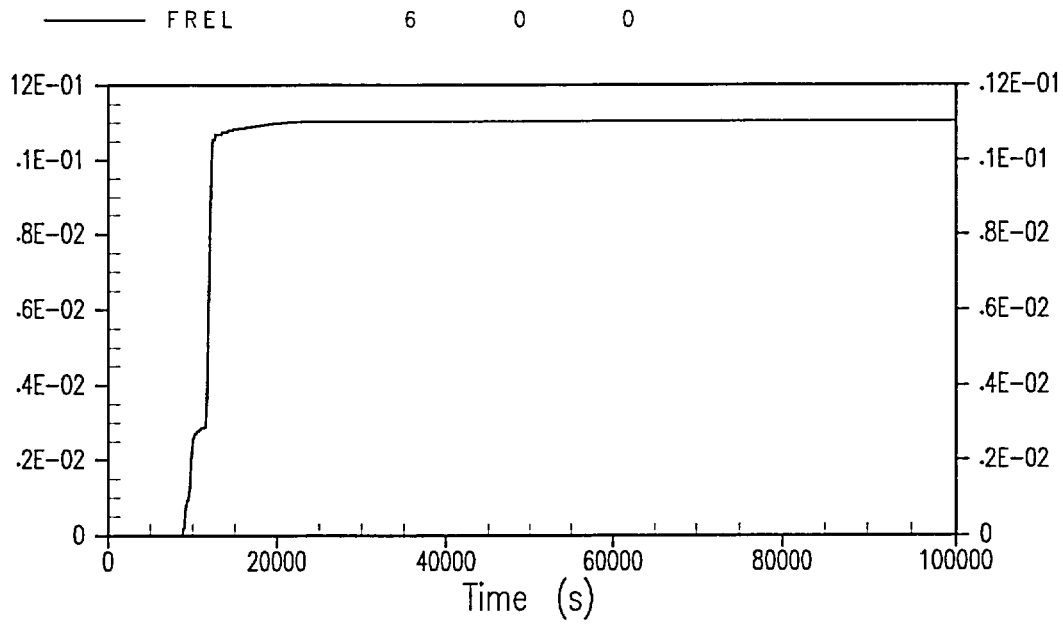


Figure 45-18

Release Category BP, Case 1A-2 – FW Failure with Creep of SG Tubes: Release Fraction of Cesium Hydroxide

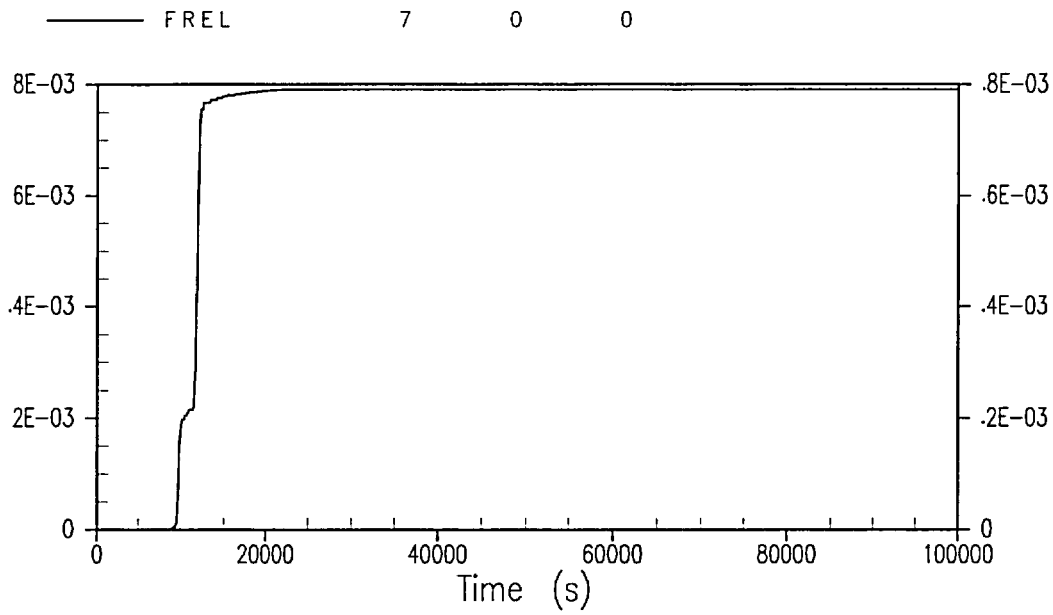


Figure 45-19

Release Category BP, Case 1A-2 – FW Failure with Creep of SG Tubes: Release Fraction of Barium Oxide

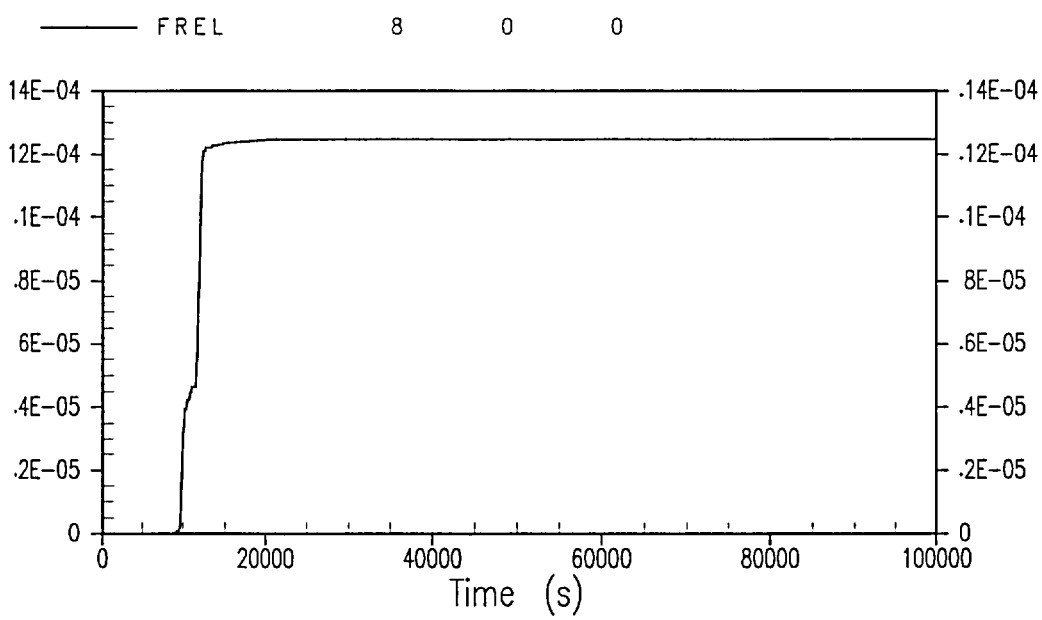


Figure 45-20

Release Category BP, Case 1A-2 – FW Failure with Creep of SG Tubes: Release Fraction of Dilanthanum Trioxide

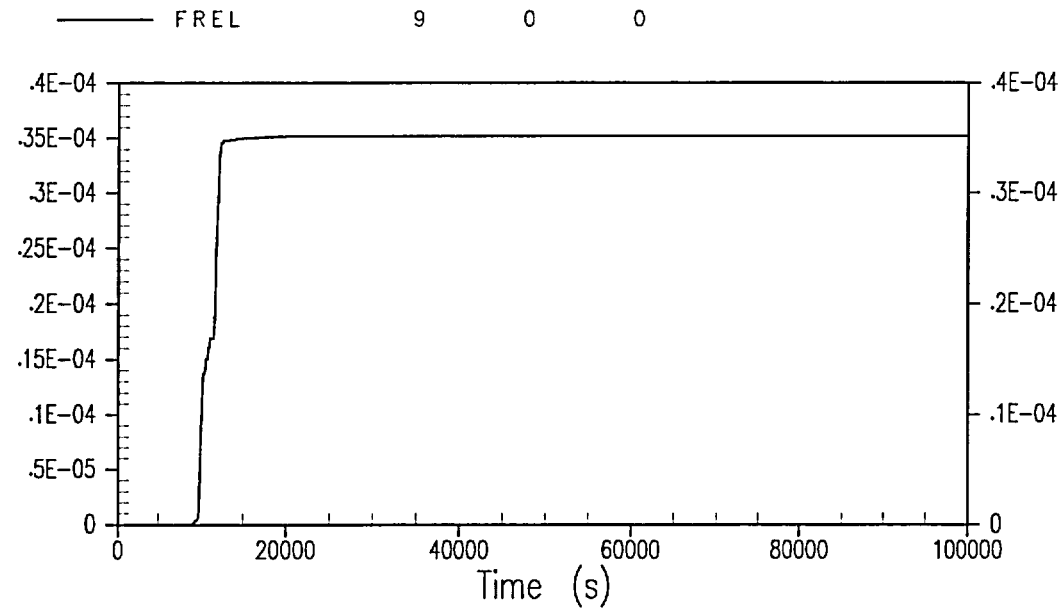


Figure 45-21

Release Category BP, Case 1A-2 – FW Failure with Creep of SG Tubes: Release Fraction of Cerium Dioxide

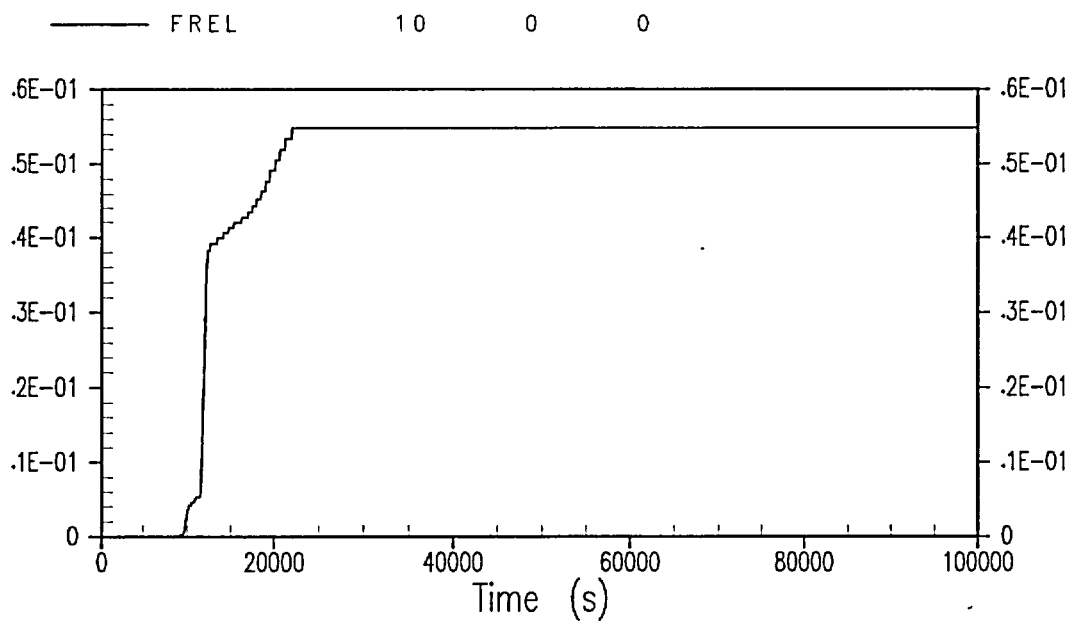


Figure 45-22

Release Category BP, Case 1A-2 – FW Failure with Creep of SG Tubes: Release Fraction of Tin

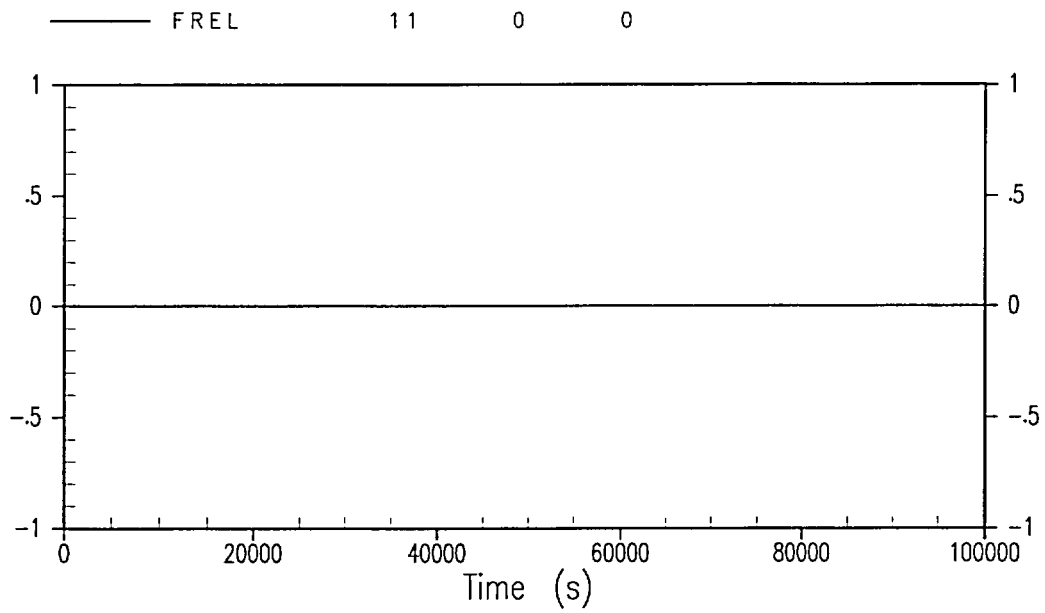


Figure 45-23

Release Category BP, Case 1A-2 – FW Failure with Creep of SG Tubes: Release Fraction of Tellurium

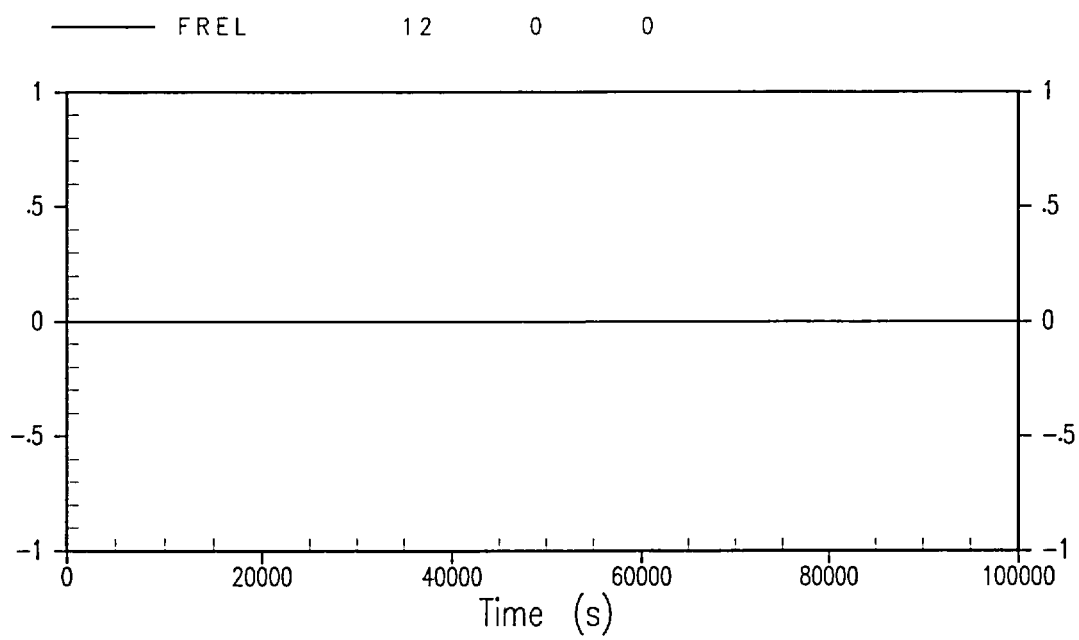


Figure 45-24

Release Category BP, Case 1A-2 – FW Failure with Creep of SG Tubes: Release Fraction of Uranium Dioxide

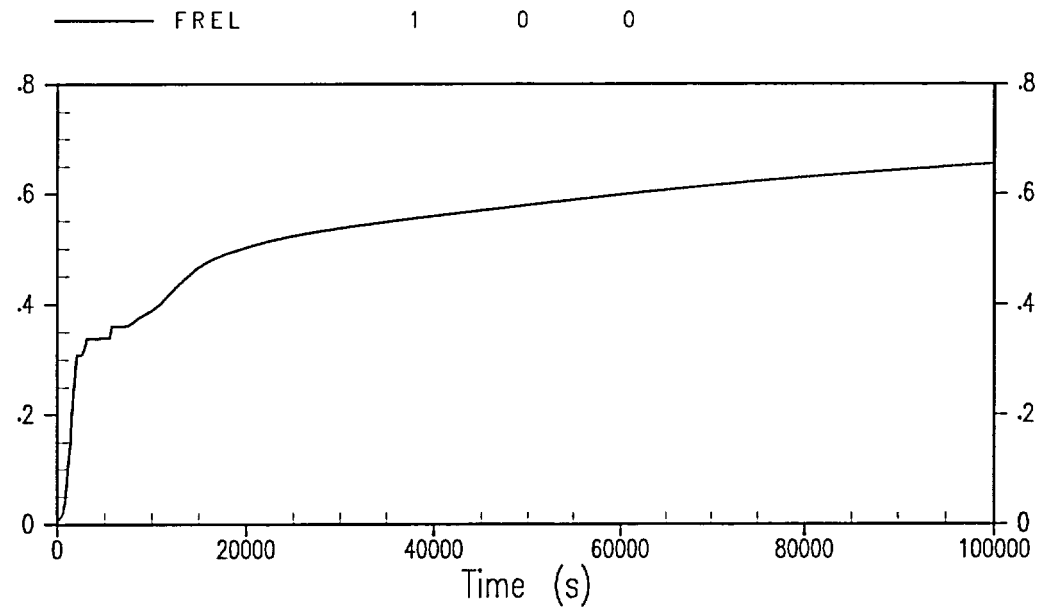


Figure 45-25

Release Category CI, Case 3C-2 – Vessel Rupture with Containment Failure: Release Fraction of Noble Gases

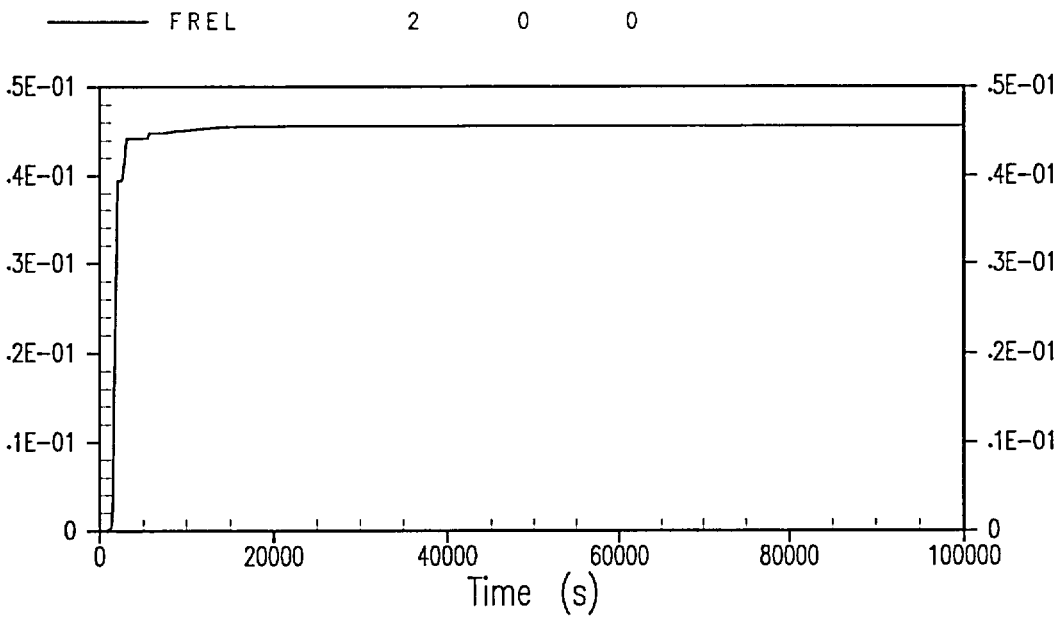


Figure 45-26

Release Category CI, Case 3C-2 – Vessel Rupture with Containment Failure: Release Fraction of Cesium Iodide

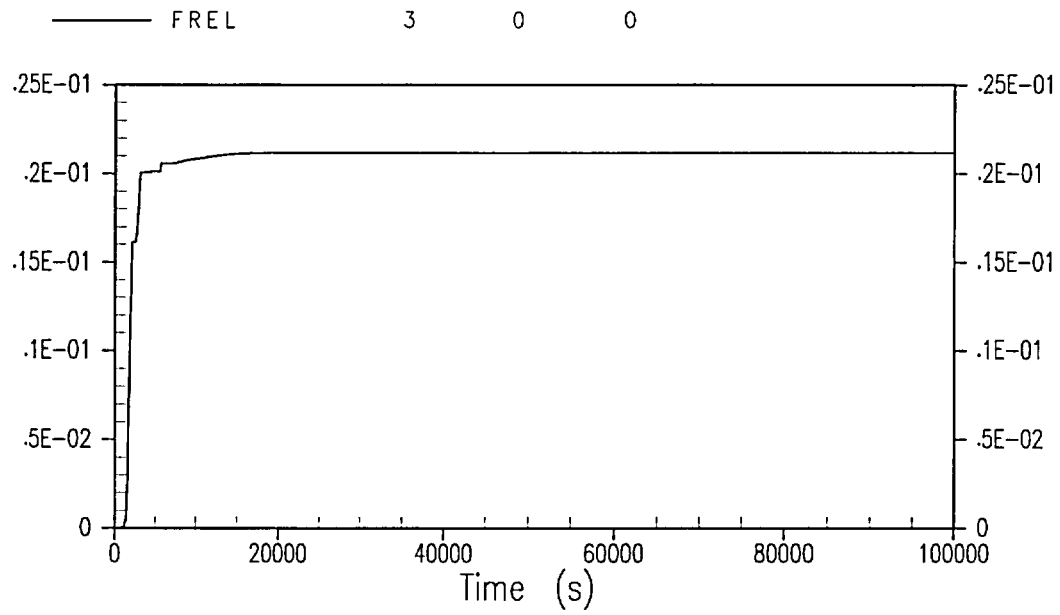


Figure 45-27

Release Category CI, Case 3C-2 – Vessel Rupture with Containment Failure: Release Fraction of Tellurium Dioxide

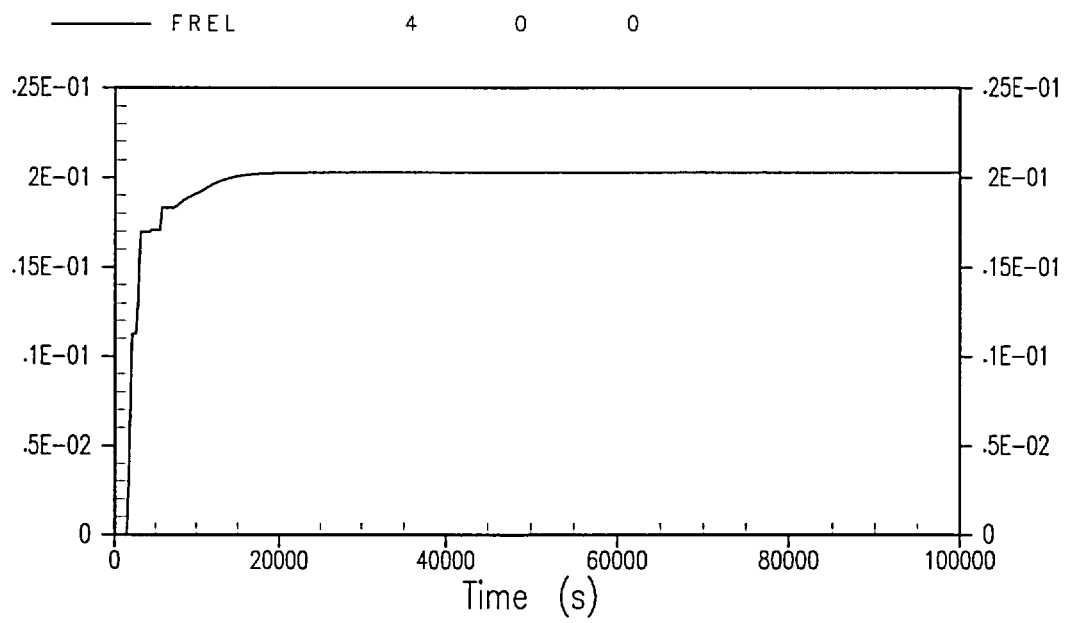


Figure 45-28

Release Category CI, Case 3C-2 – Vessel Rupture with Containment Failure: Release Fraction of Strontium Oxide

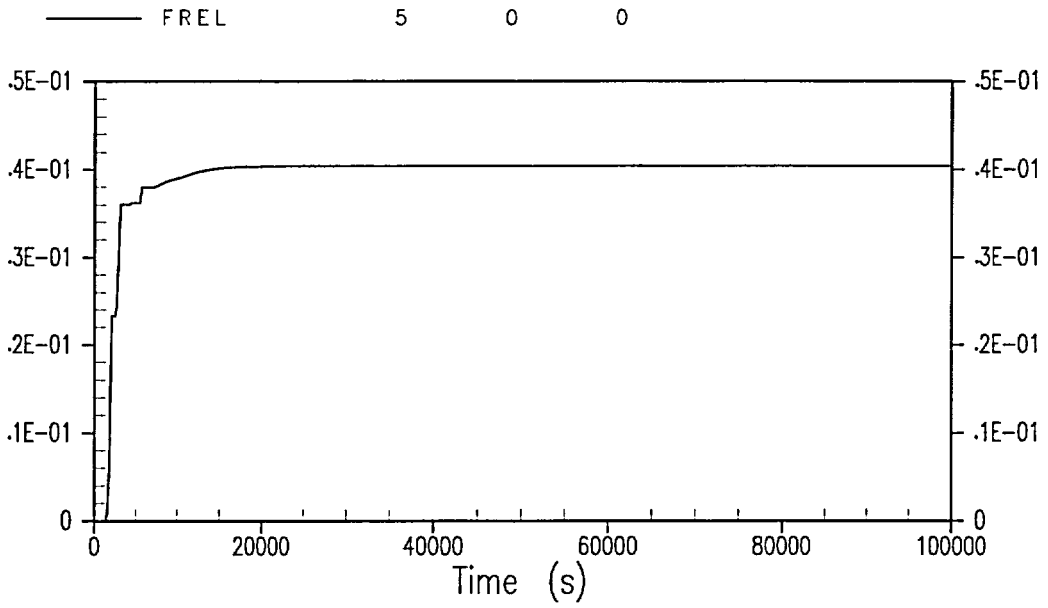


Figure 45-29

Release Category CI, Case 3C-2 – Vessel Rupture with Containment Failure: Release Fraction of Molybdenum Dioxide

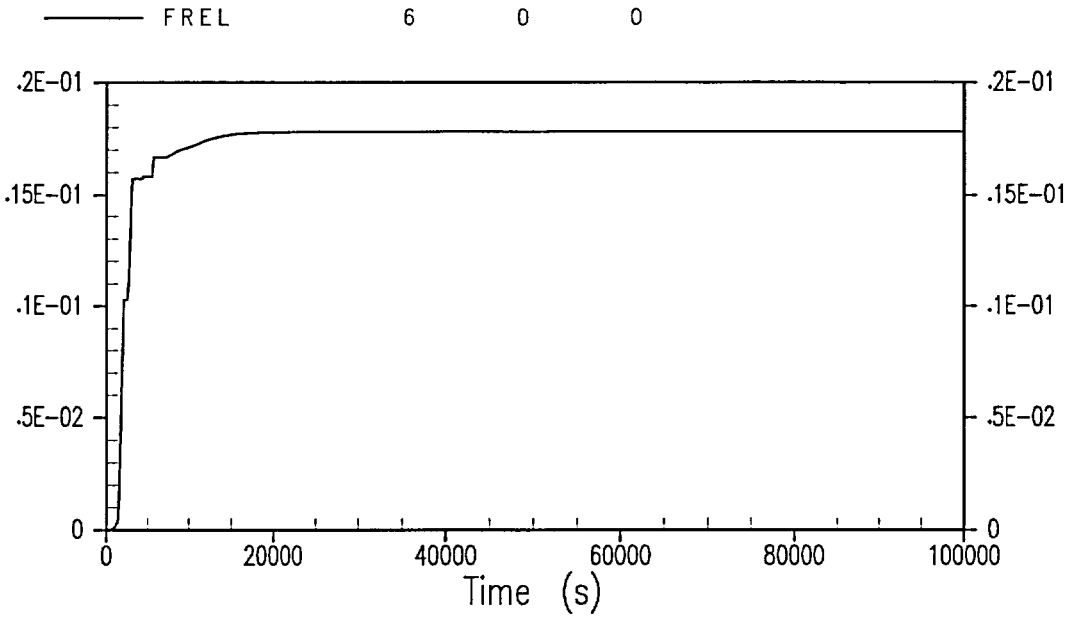


Figure 45-30

Release Category CI, Case 3C-2 – Vessel Rupture with Containment Failure: Release Fraction of Cesium Hydroxide

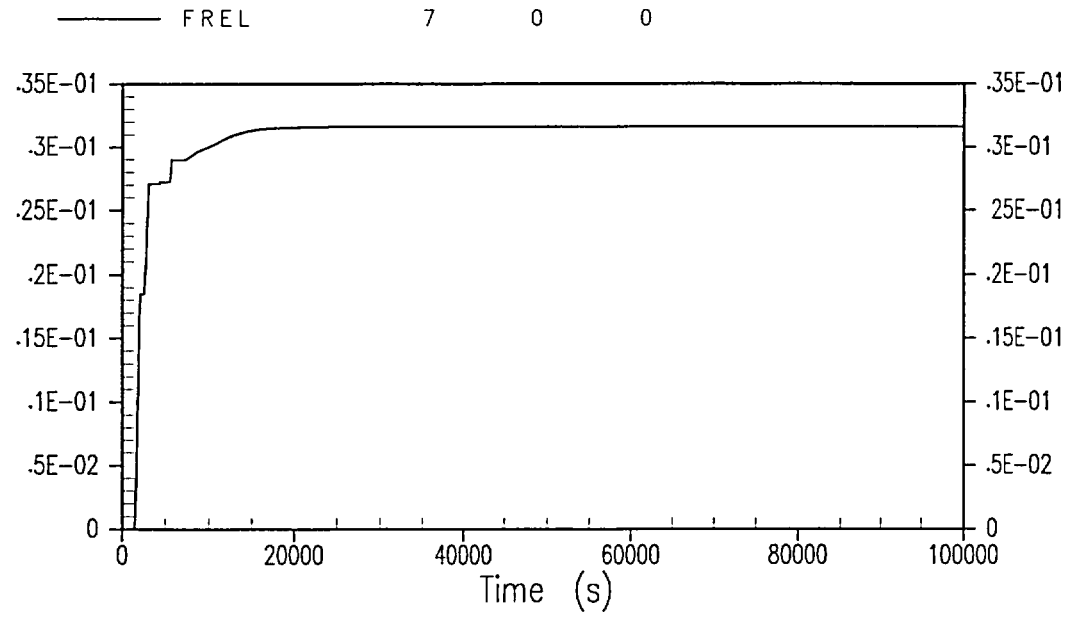


Figure 45-31

Release Category CI, Case 3C-2 – Vessel Rupture with Containment Failure: Release Fraction of Barium Oxide

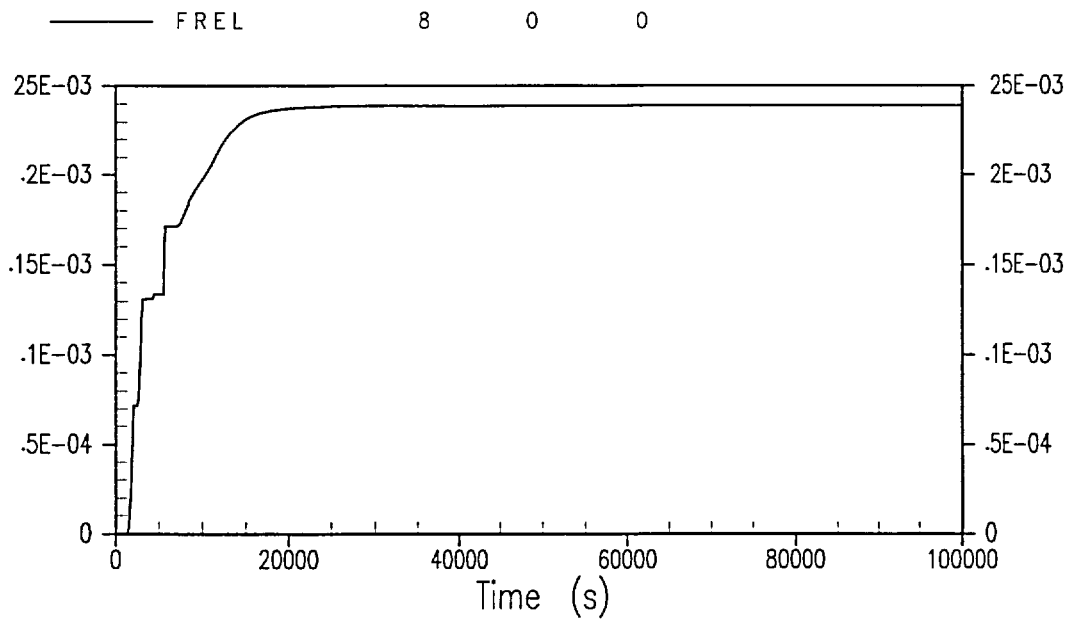


Figure 45-32

Release Category CI, Case 3C-2 – Vessel Rupture with Containment Failure: Release Fraction of Dilanthanum Trioxide

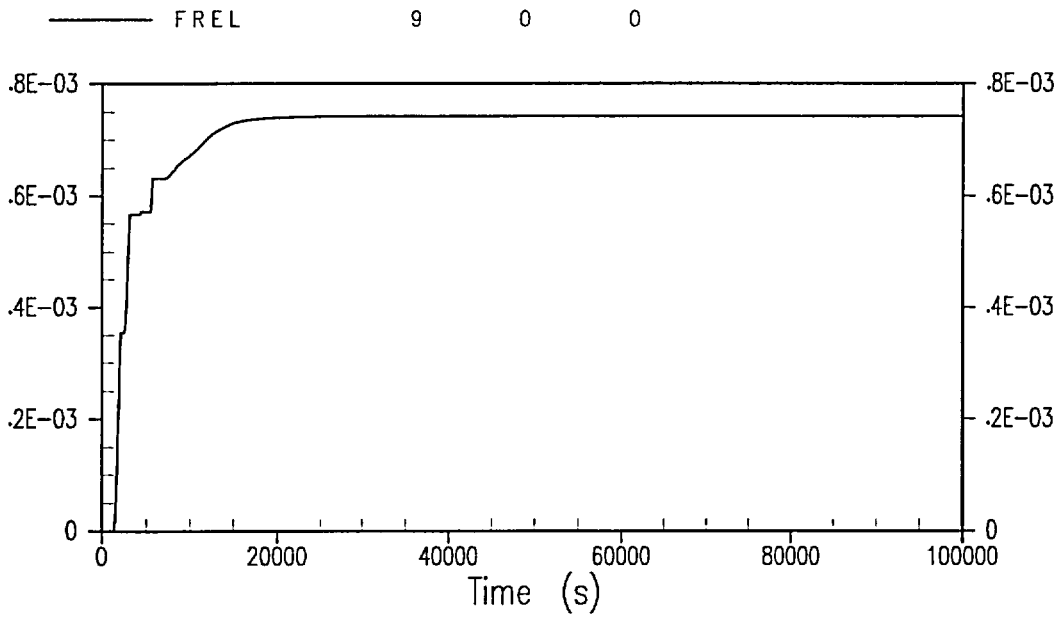


Figure 45-33

Release Category CI, Case 3C-2 – Vessel Rupture with Containment Failure: Release Fraction of Cerium Dioxide

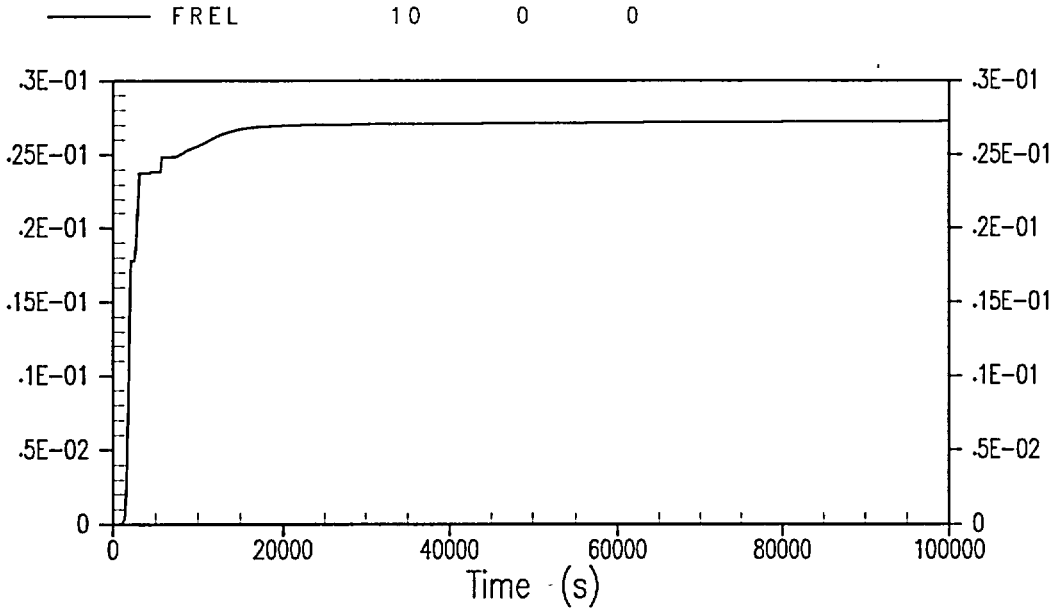


Figure 45-34

Release Category CI, Case 3C-2 – Vessel Rupture with Containment Failure: Release Fraction of Tin

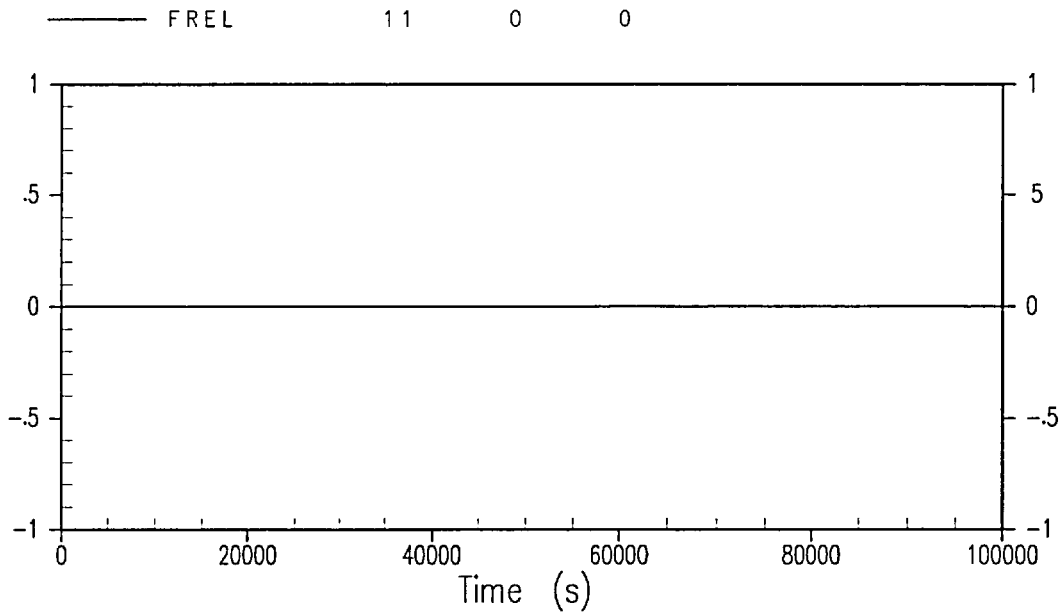


Figure 45-35

Release Category CI, Case 3C-2 – Vessel Rupture with Containment Failure: Release Fraction of Tellurium

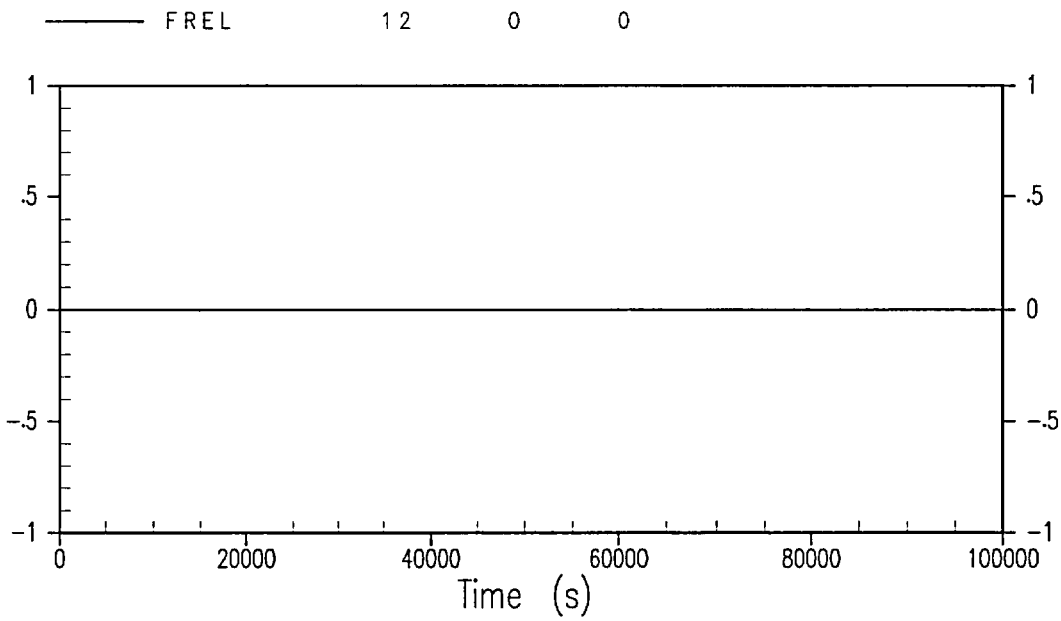


Figure 45-36

Release Category CI, Case 3C-2 – Vessel Rupture with Containment Failure: Release Fraction of Uranium Dioxide

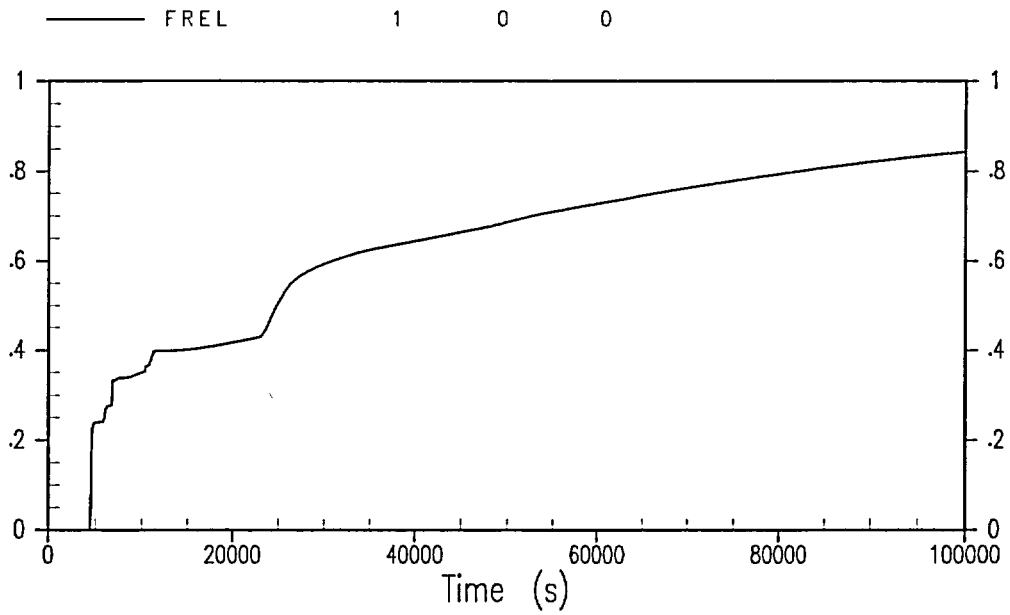


Figure 45-37

Release Category CFE, Case 3D-4 – Spurious ADS-2, Failed CMTs, Diffusion Flame: Release Fraction of Noble Gases

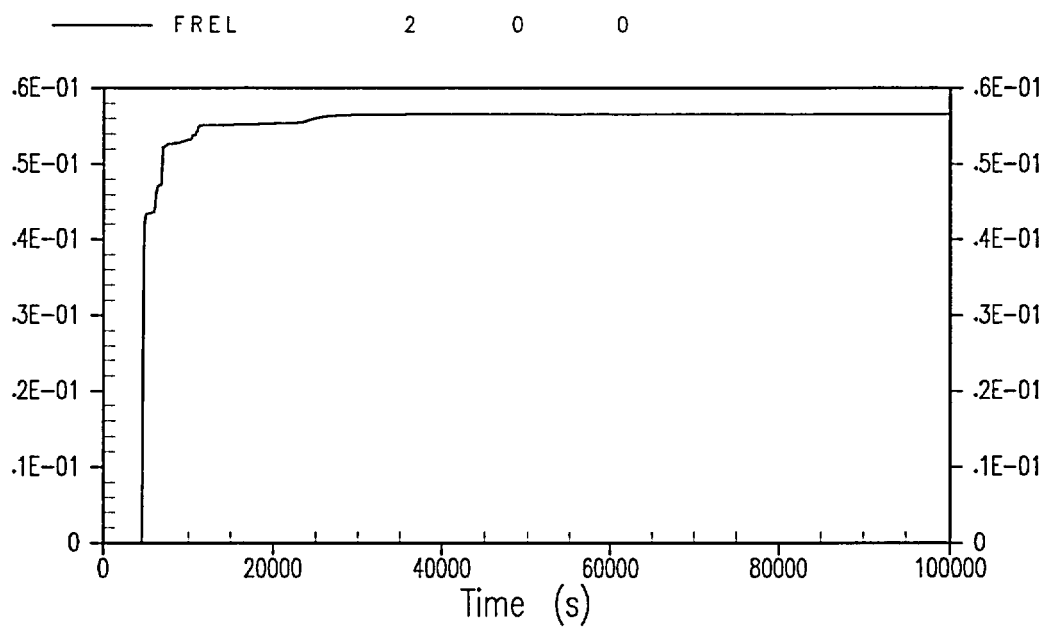


Figure 45-38

Release Category CFE, Case 3D-4 – Spurious ADS-2, Failed CMTs, Diffusion Flame: Release Fraction of Cesium Iodide

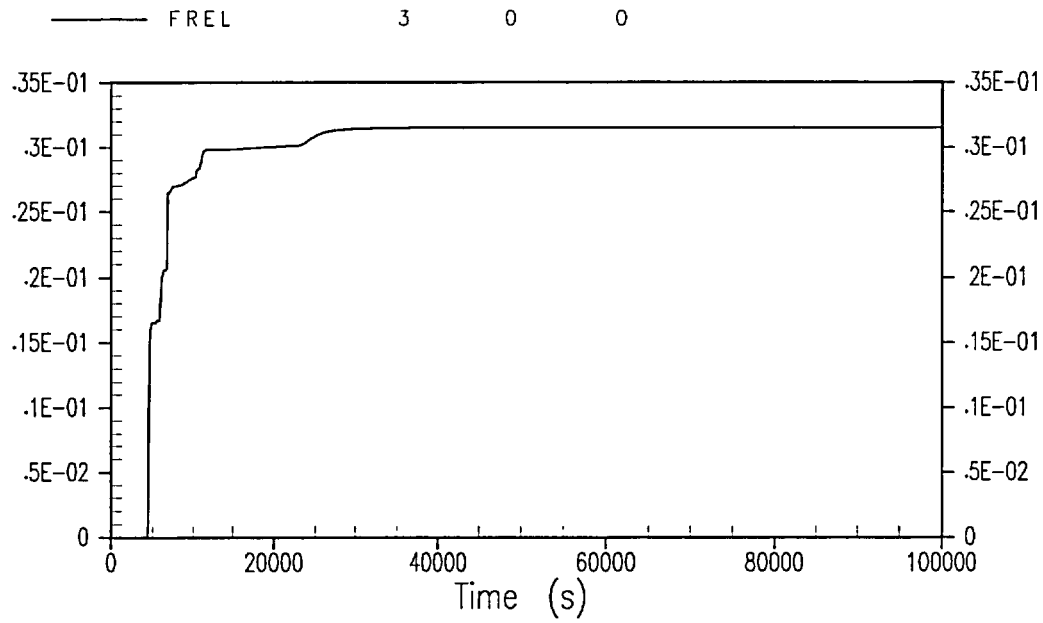


Figure 45-39

Release Category CFE, Case 3D-4 – Spurious ADS-2, Failed CMTs, Diffusion Flame: Release Fraction of Tellurium Dioxide

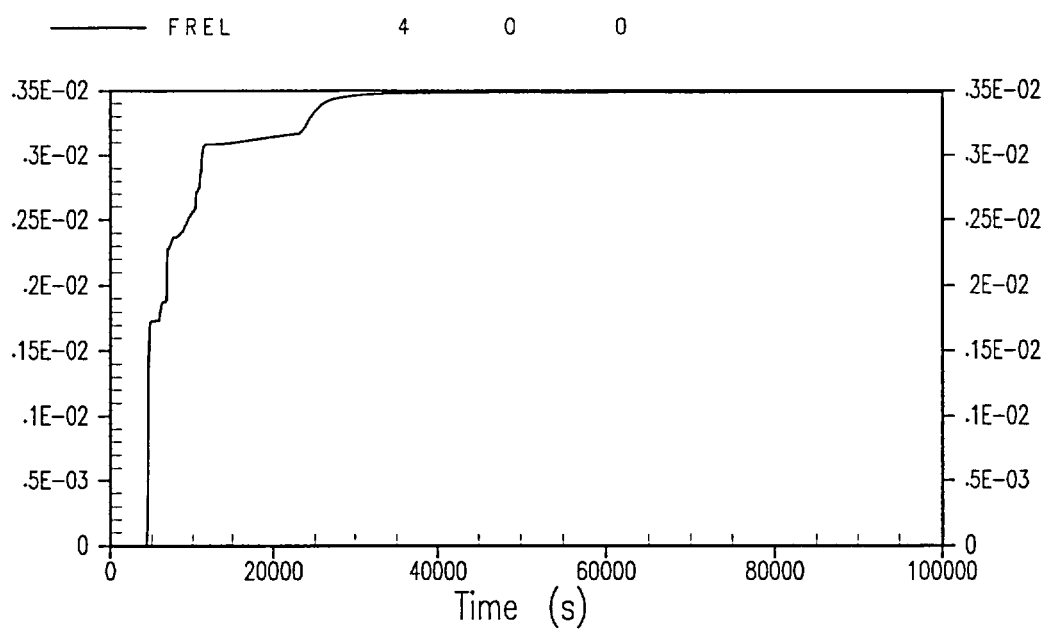


Figure 45-40

Release Category CFE, Case 3D-4 – Spurious ADS-2, Failed CMTs, Diffusion Flame: Release Fraction of Strontium Oxide

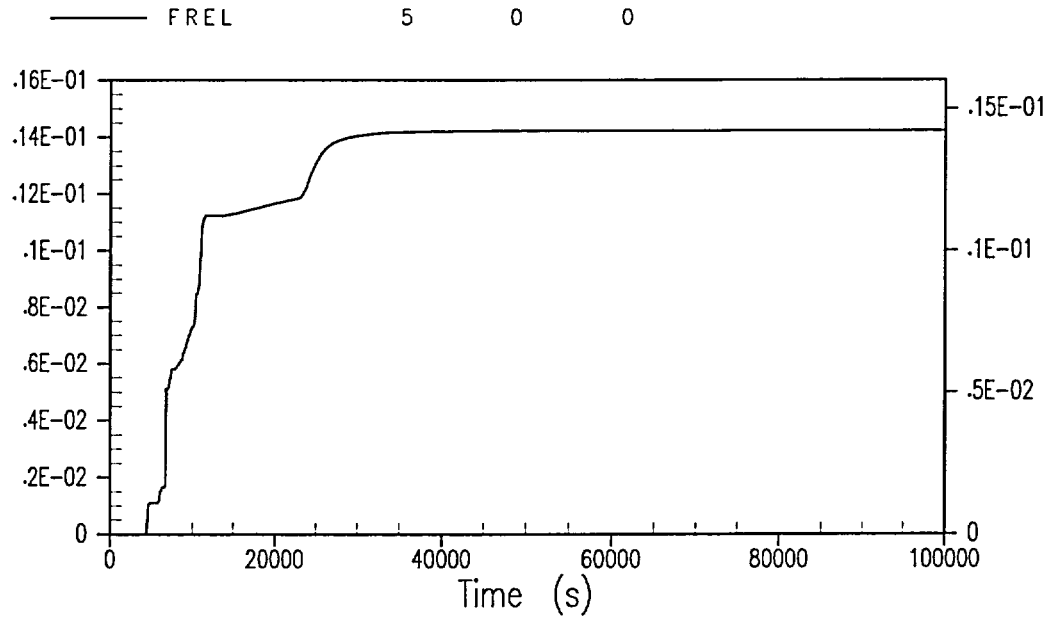


Figure 45-41

Release Category CFE, Case 3D-4 – Spurious ADS-2, Failed CMTs, Diffusion Flame: Release Fraction of Molybdenum Dioxide

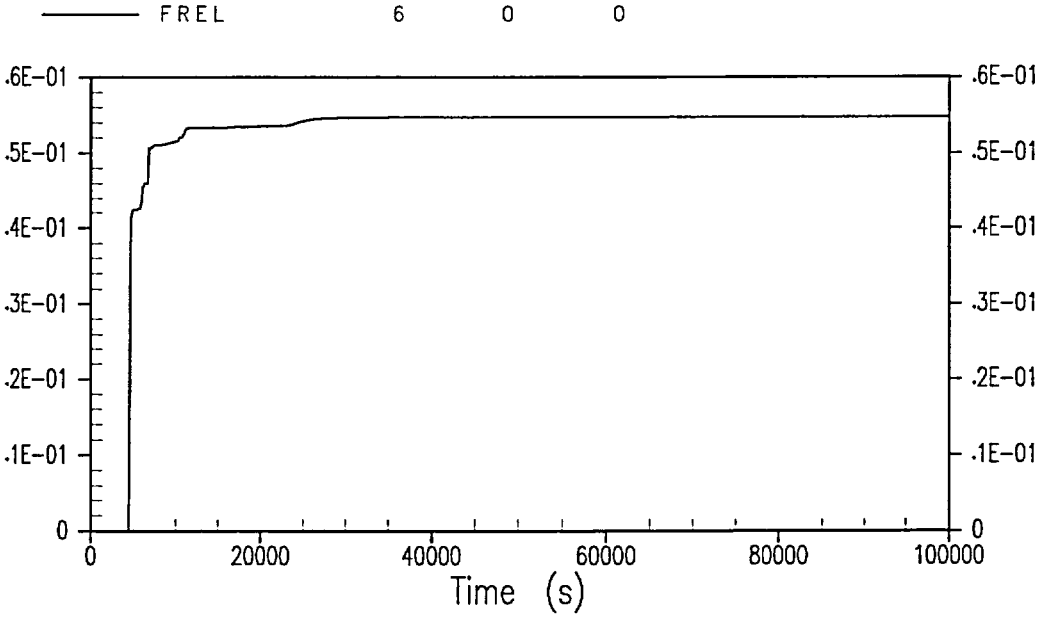


Figure 45-42

Release Category CFE, Case 3D-4 – Spurious ADS-2, Failed CMTs, Diffusion Flame: Release Fraction of Cesium Hydroxide

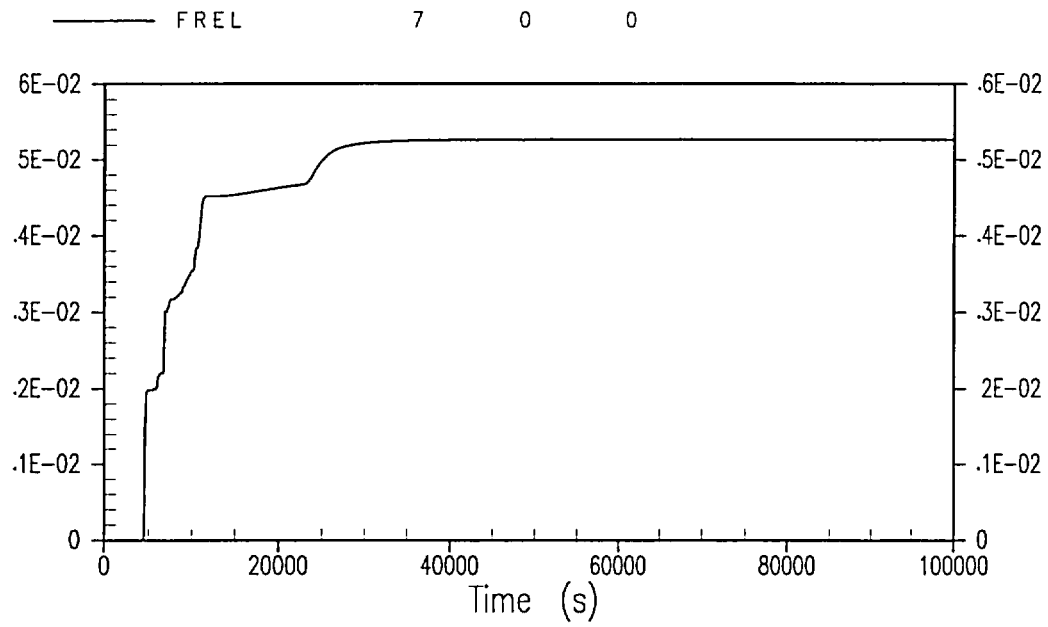


Figure 45-43

Release Category CFE, Case 3D-4 – Spurious ADS-2, Failed CMTs, Diffusion Flame: Release Fraction of Barium Oxide

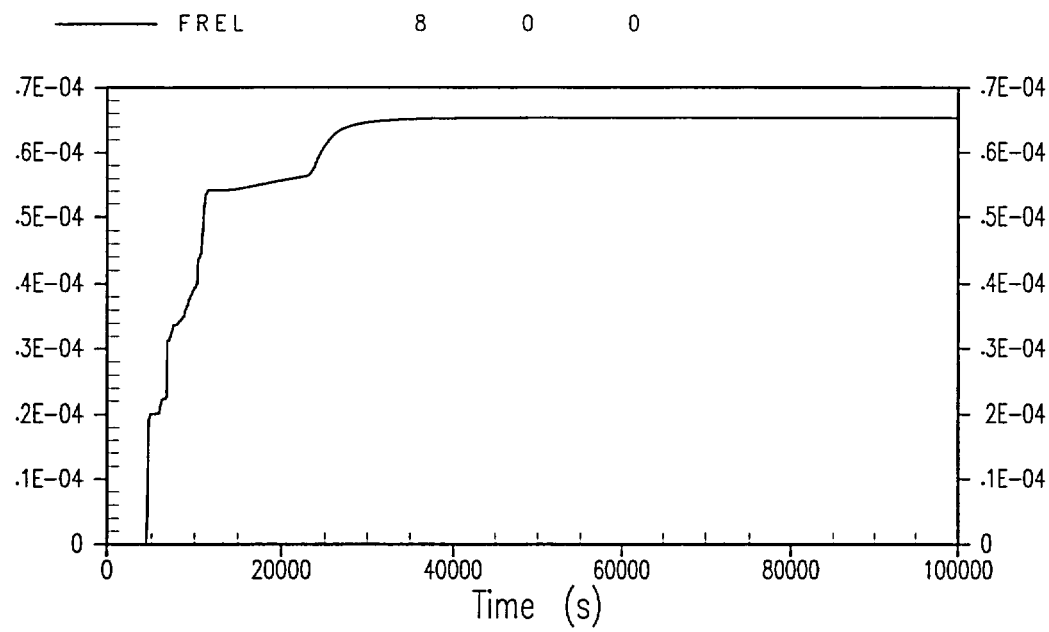


Figure 45-44

Release Category CFE, Case 3D-4 – Spurious ADS-2, Failed CMTs, Diffusion Flame: Release Fraction of Dilanthanum Trioxide

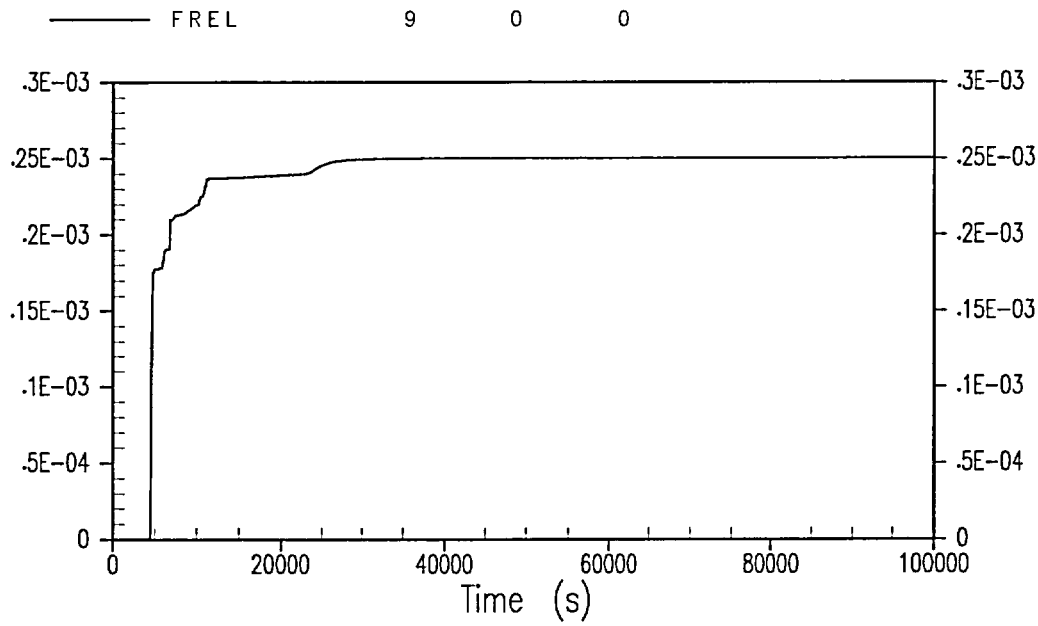


Figure 45-45

Release Category CFE, Case 3D-4 – Spurious ADS-2, Failed CMTs, Diffusion Flame: Release Fraction of Cerium Dioxide

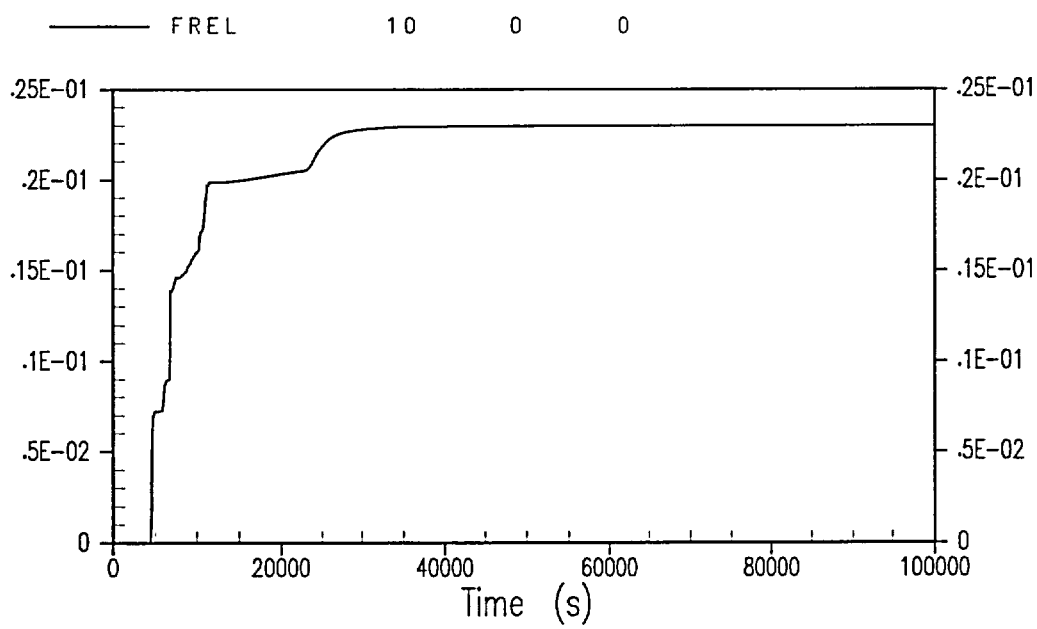


Figure 45-46

Release Category CFE, Case 3D-4 – Spurious ADS-2, Failed CMTs, Diffusion Flame: Release Fraction of Tin

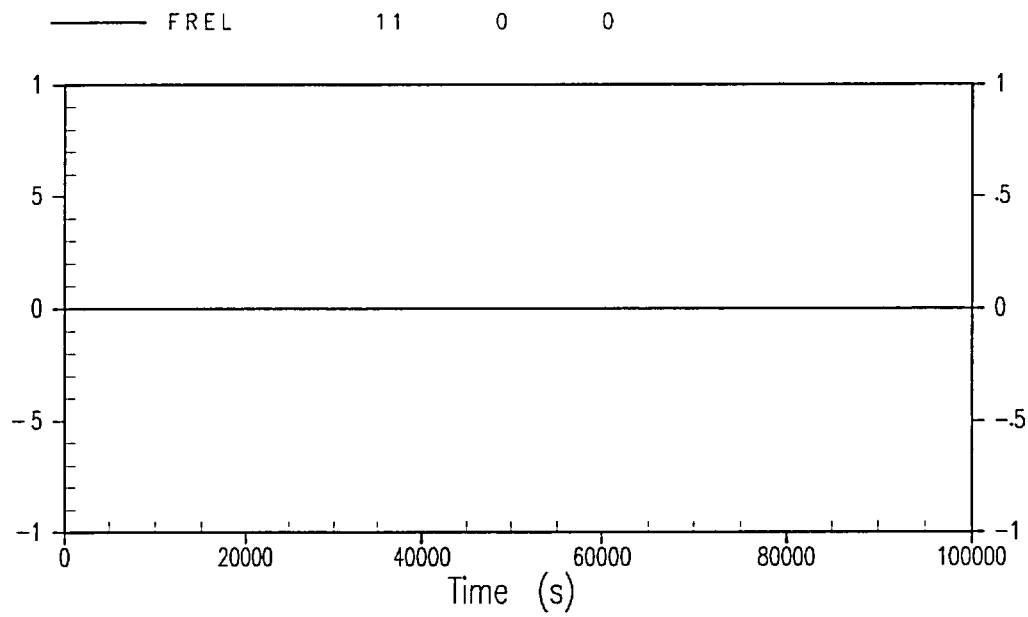


Figure 45-47

Release Category CFE, Case 3D-4 – Spurious ADS-2, Failed CMTs, Diffusion Flame: Release Fraction of Tellurium

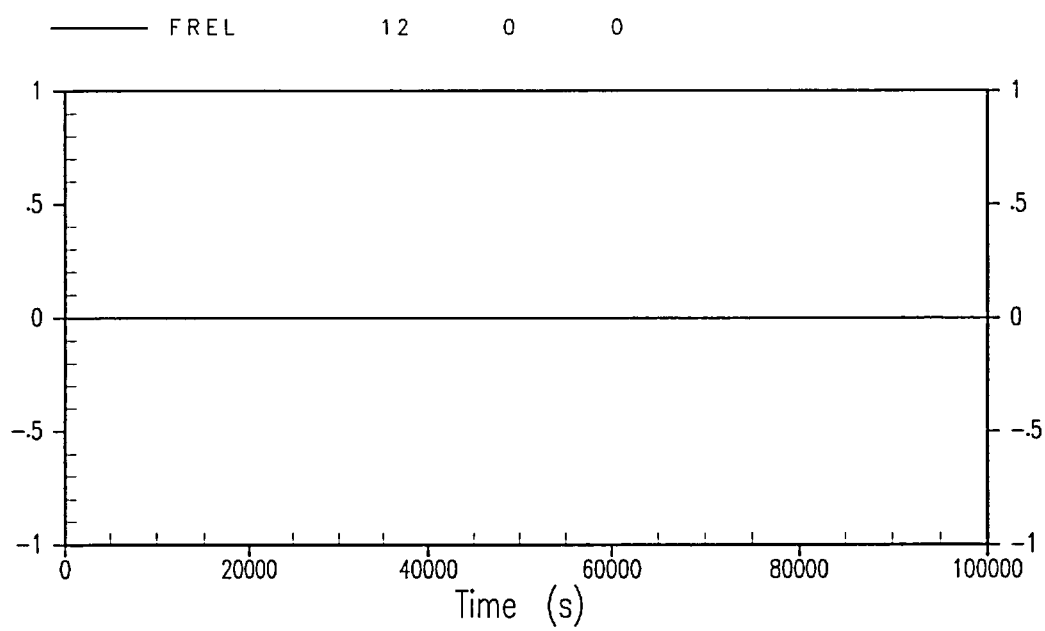


Figure 45-48

Release Category CFE, Case 3D-4 – Spurious ADS-2, Failed CMTs, Diffusion Flame: Release Fraction of Uranium Dioxide

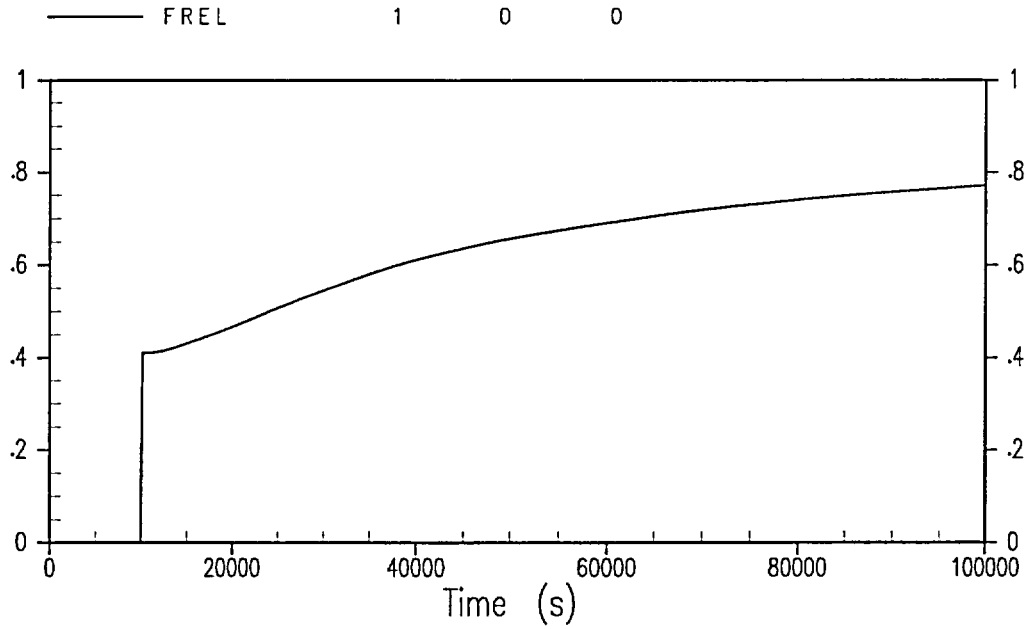


Figure 45-49

Release Category CFI, Case 3BE-3 – DVI Line Break, Failed Gravity Injection, No PXS Flooding: Release Fraction of Noble Gases

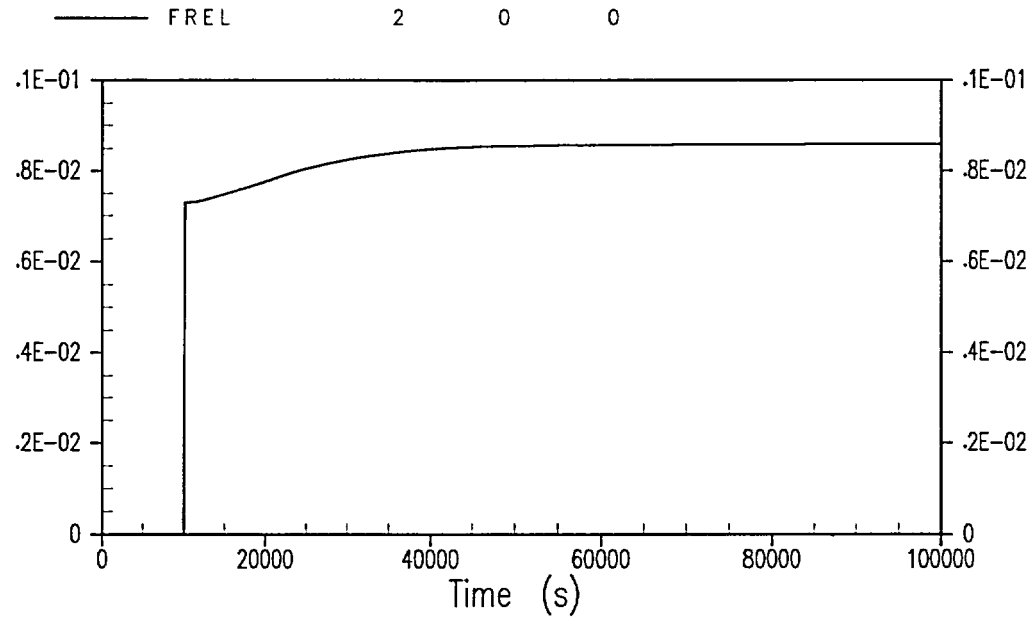


Figure 45-50

Release Category CFI, Case 3BE-3 – DVI Line Break, Failed Gravity Injection, No PXS Flooding: Release Fraction of Cesium Iodide

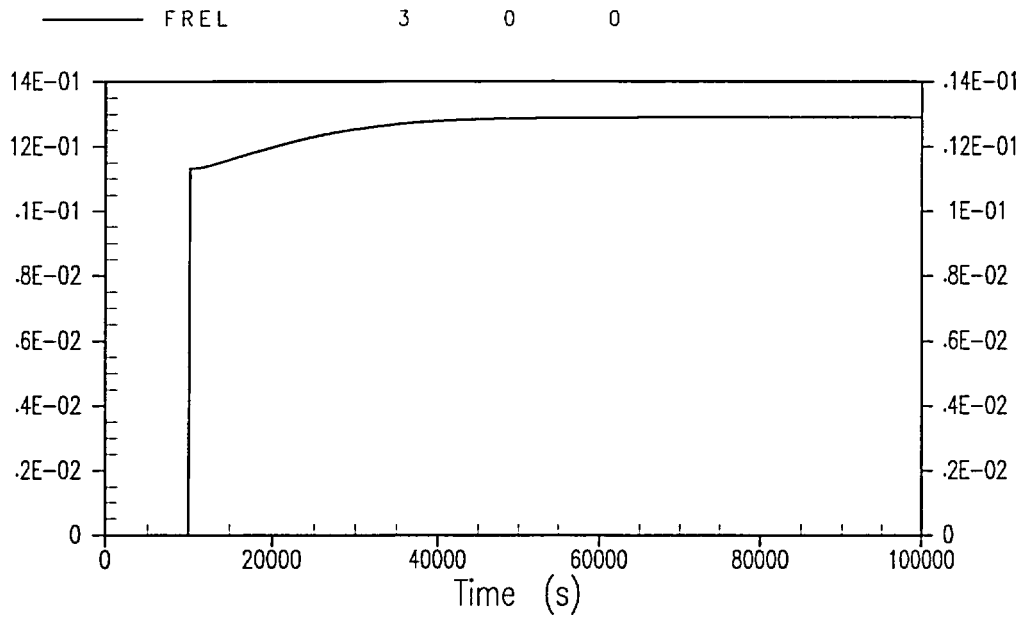


Figure 45-51

Release Category CFI, Case 3BE-3 – DVI Line Break, Failed Gravity Injection, No PXS Flooding: Release Fraction of Tellurium Dioxide

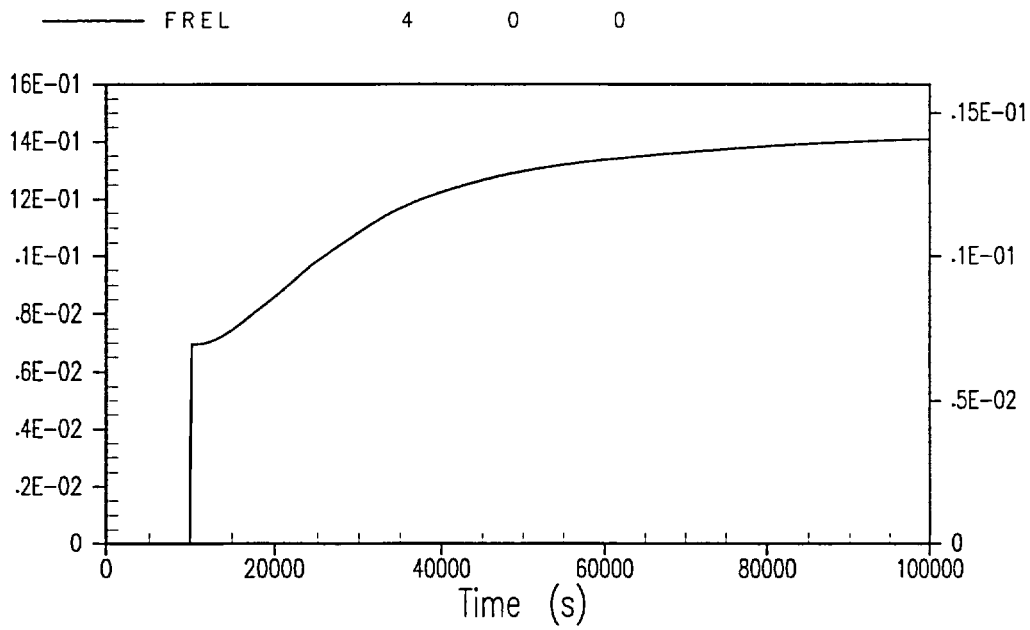


Figure 45-52

Release Category CFI, Case 3BE-3 – DVI Line Break, Failed Gravity Injection, No PXS Flooding: Release Fraction of Strontium Oxide

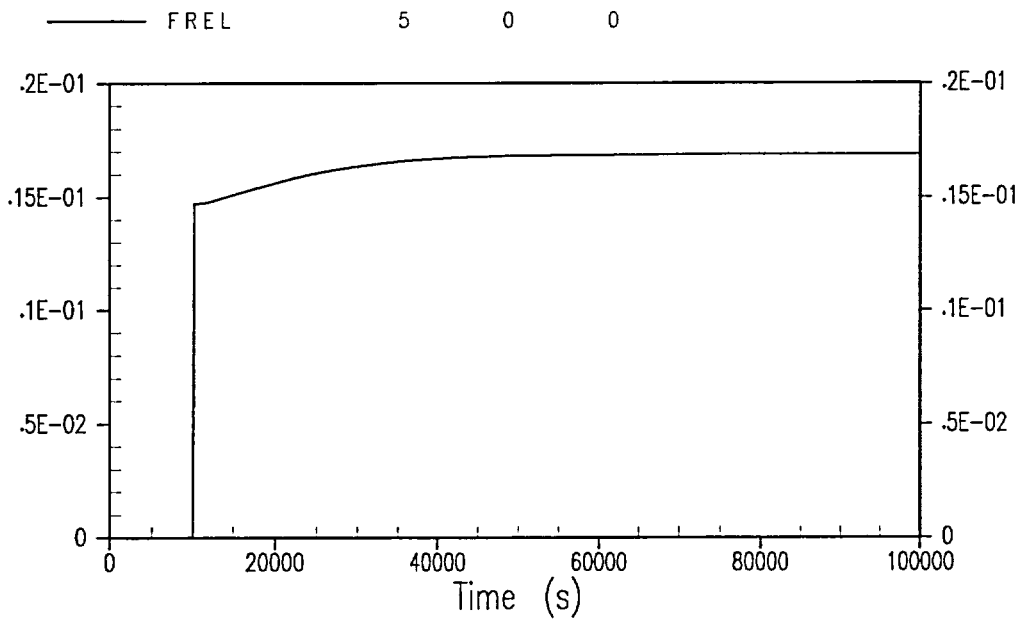


Figure 45-53

Release Category CFI, Case 3BE-3 – DVI Line Break, Failed Gravity Injection, No PXS Flooding: Release Fraction of Molybdenum Dioxide

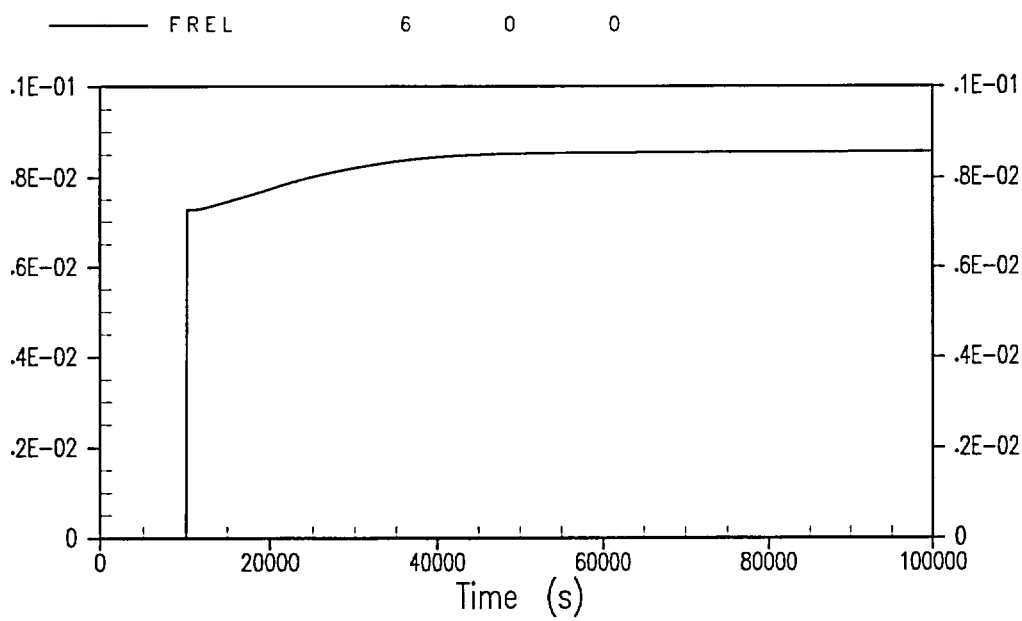


Figure 45-54

Release Category CFI, Case 3BE-3 – DVI Line Break, Failed Gravity Injection, No PXS Flooding: Release Fraction of Cesium Hydroxide

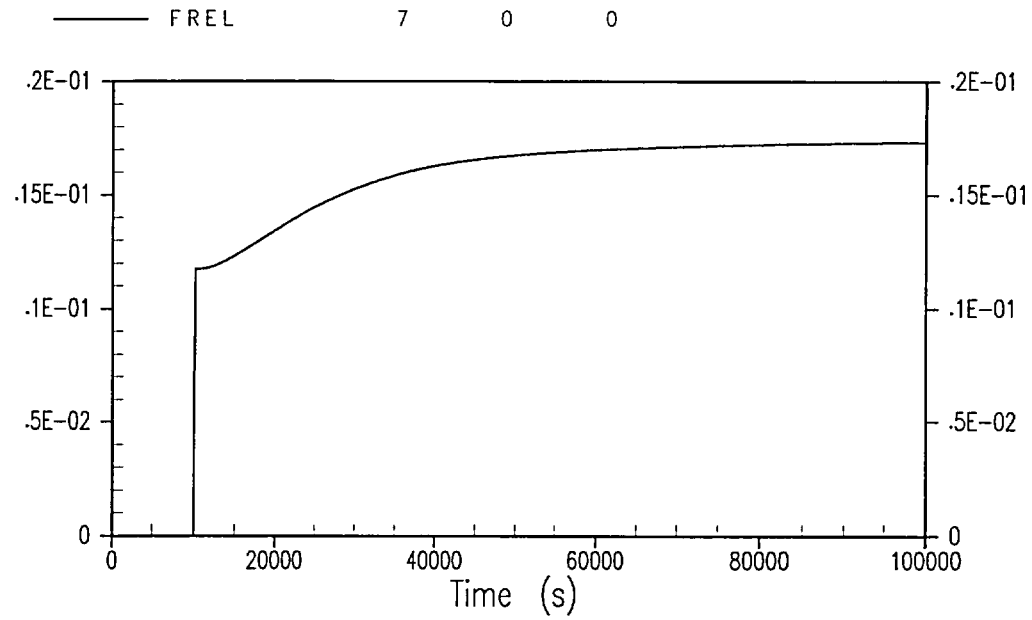


Figure 45-55

Release Category CFI, Case 3BE-3 – DVI Line Break, Failed Gravity Injection, No PXS Flooding: Release Fraction of Barium Oxide

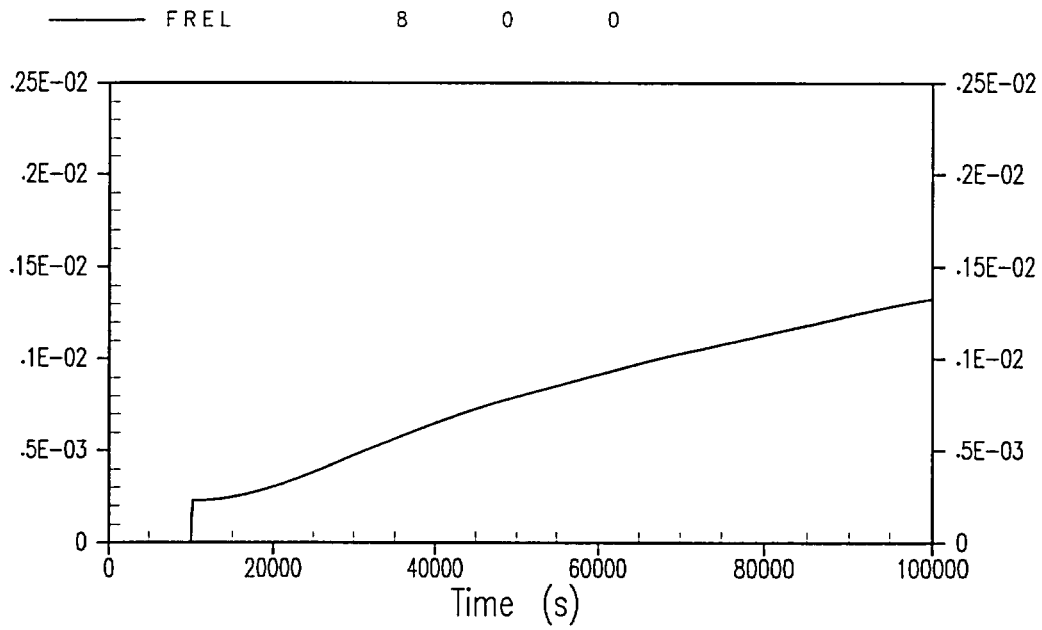


Figure 45-56

Release Category CFI, Case 3BE-3 – DVI Line Break, Failed Gravity Injection, No PXS Flooding: Release Fraction of Dilanthanum Trioxide

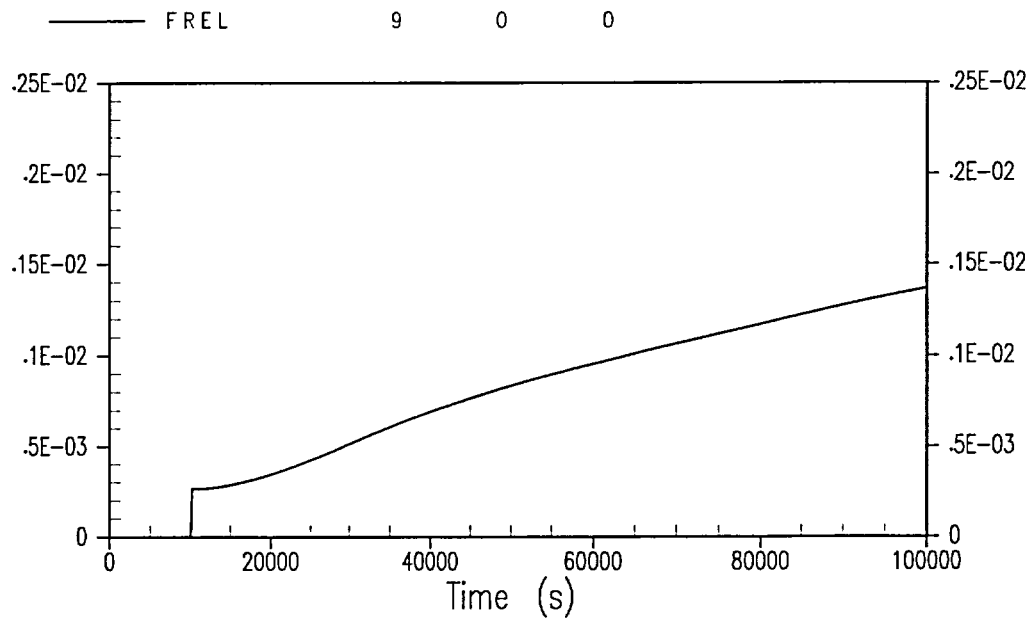


Figure 45-57

Release Category CFI, Case 3BE-3 – DVI Line Break, Failed Gravity Injection, No PXS Flooding: Release Fraction of Cerium Dioxide

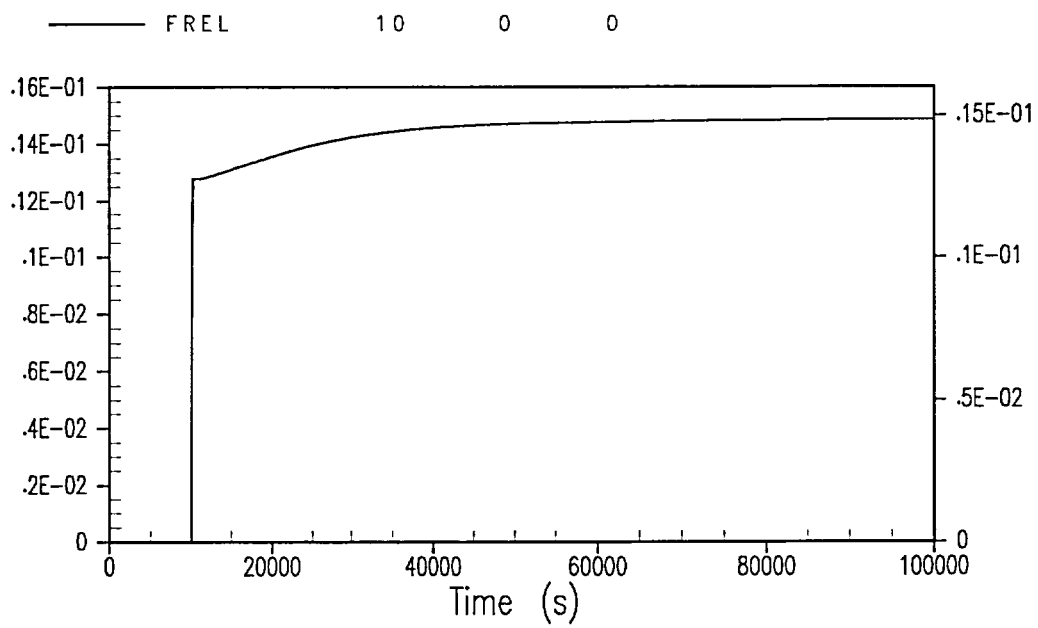


Figure 45-58

Release Category CFI, Case 3BE-3 – DVI Line Break, Failed Gravity Injection, No PXS Flooding: Release Fraction of Tin

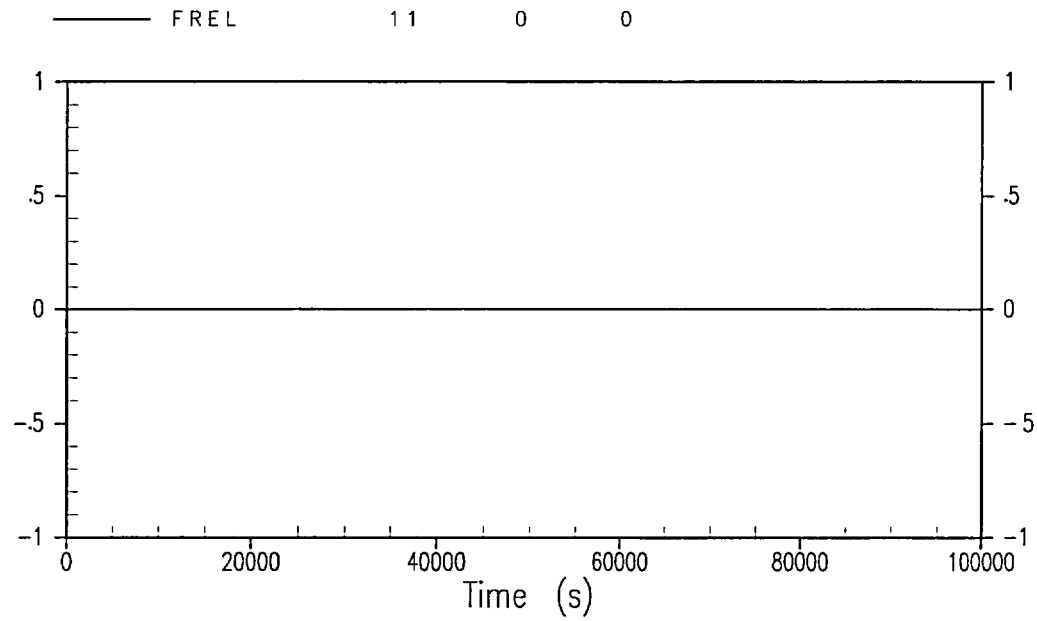


Figure 45-59

Release Category CFI, Case 3BE-3 – DVI Line Break, Failed Gravity Injection, No PXS Flooding: Release Fraction of Tellurium

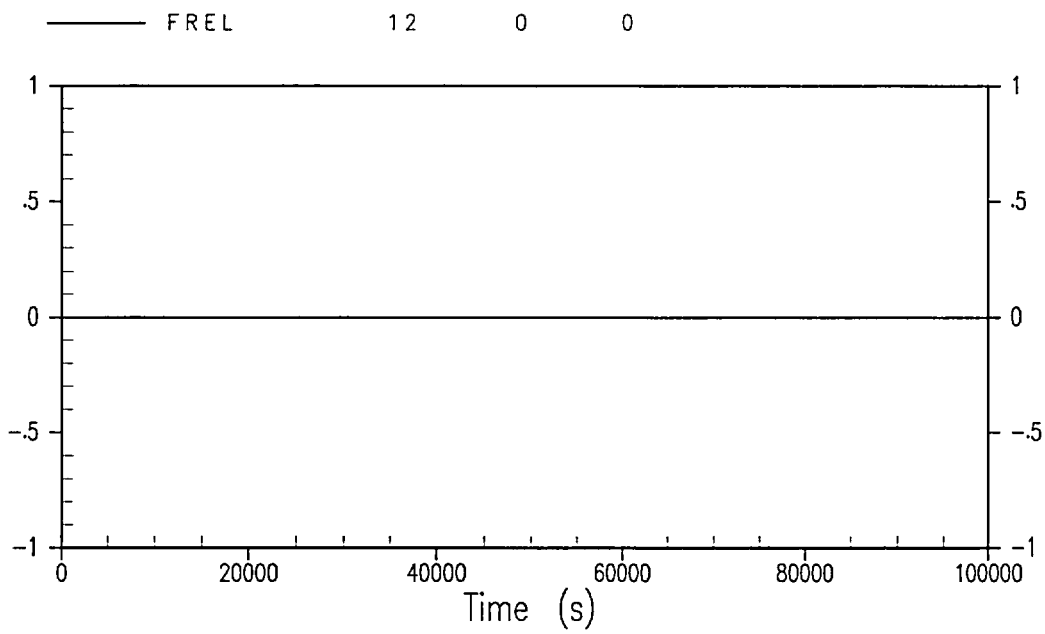


Figure 45-60

Release Category CFI, Case 3BE-3 – DVI Line Break, Failed Gravity Injection, No PXS Flooding: Release Fraction of Uranium Dioxide

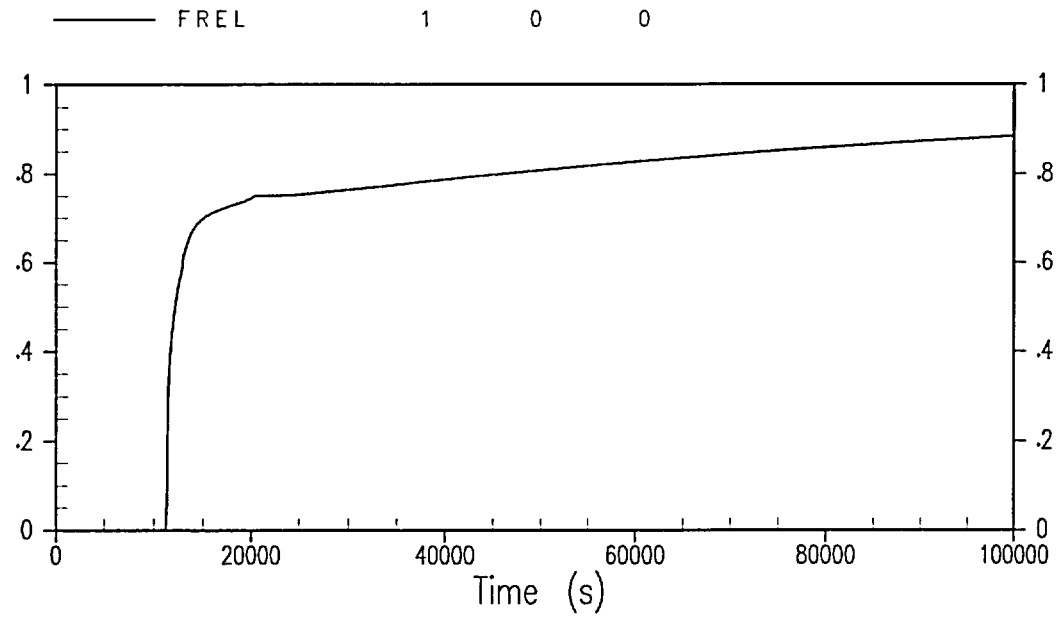


Figure 45-61

Release Category CFL, Case 3BE-7 – SBLOCA with Failed Gravity Injection: Release Fraction of Noble Gases

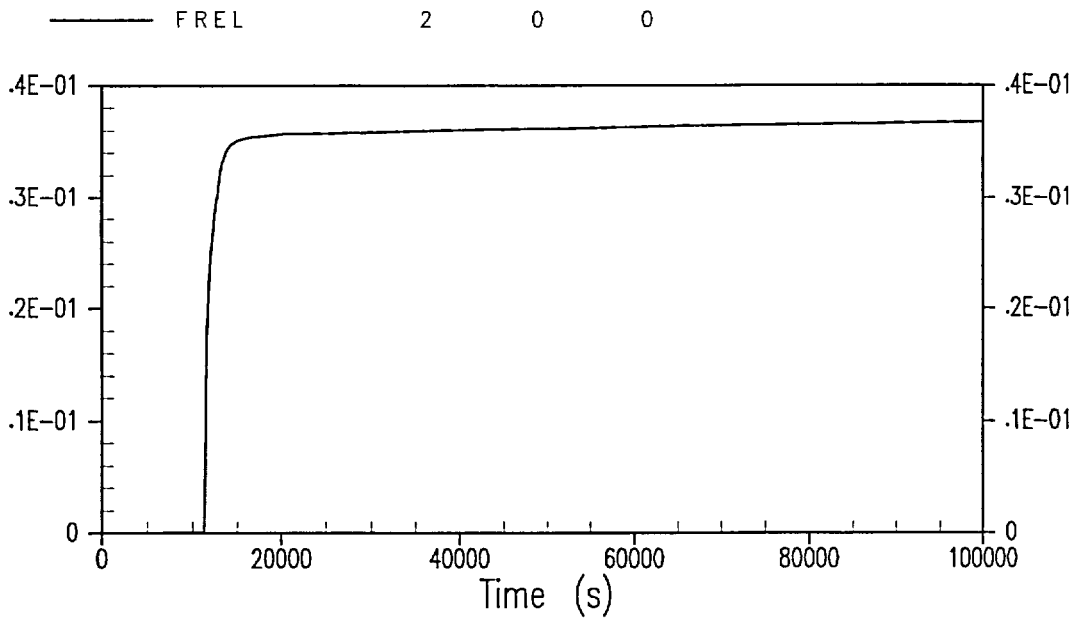


Figure 45-62

Release Category CFL, Case 3BE-7 – SBLOCA with Failed Gravity Injection: Release Fraction of Cesium Iodide

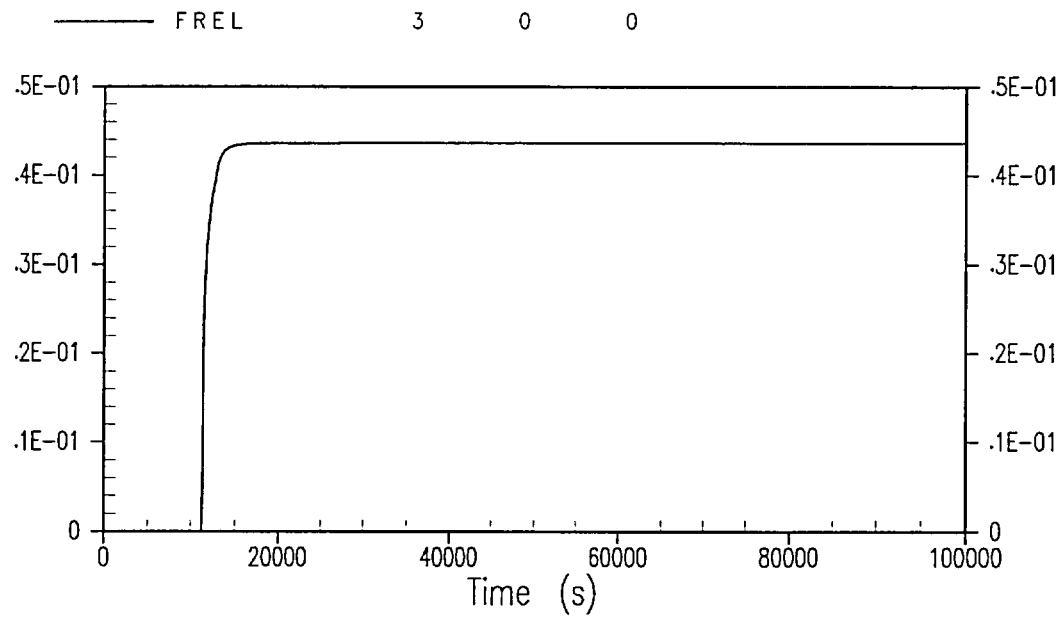


Figure 45-63

Release Category CFL, Case 3BE-7 – SBLOCA with Failed Gravity Injection: Release Fraction of Tellurium Dioxide

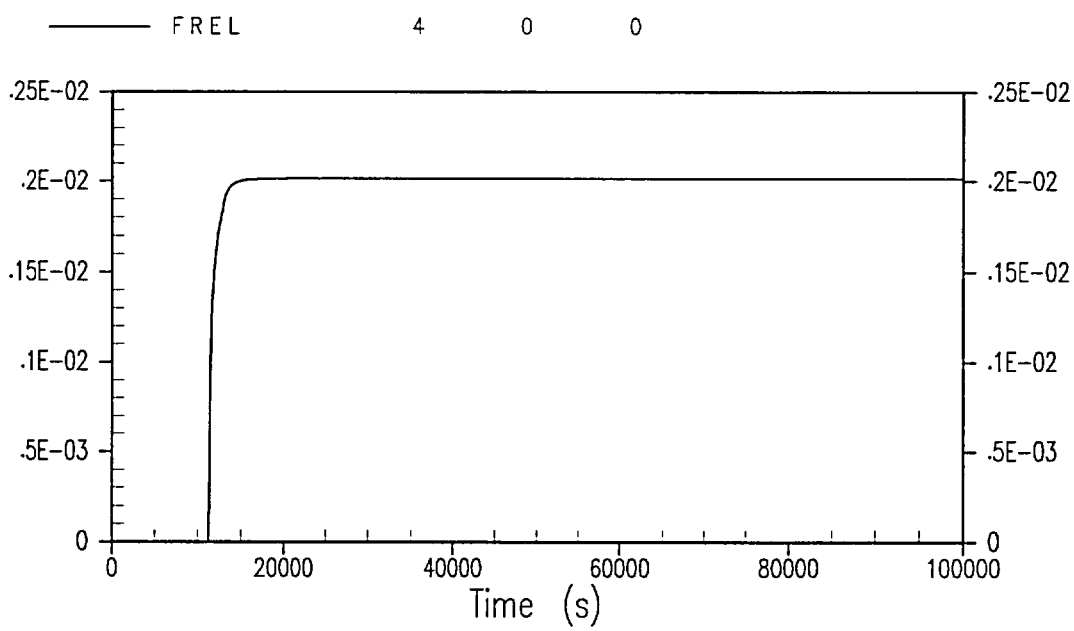


Figure 45-64

Release Category CFL, Case 3BE-7 – SBLOCA with Failed Gravity Injection: Release Fraction of Strontium Oxide

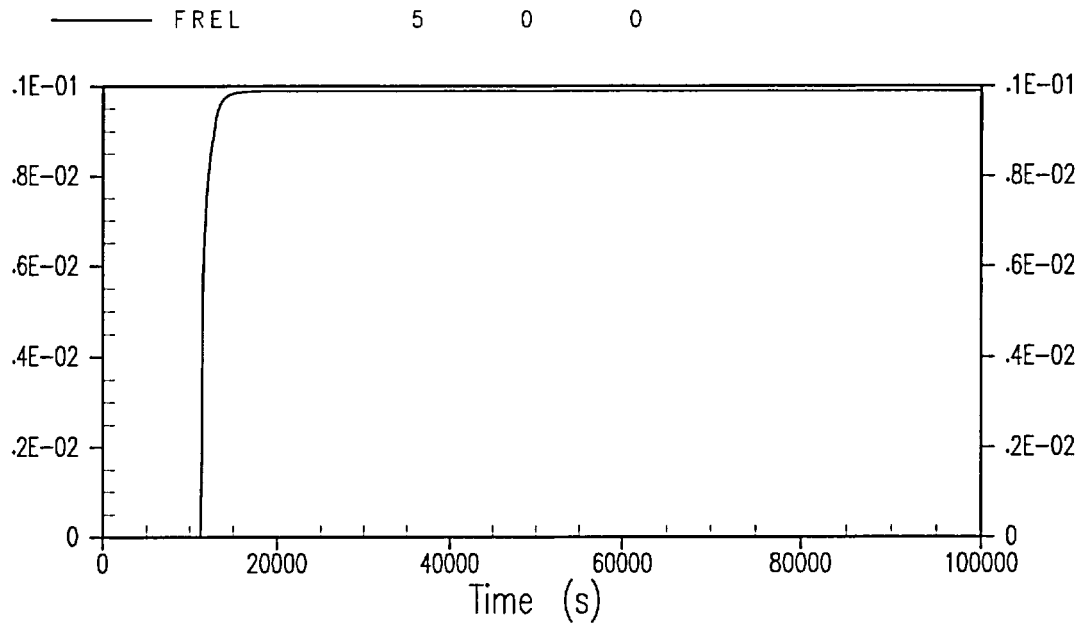


Figure 45-65

Release Category CFL, Case 3BE-7 – SBLOCA with Failed Gravity Injection: Release Fraction of Molybdenum Dioxide

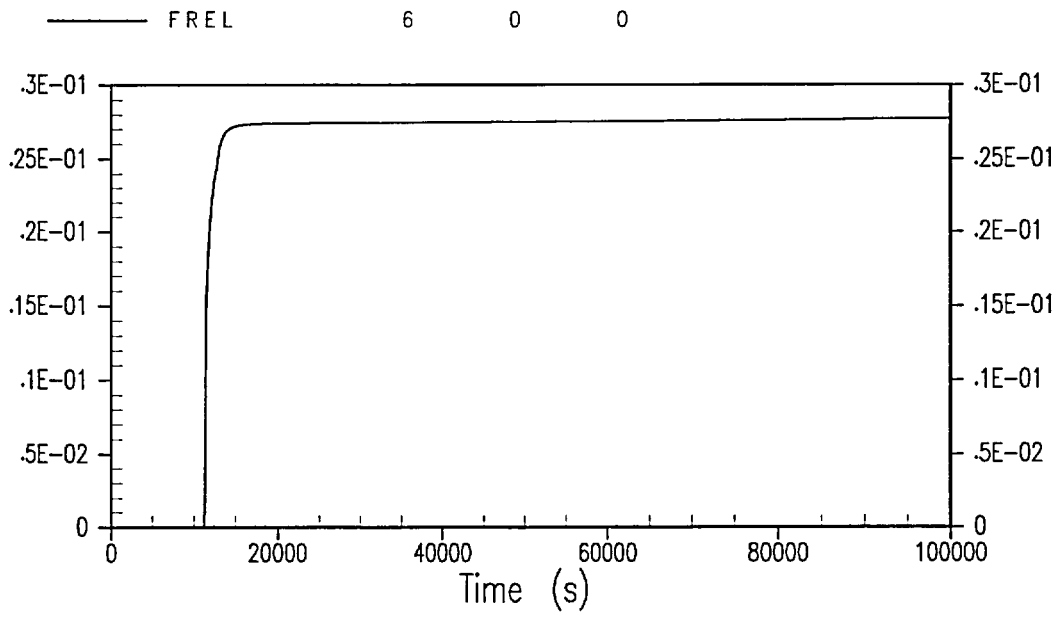


Figure 45-66

Release Category CFL, Case 3BE-7 – SBLOCA with Failed Gravity Injection: Release Fraction of Cesium Hydroxide

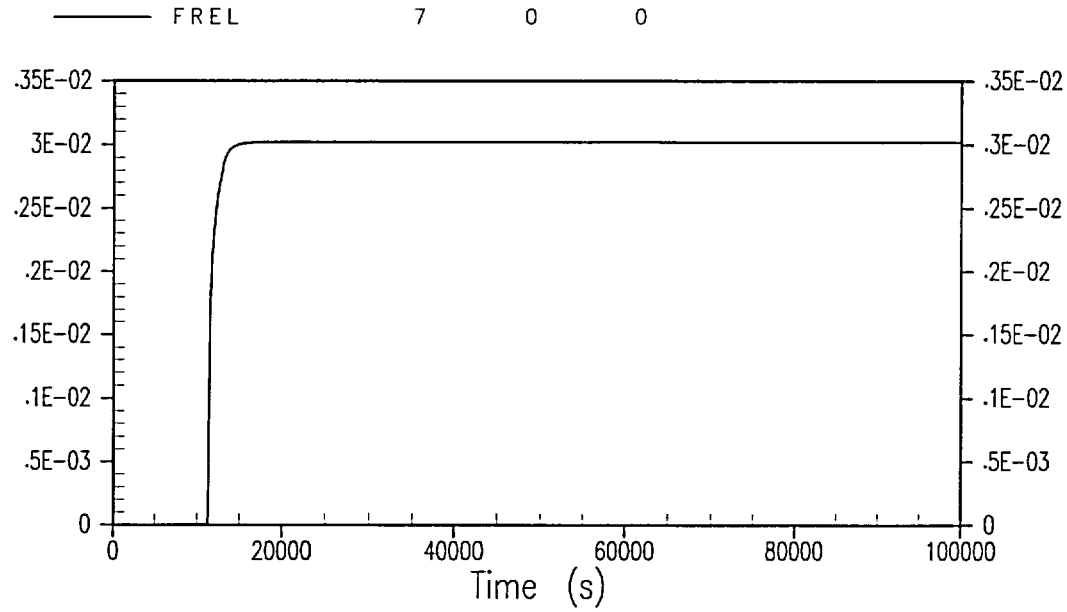


Figure 45-67

Release Category CFL, Case 3BE-7 – SBLOCA with Failed Gravity Injection: Release Fraction of Barium Oxide

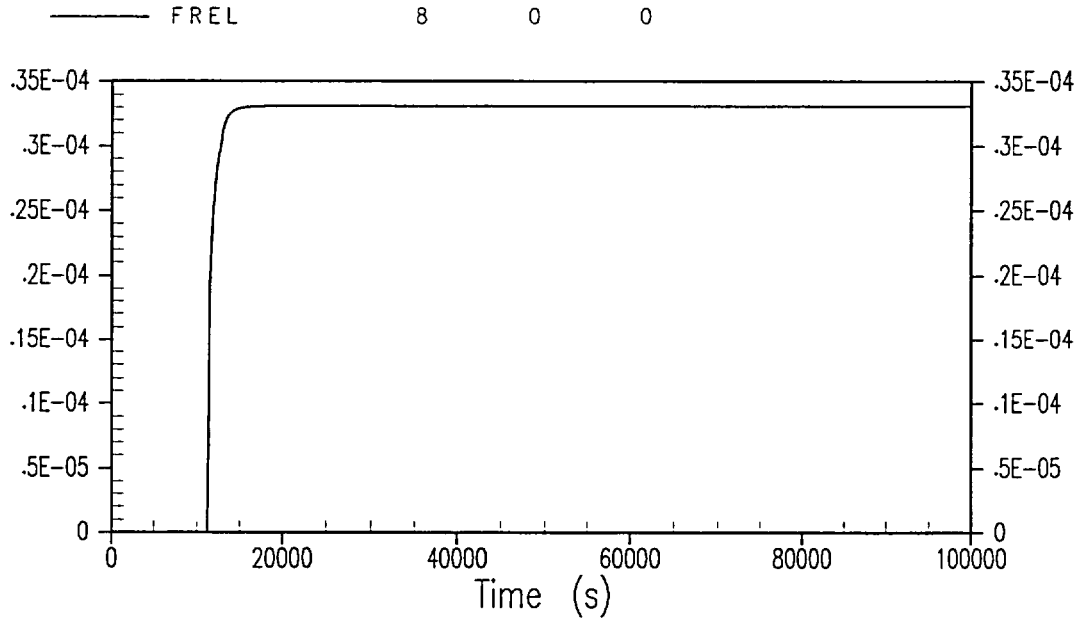


Figure 45-68

Release Category CFL, Case 3BE-7 – SBLOCA with Failed Gravity Injection: Release Fraction of Dilanthanum Trioxide

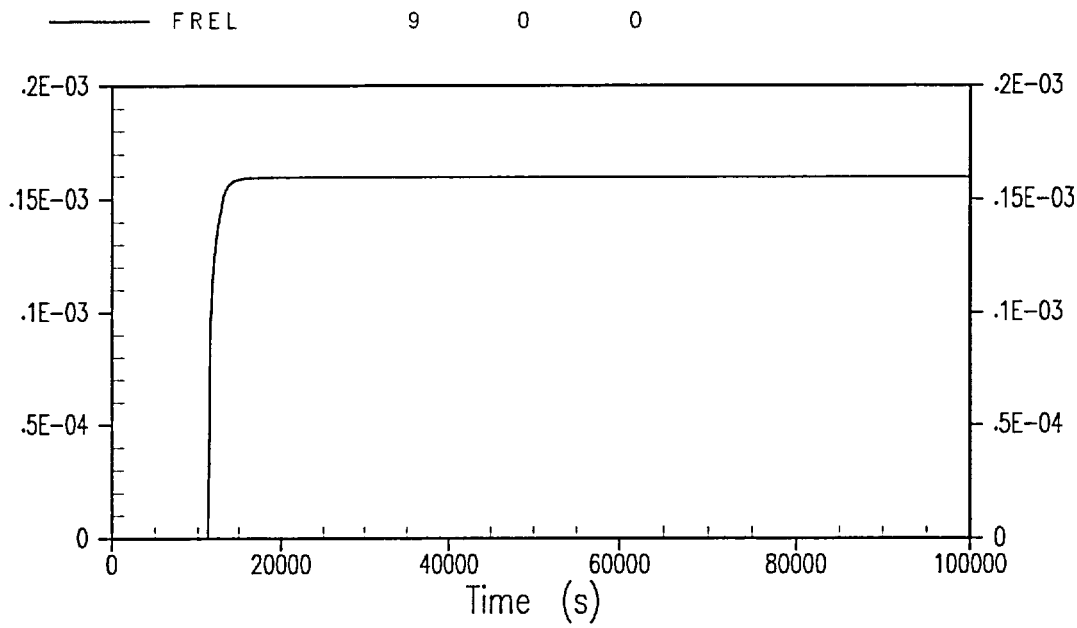


Figure 45-69

Release Category CFL, Case 3BE-7 – SBLOCA with Failed Gravity Injection: Release Fraction of Cerium Dioxide

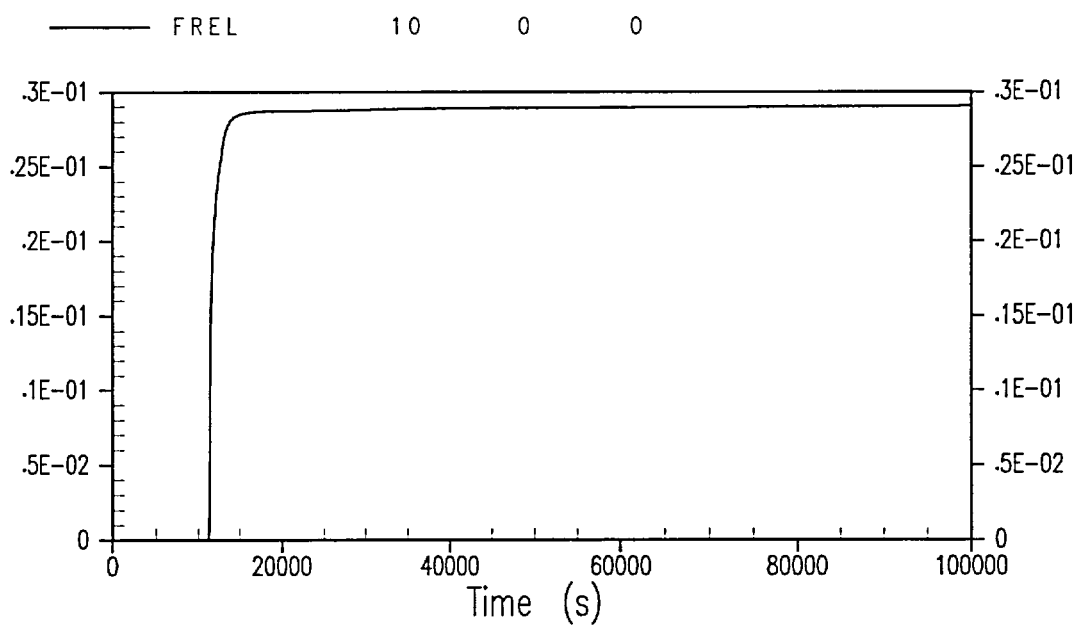


Figure 45-70

Release Category CFL, Case 3BE-7 – SBLOCA with Failed Gravity Injection: Release Fraction of Tin

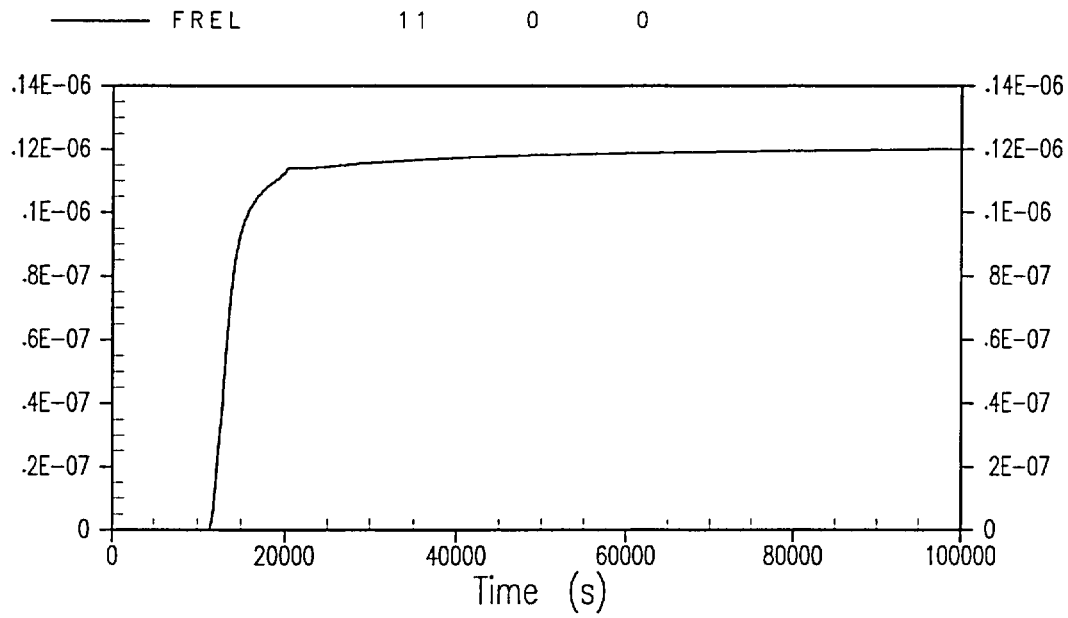


Figure 45-71

Release Category CFL, Case 3BE-7 – SBLOCA with Failed Gravity Injection: Release Fraction of Tellurium

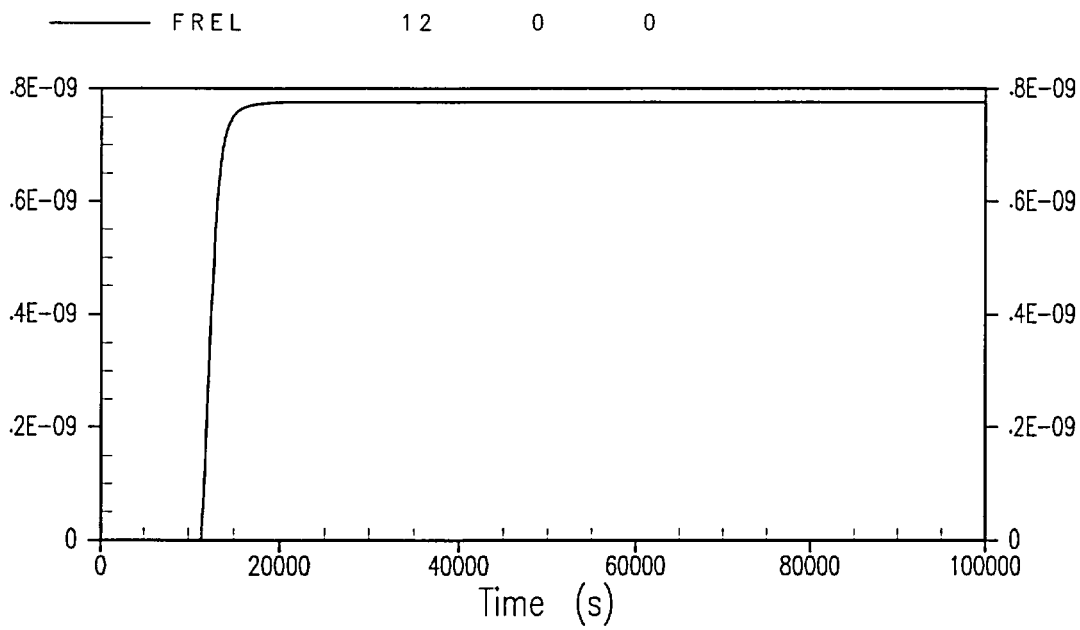


Figure 45-72

Release Category CFL, Case 3BE-7 – SBLOCA with Failed Gravity Injection: Release Fraction of Uranium Dioxide

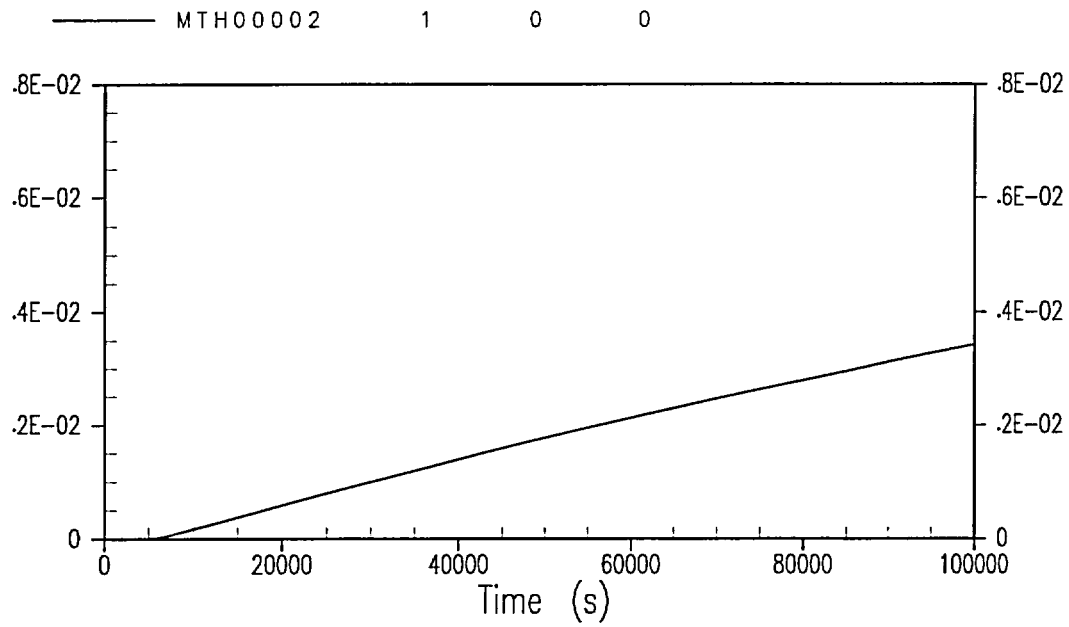


Figure 45-73

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection Direct-Release Sensitivity: Release Fraction of Noble Gases

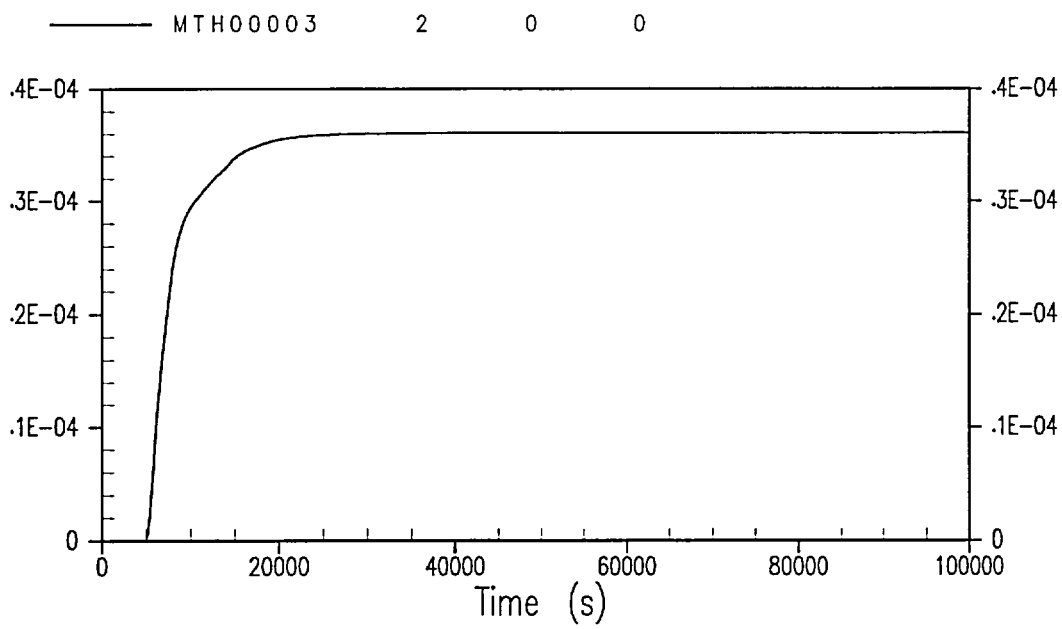


Figure 45-74

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection Direct-Release Sensitivity: Release Fraction of Cesium Iodide

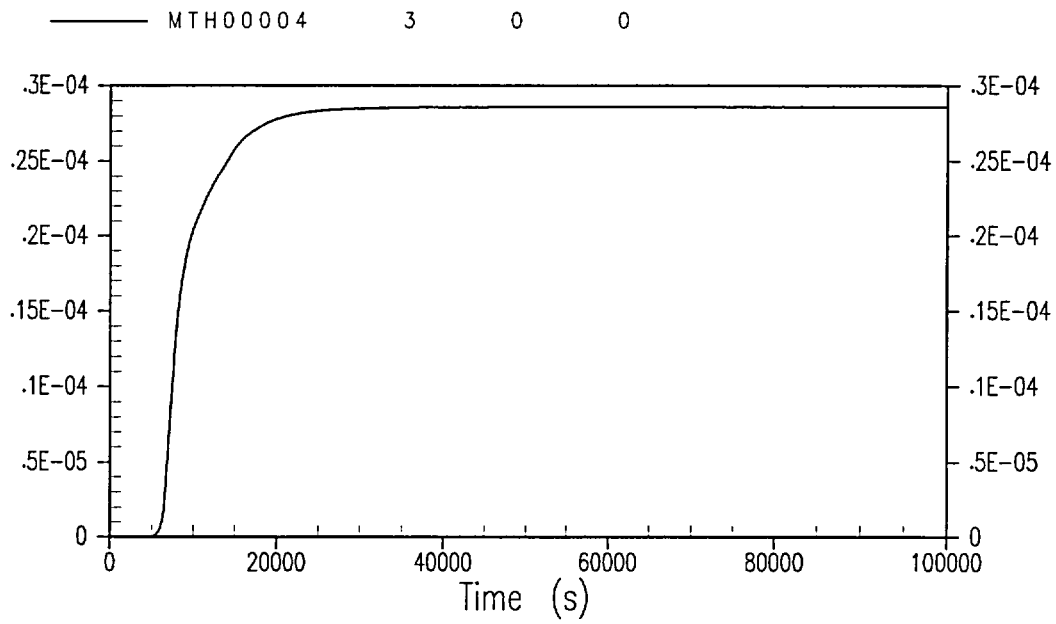


Figure 45-75

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection Direct-Release Sensitivity: Release Fraction of Tellurium Dioxide

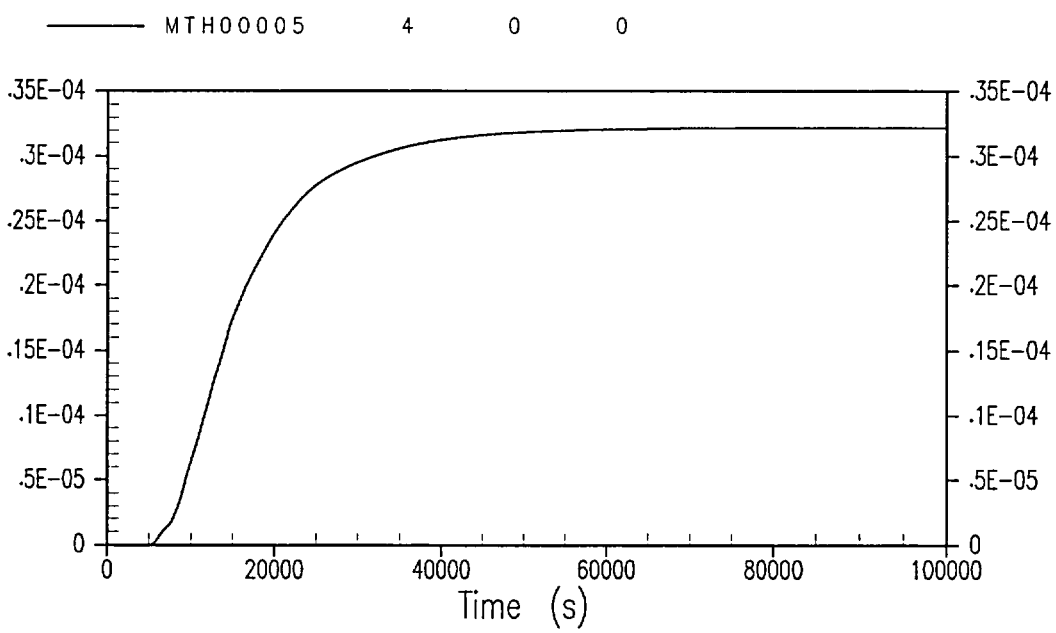


Figure 45-76

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection Direct-Release Sensitivity: Release Fraction of Strontium Oxide

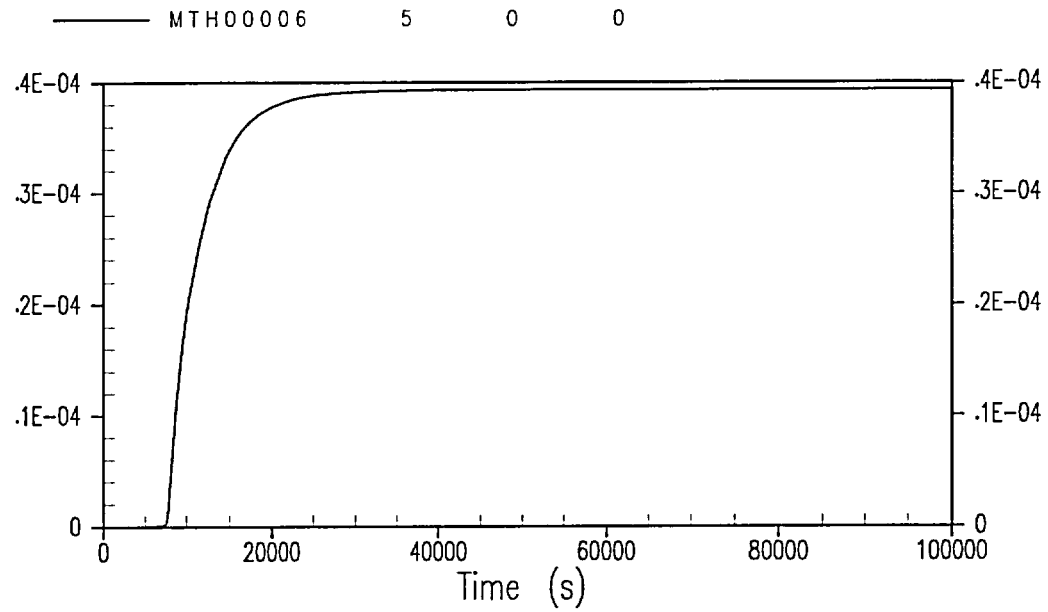


Figure 45-77

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection Direct-Release Sensitivity: Release Fraction of Molybdenum Dioxide

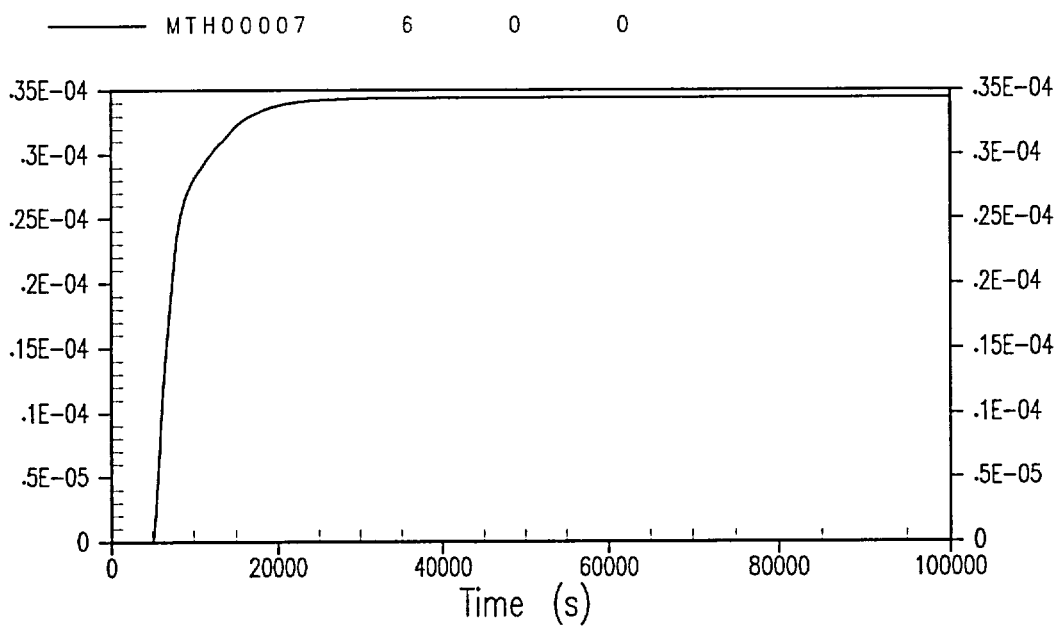


Figure 45-78

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection Direct-Release Sensitivity: Release Fraction of Cesium Hydroxide

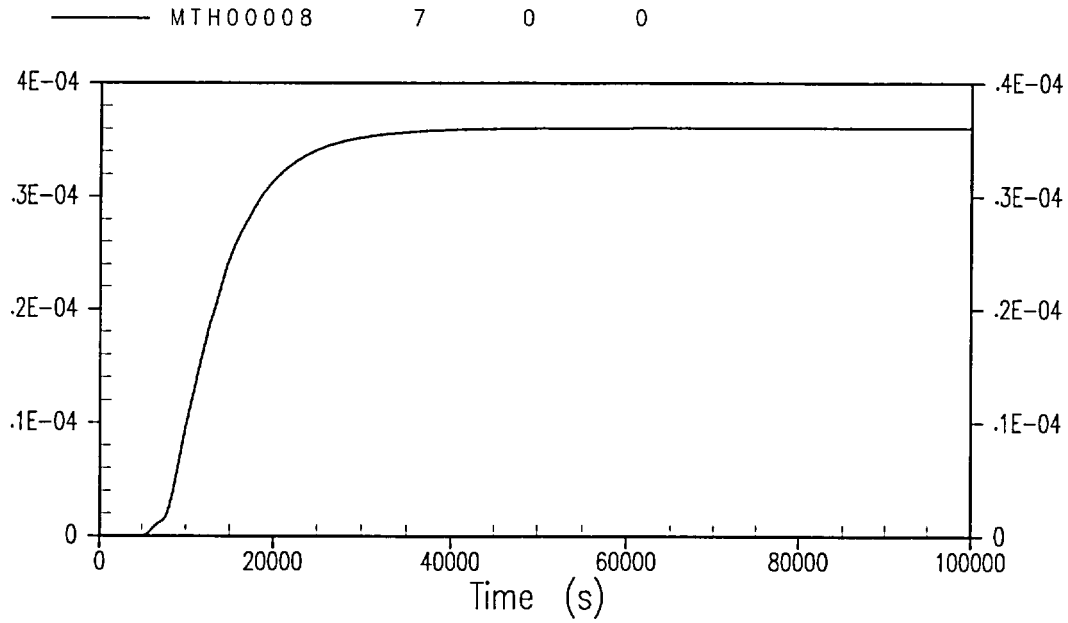


Figure 45-79

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection Direct-Release Sensitivity: Release Fraction of Barium Oxide

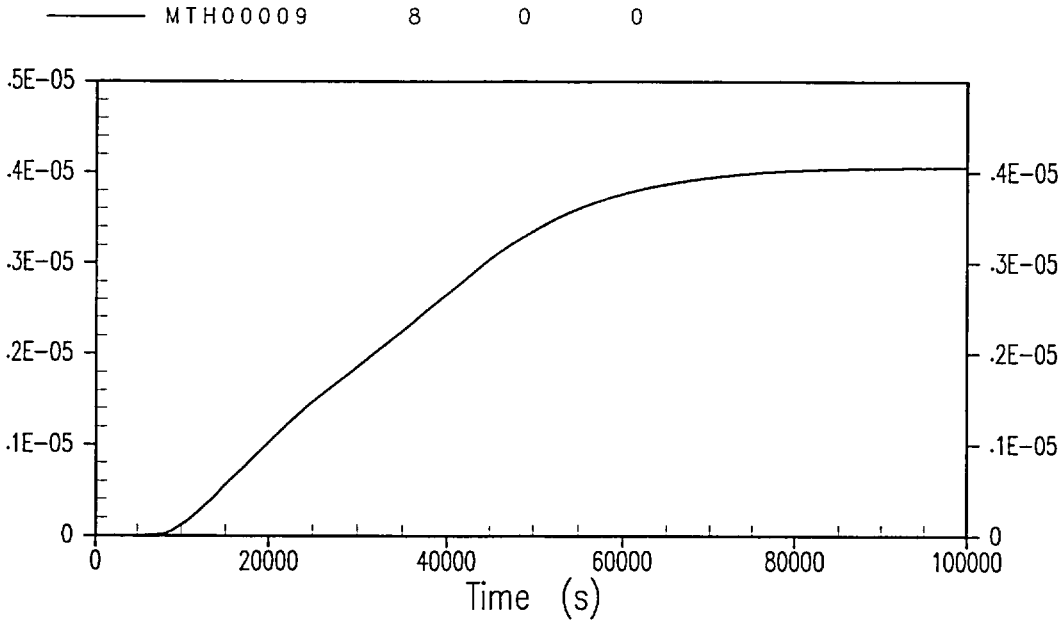


Figure 45-80

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection Direct-Release Sensitivity: Release Fraction of Dilanthanum Trioxide

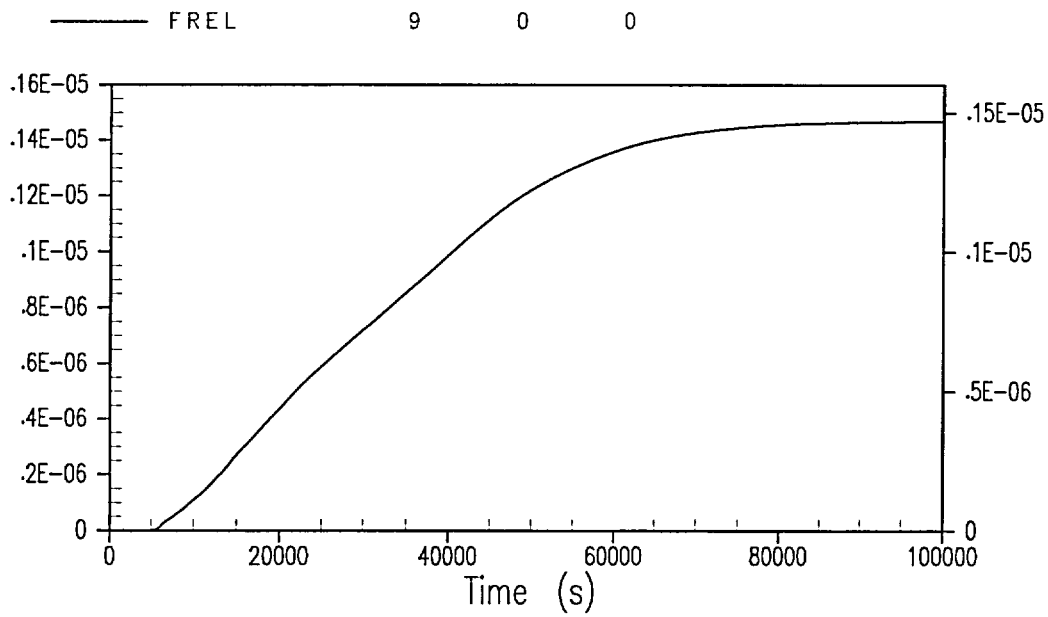


Figure 45-81

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection Direct-Release Sensitivity: Release Fraction of Cerium Dioxide

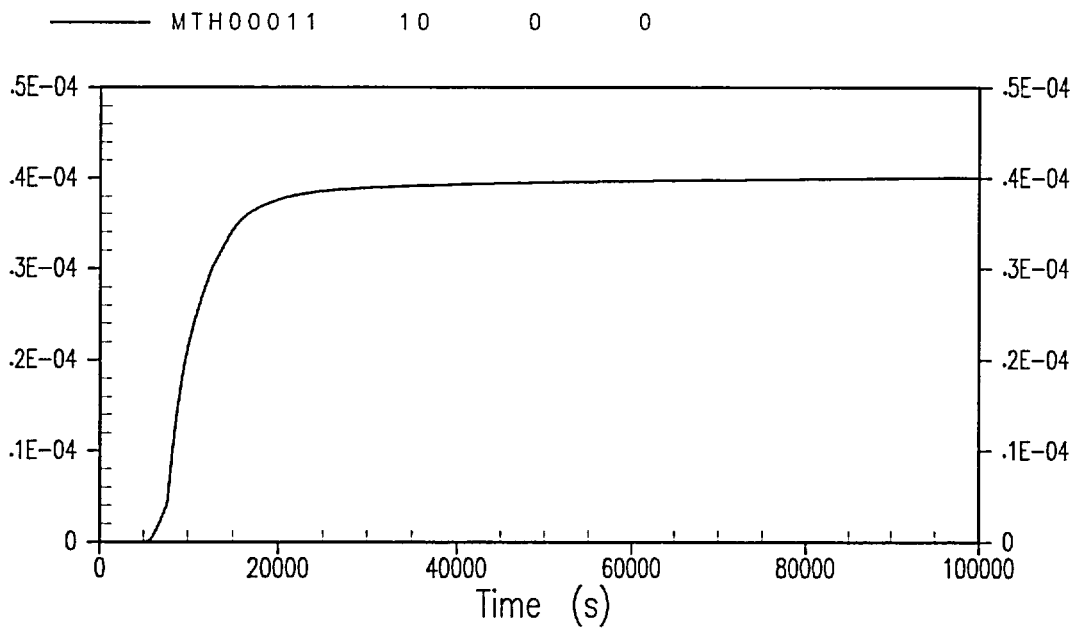


Figure 45-82

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection Direct-Release Sensitivity: Release Fraction of Tin

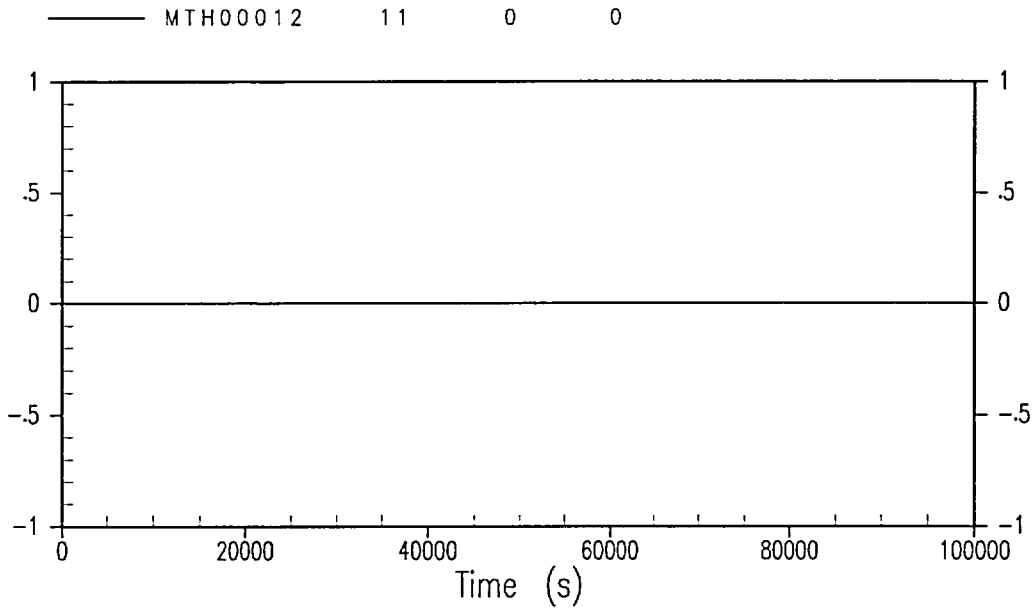


Figure 45-83

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection Direct-Release Sensitivity: Release Fraction of Tellurium

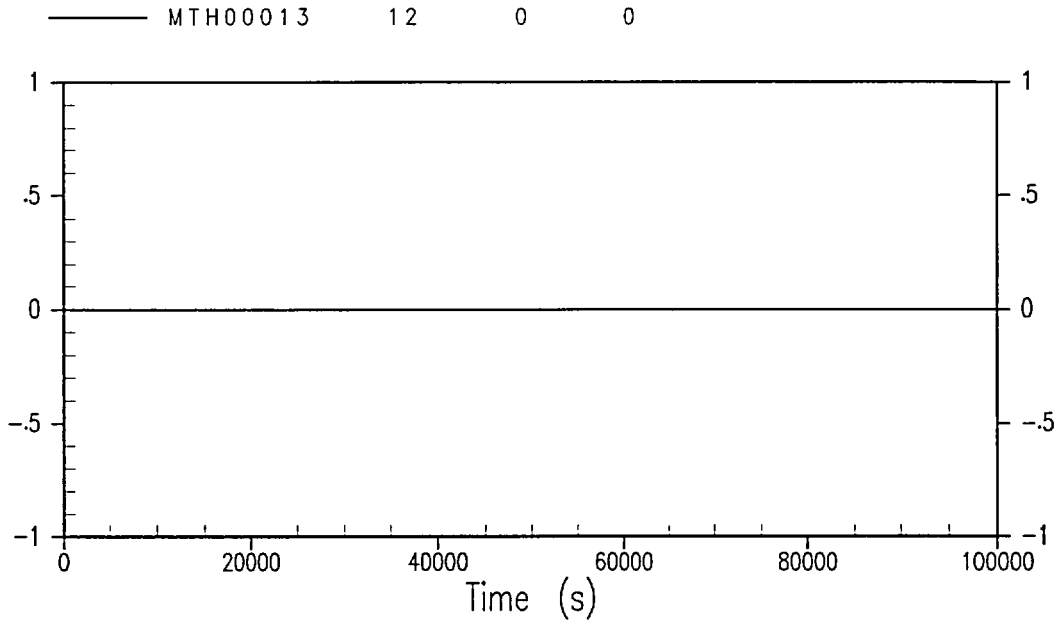


Figure 45-84

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection Direct-Release Sensitivity: Release Fraction of Uranium Dioxide