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SUBJECT: Transmittal of Westinghouse Revision 2 Response to US NRC Request for Additional Information 720.038 on the AP1000 Design Certification Review

This letter transmits the Westinghouse response to NRC Request for Additional Information (RAI) 720.038 regarding our application for Design Certification of the AP1000 Standard Plant

Please contact me if you have questions regarding this submittal.

Very truly yours,

M. M. Corletti
Passive Plant Projects & Development
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D063

AP1000 DESIGN CERTIFICATION REVIEW

Response to Request For Additional Information

RAI Number: 720.038 (Response Revision 2)

Question:

An important objective of the AP600 design certification PRA was to identify important PRA insights and assumptions and make sure that they have been addressed in the design certification through design certification requirements, such as requirements for inspection, tests, analyses and acceptance criteria (ITAAC), the requirement for a design reliability assurance program (D-RAP), and combined operating license (COL) action items. These requirements were incorporated in the Design Control Document (DCD), Table 19.59-29 "PRA-based insights," to ensure that any future plant which references the design will be built and operated in a manner that is consistent with important assumptions made in the design certification PRA. Please provide similar information for AP1000. Since the major part of this information is expected to be the same as for AP600, please start with DCD Table 19.59-29 and highlight the differences in "insights" between the two designs.

Westinghouse Revised Response:

Requested information was incorporated in the Revision 3 of AP1000 DCD Section 19-59 and PRA Chapter 59, Revision 1.

The revised response addresses the following NRC additional comments. **Revision 2 of this response reflects an update to our response to Question 1.**

NRC Additional Comments:

1. As discussed in RAI number 720.038, an important objective in the AP1000 design certification is to identify important PRA insights and assumptions to ensure that they have been addressed in ITAAC and D-RAP and COL action items. The following questions concern the lack of documentation regarding shutdown risk significant assumptions and features of the AP1000 design. Given the updated common cause analyses for the HP and LP squib valves and the shorter operator response times, the staff needs importance and sensitivity analyses for the AP1000 shutdown PRA documented in the AP1000 shutdown PRA rather than referring the reader to the AP600 Shutdown PRA. The sensitivity analyses should include:

a. The AP1000 Shutdown CDF based on a licensee following the minimum compliance with Technical Specifications which includes the licensee having only one IRWST injection and recirculation path operable during modes 5 and 6.

b. The results of the focused AP1000 shutdown PRA

c. The AP1000 Shutdown CDF assuming all human error probabilities (HEPs) are set to .5 which includes HEPs RCS-MANODS1 and RCSMANODS2.

2. Based on the RAI response to 720.065, the staff does not believe that the ability to close the containment in the AP1000 is the same for AP600 because the time to boiling is reduced from 17 to 10 minutes. The staff also noted that shutdown LRF frequencies were reported in AP1000 Implementation of the Regulatory Treatment of Nonsafety-Related Systems Process (on Table 2-2). However, there is no discussion of shutdown LRF in the AP1000 shutdown PRA, nor is there a discussion regarding the failure likelihood of closing containment given a severe accident at shutdown. The staff is requesting Westinghouse to document in the AP1000 shutdown PRA : (1) the assessment used to estimate that likelihood that the operators could fail to close containment during shutdown, and (2) a corresponding discussion of the shutdown LRF frequencies in the AP1000 shutdown PRA.

Westinghouse should update the basis into Technical Specifications for containment closure.

3. Westinghouse's response to RAI 720.070 is not adequate for the staff to derive AP1000 risk insights regarding shutdown fires, shutdown floods and seismic events at shutdown.

a. As reported in RAI 720.070, the AP600 shutdown fire frequency is comparable to the AP600 at power fire frequency. Thus, Westinghouse is requested to document changes in the AP1000 shutdown fire assessment from the AP600 shutdown fire assessment. Specifically, Westinghouse needs to identify and document in the AP1000 Shutdown PRA: (1) any differences in equipment locations in the various fire areas and zones with respect to the AP600 design and (2) the qualitative or quantitative impacts (if necessary) of such differences on shutdown risk results and shutdown risk insights.

b. The staff did not find any AP1000 PRA based insights regarding how transient combustibles will be controlled at shutdown to maintain the assumed shutdown ignition frequencies. Westinghouse needs to document in the AP1000 shutdown PRA how transient combustibles at shutdown will be controlled.

c. Considering the updated common cause analysis for the HP and LP squib valves and the revised shutdown initiating event frequencies based on an 18 month refueling cycle, Westinghouse is requested to provide the dominant AP1000 shutdown fire scenarios in the AP1000 shutdown PRA.

d. Westinghouse is requested to document in the AP1000 Shutdown PRA any changes from the AP600 shutdown internal floods assessment that could impact AP1000 shutdown risk insights.

e. Westinghouse is also requested to document in the AP1000 Shutdown PRA the dominant AP1000 shutdown flooding scenarios.

Westinghouse Additional Response:

Response to Question 1:

Three sensitivity analyses are performed for the cases mentioned in the question. These sensitivity analyses are given in Attachment 1 to this document. **Revision 2 of this response reflects an update to Attachment 1 that includes a revised Case 2 and an additional Case 4.**

Response to Question 2:

Containment closure during Shutdown

During shutdown operations, the containment Isolation requirements are governed by plant technical specifications. According to these technical specifications,

1. During plant operation in Modes 1, 2, 3, and 4, Technical Specifications 3.6.1, 3.6.2, and 3.6 3 require that the containment isolation must be maintained (therefore the containment hatches can not be opened);

2. During Modes 5 and 6, containment penetrations such as the equipment hatches may be open only if the time it takes to manually close the penetrations is less than the time it takes to steam to the containment after a loss of RCS heat removal accident. Otherwise, the containment hatches are not allowed to be open. The time to close the penetrations before steaming must include the diagnosis and decision-making time, in addition to the time required to physically complete the closure action. The eighth paragraph of the Background for the Bases of TS 3.6.8 was revised to clarify the closure timing.

3. Based on the criteria discussed above, the containment hatches will not be open during mid-loop operations before refueling, when the time to containment steaming after a loss of RCS cooling events is minimum. The fourth and eighth paragraphs of

the Background for the Bases of TS 3.6.8 were revised to specifically address mid-loop closure.

The failure probability of the containment isolation is calculated in attachment 2; it is the same as calculated in the AP600 PRA. The results and major insights of the containment isolation PRA analysis during shutdown conditions are summarized below:

1. The time window for manually closing the containment hatches (and associated penetrations) is taken to be 50 minutes in calculation of the failure probability of the manual closure of the hatches. It is expected that upon loss of RCS cooling, the first 15 minutes will be used up for diagnosis and decision making to close to hatches. It is also estimated that it will take 30 minutes for the hatches to be closed. Thus, a total of 45 minutes is needed to complete the closure of the hatches. The sixth paragraph of the Background for the Bases of TS 3.6.8 was revised to clarify the closure timing assumed in the PRA.

2. The containment isolation failure probability (when the hatches are not open) is calculated to be 1.71E-02.

3. The containment isolation failure probability when the hatches are open is calculated to be 1.95E-02. This probability includes an operator failure probability of 2.28E-03, failure to close the hatches.

   There is no significant difference between the two probabilities mentioned above, with and without the hatches being open, as long as the time window of 50 minutes is applicable.

4. Although the minimum time to boiling during mid-loop operations is mentioned, and is different in AP600 and AP1000 designs, this fact has no bearing on the calculation of the failure probability of the manual closure of the hatches. By technical specifications, hatch opening is not permitted unless the specified time window of 50 minutes to steaming is available (in modes 5 and 6); the opening of the hatch(es) would be delayed until the 50-minute time window to steaming is feasible.
   Therefore, given the criteria in the Technical Specifications that governs containment closure, the AP1000 plant will effectively improve containment closure reliability, because the containment will not be allowed to open for the same time period as assumed for AP600.

Shutdown LRF Frequencies

In Chapter 59 of the AP1000 PRA Study, a LRF value of 2.05E-08/year has been estimated by using the CCFP from the AP600 Shutdown PRA. The shutdown risk assessment for AP1000 indicates that the risk profile and insights of AP600 Shutdown PRA are applicable to

the AP1000 design. Based on that assessment the following breakdown of the AP1000 LRF is provided:

77.4% of the LRF is caused by containment failure after 24 hours (release category CFV). This release is due to accident class LP-3BE with the following characteristics:

> RCS is fully depressurized; no cavity flooding; vessel failure; debris dryout; long term core-concrete interaction; basemat melt-through.
>
> 22.5% of the LRF is caused by the compromised containment integrity, such as containment bypass (BP, 14.6%), containment isolation failure (CI, 5.0%) and intact containment with excessive leakage (XL, 2.9%). This release is mainly due to accident classes LP-CBP and LP-3BE with the following characteristics:
>
> LP-CBP (BY) = RCS overdraining during mid-loop or RNS pipe rupture during non-drained conditions; failure to manually isolate leak; failure of gravity injection or sump recirculation.
>
> LP-3BE (CI / XL) = Fully depressurized RCS; cavity flooded; vessel intact; containment isolation failed or excessive leakage.
>
> 0.15% of the LRF is caused by containment failure before 24 hours. This is an insignificant contributor to plant risk.

Response to Question 3 Item a:

See response to Question 3 Item c

Response to Question 3 Item b:

The control of transient combustibles is defined in the item 47 and 48 of the AP1000 PRA based insights (see page 59-92 of AP1000 PRA Chapter 59 Revision1).

The insight # 47 (the maintenance guidelines as described in the Shutdown Evaluation Report (WCAP-14837) should be considered when developing the plant specific operations procedures) refers the WCAP-14837 – Shutdown Evaluation that provides the following internal fire protection design features to minimize the fire occurrence in shutdown conditions:

- Use of noncombustible structural materials in plant buildings
- Control combustible materials

- Procedural guidance expected to be implemented by combined operating license (COL) applicant regarding safe work practices for hot work, control of combustible materials, and housekeeping.

Note that the COL implementation is confirmed by the insight disposition that refers the section 13.5.1 (Combined License Information Item) of the AP1000 DCD.

In addition the disposition of insight # 48 (transient combustible should be controlled) refers the Table 9.5.1-1 (AP1000 Fire Protection Program Compliance with BTP CMEB 9.5-1) Items 77-83 of the AP1000 DCD.

Response to Question 3 Item c:

An evaluation of the shutdown fire events has been performed and the dominant fire scenarios are given in Attachment 3c.

Response to Question 3 Item d:

The AP1000 Shutdown PRA was assessed for internal floods that could have a possible impact on safety during the modes identified in the shutdown analysis. Areas were screened out that presented no apparent flooding problems based on the systems modeled for maintaining a safe, stable state. Attachment 3d provides information on areas screened out in addition to areas considered being at risk to internal flooding. The PRA internal flooding analysis was performed specifically for the AP1000 plant.

The minimization of potential flooding sources in the safety-related areas in addition to the physical separation of redundant safety-related components and systems from each other and from non-safety-related components minimizes the consequences of internal flooding. The core damage frequencies arising from flooding events during shutdown operations are not appreciable contributors to overall AP1000 core damage frequencies.

The internal flooding analysis conservatively assumes that flooding of non-safety-elated equipment results in system failure of the affected system. This resulted in a higher flooding-induced core damage frequency at shutdown than at-power, because of the use of the non-safety-related normal residual heat removal system as the primary means of decay heat removal at shutdown.

Response to Question 3 Item e:

The dominant AP1000 shutdown flooding scenarios were determined and a quantitative analysis performed. There are 8 dominant flooding scenarios evaluated, which are fully described in Attachment 3d.

The top two shutdown flooding scenarios comprise 90 percent of the shutdown flooding-induced core damage frequency. The dominant shutdown flooding core damage initiators are as follows:

- Shutdown flooding scenario 2, loss of decay heat removal due to failure of the component cooling water system or service water system during reactor coolant system drained condition. This is due to a rupture of component cooling water, fire protection, or service

water piping in the turbine building general area. This initiator contributes 45 percent of the shutdown flooding core damage frequency.

- Shutdown flooding scenario 8, loss of decay heat removal due to failure within the RNS during reactor coolant system drained condition. This is due to a rupture of chemical and volume control or fire protection piping in the auxiliary building RCA. This initiator contributes 45 percent of the shutdown flooding core damage.

Design Control Document (DCD) Revision:

DCD Chapter 16.1 will be updated as follows:

Paragraphs four, six, and eight of TS 3.6.8 Bases Background

Figure B 3.6.8-1 provides allowable closure times for four representative sets of plant conditions. The time to steaming is dependent on various plant parameters (RCS temperature, IRWST temperature, etc.) and plant configuration (RCS Pressure Boundary Intact, RCS Open, etc.). Therefore, the actual representation of the time to steaming may be different than that provided in Figure B 3.6.8-1. In determining the minimum time to steaming, conservative assumptions regarding core decay heat, RCS configuration, and initial RCS inventory are used to minimize the calculated time to steaming. . The curves are based on the core decay heat prior to refueling, so that closure times are longer following the core reload.

These events are further discussed in Section 19.59.5 of Reference 1. Time to steaming is dependent on the postulated RCS configuration (intact versus open), and is based on the response of the plant considering features such as the operation of the 4th stage ADS valves if necessary, status of the upper internals, status of refueling cavity, etc. Conservative assumptions regarding these features are made in the determination of the minimum time to steaming. The time assumed in the PRA to close the penetrations before steaming to containment included 15 minutes for the diagnosis and decision-making time, in addition to the time required to physically complete the closure action.

The assumptions used in determining the required closure time for the various containment openings should be conservative, and should be consistent with the plant operating procedures, staffing levels, and status of the containment openings. The evaluation should consider the ability to close the containment for the limiting loss of shutdown cooling event, and considering the possibility of a station blackout. In determining if containment can be closed within the time permitted to containment closure specified in Figure B 3.6.8 -1, the time to close containment penetrations must include both the diagnosis and decision-making time and the time required to physically complete the closure action.

Containment should be closed during the initial mid-loop period for a refueling since the time permitted to containment closure is shorter than the time to diagnose and make a decision that closure is needed following an event. The need to close containment for the mid-loop period following a refueling must

be evaluated since decay heat varies with the time after shutdown and the impact of the partial core replacement with new fuel. It is expected that containment will be closed for activities where drain-down is planned, such as the RCS drain-down from no-load pressurizer level for the initial mid-loop period during a refueling. Containment is not expected to be closed for minor, unplanned RCS volume transients, such as a short-term inventory where the pressurizer level may be reduced, but not emptied, and where recovery actions are within the time to containment closure.

PRA Revision:

The following changes will be incorporated in the next revision of the PRA.

- In Chapter 54, a section "Shutdown Assessment Importance and Sensitivity Analyses" and subsection "Assessment of Containment Closure Failure Probability" will be added to incorporate question 1 and 2 response.
- In Chapter 56, a section "Shutdown Operation" will be added to incorporate question 3 item d and e response.
- In Chapter 57, a section "Shutdown Fire Analyses" will be added to incorporate question 3 item a and c response.

Attachment 1 - AP1000 PRA Sensitivity Analyses

Case 1 Minimum Equipment per Tech Specs During Drained Conditions

AP1000 Technical Specifications (TS) 3.5.8 allows one of the IRWST injection trains and one of the containment sump recirculation trains to be out of service during reduced inventory conditions; and TS 3.4.14 allows two ADS 4th stage valves to be out of service during reduced inventory conditions. This sensitivity study is performed to estimate the core damage frequency if one train of IRWST, the associated containment sump recirculation train and two ADS 4th stage valves are out of service at the same time.

It is assumed that the A train of IRWST and corresponding sump recirculation train are unavailable. This also makes the IRWST to RNS connection via valve V23 unavailable. Moreover, the first two lines of the ADS stage 4 are assumed unavailable. The sensitivity analysis is done on the drained initiating events. The non-drained cases remain the same as the base case.

The affected components and their corresponding basic events are identified. These components are set to failure to simulate their being out of service. The CCF events associated with these component groups are also identified and their failure probabilities are increased. Table 1-2 shows the components, basic events, and CCF events that are modified. Table 1-3 shows the CCF and other relevant calculations.

The CDF result of the sensitivity analysis for the drained cases is 1.95E-06/year. The base non-drained CDF contribution is added to give the total CDF of 2.19E-06 for this sensitivity analysis. This should be compared to the base case of 1.23E-07/year CDF.

The results of the sensitivity analysis are summarized in Table 1-1.

The sensitivity analysis shows that although there is a factor of 18 increase in the CDF compared to the base case, the plant CDF for shutdown events is still small (2.2E-06/year) even if the IRWST, sump recirculation and ADS trains identified above are out of service during drained shutdown cases, as allowed by technical specifications.

Table 1-1 Contribution of Initiating Events to Plant CDF – Shutdown sensitivity Case 1

Plant CDF from drained events = 1.95E-06
Total Plant CDF (drained + non-drained) = 2.19E-06

Initiating Event	% Contribution	IEV Frequency a	IEV CDF b	CDP b/a	
1 IEV-CCWD	69.2	7.16E-04	1.51E-06	2.11E-03	drained events
2 IEV-RNSD	9.2	9.69E-05	2.01E-07	2.08E-03	drained events
3 IEV-LOSPD	8.8	5.28E-03	1.93E-07	3.66E-05	drained events
4 IEV-RCSOD	1.1	5.28E-06	2.49E-08	4.72E-03	drained events
5 IEV-LOCA24D	0.9	1.15E-05	1.97E-08	1.71E-03	drained events
IEV-LOSPND	8.2	1.82E-02	1.79E-07	9.82E-06	non-drained events
IEV-CCWND	1.9	3.99E-03	4.09E-08	1.02E-05	non-drained events
IEV-RNSND	0.5	1.02E-03	1.04E-08	1.02E-05	non-drained events
IEV-LOCA24ND	0.1	1.73E-05	2.46E-09	1.42E-04	non-drained events
IEV-LOCAPRND	0.0	1.61E-05	2.84E-10	1.76E-05	non-drained events

Note = Non-drained cases are the same as the base case.

Table 1-2. Basic Event Probabilities to be Revised

	Component		Basic Event	Old Prob.	New Prob.
1	CCF of ADS-4 EVs	2	ADX-EV-SA	3.00E-05	3.80E-05
2	EV-118A	143	IRWMOD09	1.46E-03	1
3	EV-120A	144	IRWMOD10	1.46E-03	1
4	Screen Plug	151	IWA-PLUG	2.40E-04	1
5	CV-122A	152	IWACV122AO	8.76E-03	1
6	EV-123 A	153	IWACV123AO	8.76E-03	1
7	CV-124A	154	IWACV124AO	8.76E-03	1
8	EV-125A	155	IWACV125AO	8.76E-03	1
9	CCF IRWST CVs	167	IWX-CV-AO	3.00E-05	4.00E-05
10	CCF IRWST EVs	168	IWX-EV4-SA	2.60E-05	3.30E-05
11	Screen Plug	228	REA-PLUG	2.40E-04	1
12	CV-120A	229	REACV119GO	1.75E-03	1
13	MOV-RNS-23	243	RN23MOD5S	2.21E-03	1
	ADS-4 Line 1 EV		AD4MOD7	not in cutsets	
	ADS-4 Line 2 EV		AD4MOD8	not in cutsets	
	OK	157	IWB-PLUG	2.40E-04	
	OK	158	IWBCV122AO	8.76E-03	
	OK	159	IWBCV123AO	8.76E-03	
	OK	160	IWBCV124AO	8 76E-03	
	OK	161	IWBCV125AO	8.76E-03	

Basic Events Revised:

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; SENDATA 1 1
; 03/13/03, 13:34:27

h:\ap1000~2\38-1\case-1\drained.wlk

Case 1
h:\ap1000~2\38-1\case-1\drained.wl1

ADX-EV-SA 3.8E-05
IWA-PLUG R
IWACV122AO R
IWACV123AO R
IWACV124AO R
IWACV125AO R
IWX-CV-AO 4.0e-05
RN23MOD5S R
IRWMOD09 R
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IRWMOD10 R
IWX-EV4-SA 3.3e-05
REA-PLUG R
REACV119GO R
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Table 1-3 Revise CCF Basic Event Probabilities

CCF calcs CCF basic event probabilities must be increased since some redundant components are out of service.

ADS 4th stage EVs. 1/4 needed for success; group size is 4; only 2 available.
Random Failure probability = 5.80E-04

	CCF Multiplier	Q	N # of Comb.	Q*N	Original Should have been # of Comb.	Q*N	Original used # of Comb.	Q*N
2/4	1.70E-02	9 860E-06	1	9.860E-06	0	0.000E+00	0	0.000E+00
3/4	1.70E-03	9.860E-07	2	1.972E-06	0	0.000E+00	4	3.944E-06
4/4	4.50E-02	2.610E-05	1	2.610E-05	1	2.610E-05	1	2.610E-05
Calc 1		**ADX-EV-SA**		**3.8E-05**		2.610E-05		**3.0E-05**

replace ADX-EV-SA with the new value

but 3.0E-05 was used; was conservative.

IRWST Check valves 1/4 needed for success; group size is 4; only two available
Random Failure Probability = 1.75E-03

		Q	N # of Comb.	Q*N	Original used # of Comb.	Q*N
2/4	3.10E-04	5.425E-07	1	5.425E-07	0	0.000E+00
3/4	2.80E-03	4.900E-06	2	9.800E-06	0	0 000E+00
4/4	1.70E-02	2.975E-05	1	2 975E-05	1	2.975E-05
Calc 2		**IWX-CV-AO**		**4.0E-05**		**3.0E-05**

replace IWX-CV-AO with the new value

IRWST EVs — 1/4 needed for success; group size is 6; three are out of service

Random Failure Probability = 5.80E-04

		Q	N # of Comb.	Q*N	Original used # of Comb	Q*N
2/6	1.00E-02	5.800E-06	1	5.800E-06	0	0.000E+00
3/6	5 00E-04	2.900E-07	4	1.160E-06	0	0.000E+00
4/6	4.50E-02	2.610E-05	1	2.610E-05	1	2.610E-05
Calc 3		**IWX-EV4-SA**		**3.3E-05**		**2.6E-05**

replace IWX-EV4SA with the new value

Case 2 No credit for Standby Non-Safety Systems

In AP1000 PRA, a sensitivity case was performed for events at power (case 36), in which the standby systems were assumed to be unavailable when an initiating event occurs. This case was used as the reference for RTNSS evaluation. The same sensitivity case is performed for shutdown PRA. The standby systems assumed to be unavailable in response to a shutdown event are:

1. CVS
2. SFW
3. RNS
4. DAS
5. DGs

These are the same systems used in the above mentioned sensitivity case 36. Note that CVS and SFW are not credited in the shutdown PRA and thus do not appear in the core damage cutsets.

Motor operated valve MOV23 in the RNS path can be used for gravity injection by an operator action, if the normal IRWST injection fails. This function of the valve is safety–related and is already credited in the AP1000 shutdown PRA event trees, in the node GIRNS (Gravity Injection via RNS). This path is also credited in the current sensitivity analysis.

The sensitivity analysis results in a plant CDF of **1.23E-06**~~1.461E-05~~/year. The top ~~200~~ core damage cutsets are reported in Table 2-1. The basic events set to failure ("dropped") to make the sensitivity analysis are reported in table 2-2 to enable future duplication of the case.

Table 2-3 gives the contribution of initiating events to plant CDF:

Table 2-3 Contribution of Initiating Events to Plant CDF - Shutdown sensitivity Case 2

Plant CDF = 1.23E-06
Number of Initiating Events = 10

	Initiating Event	% Contribution	IEV Frequency a	IEV CDF b	CDP b/a	
1	IEV-LOSPD	72.31	5.28E-03	8.89E-07	1.68E-04	drained
2	IEV-LOSPND	14.53	1.82E-02	1.79E-07	9.82E-06	
3	IEV-CCWD	7.35	7.16E-04	9.04E-08	1.26E-04	drained

4	IEV-CCWND	3.32	3.99E-03	4.09E-08	1.02E-05	
5	IEV-RNSD	0.99	9.69E-05	1.22E-08	1.26E-04	drained
6	IEV-RNSND	0.85	1.02E-03	1.04E-08	1.02E-05	
7	IEV-RCSOD	0.31	5.28E-06	3.79E-09	7.19E-04	drained
8	IEV-LOCA24ND	0.2	1.73E-05	2.46E-09	1.42E-04	
9	IEV-LOCA24D	0.12	1.15E-05	1.45E-09	1.26E-04	drained
10	IEV-LOCAPRND	0.02	1.61E-05	2.84E-10	1.76E-05	
	Sum =	100	2.94E-02	1.23E-06	4.19E-05	

Results of the table show that, 3 events per hundred years of plant operation are postulated. This corresponds to about 1 event per plant lifetime. If such an event occurs, and is assumed not to be mitigated by non-safety systems of RNS, DAS, and DGs, the average conditional core damage probability (CDP) of AP1000 is 45E-054. This result indicates that the plant is very robust against shutdown accidents even with only safety front-line systems credited to mitigate such events. When the above mentioned non-safety systems are credited, the average conditional core damage probability becomes 4.~~1~~8E-06 (1.23E-07/2.94E-02). This is a very low CDP**, given a challenge to the plant systems occur during low power and shutdown operations.**~~.~~

Estimation of Large Release Frequency

The large release frequency (LRF) associated with the CDF in this sensitivity case is estimated as 6.88E-07/year. For this estimate the conditional containment failure probability of 0.559 which was calculated for AP600 focused PRA is used. This relatively high failure fraction is deemed to be applicable to AP1000.

The benefit of crediting manual DAS in this sensitivity analysis is presented in case 4, which is reported below.

Table 2-1. ***** DOMINANT CUTSETS ***** Page: 1

Title: AP1000 Shutdown PRA Sensitivity Case 2
File: cmtot.wl1 (Case 1)
Reduced Sum of Cutsets: 1.2300E-06

NUMBER	CUTSET PROB	PERCENT	BASIC EVENT NAME	EVENT PROB.	IDENTIFIER
1	1.19E-07	9.67	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS FILLED	1.82E-02	IEV-LOSPND
			OFFSITE AC POWER RECOVERED IN 2 HOURS	7.60E-01	SUC-R2S
			CCF OF THE POWER INTERFACE OUTPUT BOARDS IN PMS	8.62E-06	CCX-EP-SAM
2	1.04E-07	8.46	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			COMMON CAUSE FAILURE OF THE BATTERIES IDSA-DB-1A/1B	4.70E-05	CCX-BY-PN
3	9.19E-08	7.47	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			OFFSITE AC POWER RECOVERED IN 1 HOUR	5.80E-01	SUC-R1S
			CCF OF ADS 4TH S AGE SQUIB VALVES TO OPEN	3.00E-05	ADX-EV-SA
4	7.96E-08	6.47	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			OFFSITE AC POWER RECOVERED IN 1 HOUR	5.80E-01	SUC-R1S
			IWX-MV-GO1	2.60E-05	IWX-MV-GO1
5	7.96E-08	6.47	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			OFFSITE AC POWER RECOVERED IN 1 HOUR	5.80E-01	SUC-R1S
			IWX-EV4-SA	2.60E-05	IWX-EV4-SA
6	6.65E-08	5.41	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			CCF OF ADS 4TH S AGE SQUIB VALVES TO OPEN	3.00E-05	ADX-EV-SA
7	5.77E-08	4.69	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			IWX-MV-GO1	2.60E-05	IWX-MV-GO1
8	5.77E-08	4.69	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			IWX-EV4-SA	2.60E-05	IWX-EV4-SA

9	5.32E-08	4.33	LOSS OF OFFSITE FAILURE TO COMMON CAUSE	POWER INITIATING RECOVER AC POWER FAILURE OF THE	EVENT OCCURS IN 1 HOUR INVERTER	WITH RCS DRAINED	5.28E-03 4.20E-01 2.40E-05	IEV-LOSPD OTH-R1 CCX-IV-XR
10	3.77E-08	3.07	LOSS OF OFFSITE FAILURE TO CCF OF THE POWER	POWER INITIATING RECOVER AC POWER INTERFACE OUTPUT	EVENT OCCURS IN 2 HOURS BOARDS IN PMS	WITH RCS FILLED	1.82E-02 2.40E-01 8.62E-06	IEV-LOSPND OTH-R2 CCX-EP-SAM
11	3.67E-08	2.98	LOSS OF OFFSITE OFFSITE CCF OF STRAINERS	POWER INITIATING AC POWER IN IRWST TANK	EVENT OCCURS RECOVERED IN	WITH RCS DRAINED 1 HOUR	5.28E-03 5.80E-01 1.20E-05	IEV-LOSPD SUC-R1S IWX-FL-GP
12	3.67E-08	2.98	LOSS OF OFFSITE OFFSITE REX-FL-GP	POWER INITIATING AC POWER	EVENT OCCURS RECOVERED IN	WITH RCS DRAINED 1 HOUR	5.28E-03 5.80E-01 1.20E-05	IEV-LOSPD SUC-R1S REX-FL-GP
13	3.44E-08	2.80	LOSS OF CCS/SWS CCF OF THE POWER	WITH RCS FILLED INTERFACE OUTPUT	INITIATING EVENT BOARDS IN PMS	OCCURS	3.99E-03 8.62E-06	IEV-CCWND CCX-EP-SAM
14	2.66E-08	2.16	LOSS OF OFFSITE FAILURE TO REX-FL-GP	POWER INITIATING RECOVER AC POWER	EVENT OCCURS IN 1 HOUR	WITH RCS DRAINED	5.28E-03 4.20E-01 1.20E-05	IEV-LOSPD OTH-R1 REX-FL-GP
15	2.66E-08	2.16	LOSS OF OFFSITE FAILURE TO CCF OF STRAINERS	POWER INITIATING RECOVER AC POWER IN IRWST TANK	EVENT OCCURS IN 1 HOUR	WITH RCS DRAINED	5.28E-03 4.20E-01 1.20E-05	IEV-LOSPD OTH-R1 IWX-FL-GP
16	2.64E-08	2.15	LOSS OF OFFSITE OFFSITE CCF OF THE POWER	POWER INITIATING AC POWER INTERFACE OUTPUT	EVENT OCCURS RECOVERED IN BOARDS IN PMS	WITH RCS DRAINED 1 HOUR	5.28E-03 5.80E-01 8.62E-06	IEV-LOSPD SUC-R1S CCX-EP-SAM
17	2.15E-08	1.75	LOSS OF CCS/SWS CCF OF ADS 4TH S	WITH RCS DRAINED AGE SQUIB VALVES	INITIATING EVENT TO OPEN	OCCURS	7.16E-04 3.00E-05	IEV-CCWD ADX-EV-SA
18	1.91E-08	1.55	LOSS OF OFFSITE FAILURE TO CCF OF THE POWER	POWER INITIATING RECOVER AC POWER INTERFACE OUTPUT	EVENT OCCURS IN 1 HOUR BOARDS IN PMS	WITH RCS DRAINED	5.28E-03 4.20E-01 8.62E-06	IEV-LOSPD OTH-R1 CCX-EP-SAM
19	1.86E-08	1.51	LOSS OF CCS/SWS IWX-MV-GO1	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04 2.60E-05	IEV-CCWD IWX-MV-GO1
20	1.86E-08	1.51	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD

			IWX-EV4-SA				2.60E-05	IWX-EV4-SA
21	1.66E-08	1.35	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS FILLED	1.82E-02	IEV-LOSPND
			OFFSITE	AC POWER	RECOVERED IN	2 HOURS	7.60E-01	SUC-R2S
			SOFTWARE CCF	OF ALL CARDS			1.20E-06	CCX-SFTW
22	1.11E-08	.90	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			OFFSITE	AC POWER	RECOVERED IN	1 HOUR	5.80E-01	SUC-R1S
			CCF OF ORIFICES				3.63E-06	CCX-ORY-SPX
23	1.02E-08	.83	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		2.09E-03	PMAMOD11
			MECHANICAL	FAILURE CAUSES	MOV 023 TO	FAIL-TO-OPEN	2.21E-03	RN23MOD5S
24	8.79E-09	.71	LOSS OF RNS WITH	RCS FILLED	INITIATING EVENT	OCCURS	1.02E-03	IEV-RNSND
			CCF OF THE POWER	INTERFACE OUTPUT	BOARDS IN PMS		8.62E-06	CCX-EP-SAM
25	8.59E-09	.70	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			CCF OF STRAINERS	IN IRWST TANK			1.20E-05	IWX-FL-GP
26	8.59E-09	.70	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			REX-FL-GP				1.20E-05	REX-FL-GP
27	8.05E-09	.65	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			OFFSITE	AC POWER	RECOVERED IN	1 HOUR	5.80E-01	SUC-R1S
			CCF OF PRESSURE	TRANSMITTERS			2.63E-06	CCX-XMTRX
28	8.05E-09	.65	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			CCF OF ORIFICES				3.63E-06	CCX-ORY-SPX
29	7.42E-09	.60	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		2.09E-03	PMAMOD11
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	1.60E-03	RHN-MAN05
30	6.17E-09	.50	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			CCF OF THE POWER	INTERFACE OUTPUT	BOARDS IN PMS		8.62E-06	CCX-EP-SAM
31	6.16E-09	.50	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			OFFSITE	AC POWER	RECOVERED IN	1 HOUR	5.80E-01	SUC-R1S

			IWX-XMTR				2.01E-04	IWX-XMTR
			REN-MAN04				1.00E-02	REN-MAN04
32	5.83E-09	.47	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			CCF OF PRESSURE	TRANSMITTERS			2.63E-06	CCX-XMTRX
33	5.69E-09	.46	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			FAILURE UPON	DEMAND OF LOGIC	GROUP PROCESSING		1.16E-03	PMA0301ASA
			MECHANICAL	FAILURE CAUSES	MOV 023 TO	FAIL-TO-OPEN	2.21E-03	RN23MOD5S
34	5.69E-09	.46	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			FAILURE UPON	DEMAND OF LOGIC	GROUP PROCESSING		1.16E-03	PMA0301BSA
			MECHANICAL	FAILURE CAUSES	MOV 023 TO	FAIL-TO-OPEN	2.21E-03	RN23MOD5S
35	5.24E-09	.43	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS FILLED	1.82E-02	IEV-LOSPND
			FAILURE TO	RECOVER AC POWER	IN 2 HOURS		2.40E-01	OTH-R2
			SOFTWARE CCF	OF ALL CARDS			1.20E-06	CCX-SFTW
36	4.79E-09	.39	LOSS OF CCS/SWS	WITH RCS FILLED	INITIATING EVENT	OCCURS	3.99E-03	IEV-CCWND
			SOFTWARE CCF	OF ALL CARDS			1.20E-06	CCX-SFTW
37	4.46E-09	.36	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			IWX-XMTR				2.01E-04	IWX-XMTR
			REN-MAN04				1.00E-02	REN-MAN04
38	4.12E-09	.33	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			FAILURE UPON	DEMAND OF LOGIC	GROUP PROCESSING		1.16E-03	PMA0301ASA
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	1.60E-03	RHN-MAN05
39	4.12E-09	.33	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			FAILURE UPON	DEMAND OF LOGIC	GROUP PROCESSING		1.16E-03	PMA0301BSA
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	1.60E-03	RHN-MAN05
40	3.67E-09	.30	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			OFFSITE	AC POWER	RECOVERED IN	1 HOUR	5.80E-01	SUC-R1S
			SOFTWARE CCF	OF ALL CARDS			1.20E-06	CCX-SFTW

41	2.91E-09	.24	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05	IEV-RNSD
			CCF OF ADS 4TH S	AGE SQUIB VALVES	TO OPEN		3.00E-05	ADX-EV-SA
42	2.66E-09	.22	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			SOFTWARE CCF	OF ALL CARDS			1.20E-06	CCX-SFTW
43	2.60E-09	.21	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			CCF OF ORIFICES				3.63E-06	CCX-ORY-SPX
44	2.53E-09	.21	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			FAILURE OF INV.,	STATIC SWITCH	AND ASSOC.	BREAKERS	5.16E-04	IDAMOD05
			MECHANICAL	FAILURE CAUSES	MOV 023 TO	FAIL-TO-OPEN	2.21E-03	RN23MOD5S
45	2.52E-09	.20	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05	IEV-RNSD
			IWX-MV-G01				2.60E-05	IWX-MV-G01
46	2.52E-09	.20	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05	IEV-RNSD
			IWX-EV4-SA				2.60E-05	IWX-EV4-SA
47	2.20E-09	.18	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			OFFSITE	AC POWER	RECOVERED IN	1 HOUR	5.80E-01	SUC-R1S
			MECHANICAL	FAILURE CAUSES	MOV 121A TO	FAIL-TO-OPEN	3.00E-03	IRWMOD05S
			IRWST DISCHARGE	LINE "B"	STRAINER	PLUGGED	2.40E-04	IWB-PLUG
48	2.18E-09	.18	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EVENT	5.28E-06	IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.50E-02	RHN-MAN04
			COND. PROB. OF	IWN-MAN00 (OP. F	ILS TO ACTUATE I	WST INJ)	5.00E-02	IWN-MAN00C
			COND. PROB. OF	RHN-MAN05 (OP.	FAILS TO OPEN	RNS MOV V023)	1.50E-01	RHN-MAN05C
49	1.88E-09	.15	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			CCF OF PRESSURE	TRANSMITTERS			2.63E-06	CCX-XMTRX
50	1.83E-09	.15	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			FAILURE OF INV.,	STATIC SWITCH	AND ASSOC.	BREAKERS	5.16E-04	IDAMOD05
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	1.60E-03	RHN-MAN05

~~Title: AP1000 SHUTDOWN PRA SENSITIVITY CASE 2~~
~~File: case 2.wlk~~
~~Reduced Sum of Cutsets: 1.4610E-05~~

NUMBER	CUTSET PROB	PERCENT	BASIC EVENT NAME			EVENT PROB.	IDENTIFIER
1	4.63E-06	31.69	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER IN 1 HOUR		4.20E-01	OTH-R1
			FAILURE OF	PMS OUTPUT	LOGIC I/Os	2.09E-03	PMAMOD11
2	2.57E-06	17.59	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER IN 1 HOUR		4.20E-01	OTH-R1
			FAILURE UPON	DEMAND OF LOGIC	GROUP PROCESSING	1.16E-03	PMA0301ASA
3	2.57E-06	17.59	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER IN 1 HOUR		4.20E-01	OTH-R1
			FAILURE UPON	DEMAND OF LOGIC	GROUP PROCESSING	1.16E-03	PMA0301BSA
4	1.14E-06	7.80	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER IN 1 HOUR		4.20E-01	OTH-R1
			FAILURE OF INV.,	STATIC SWITCH	AND ASSOC. BREAKERS	5.16E-04	IDAMOD05
5	7.03E-07	4.81	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER IN 1 HOUR		4.20E-01	OTH-R1
			LOSS OF DIST.	PANEL OR BREAKER A07 SPURIOUSLY	OPENS	3.17E-04	IDAMOD04
6	6.65E-07	4.55	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER IN 1 HOUR		4.20E-01	OTH-R1
			BUS UNAVAILABLE	DUE TO TEST OR	CORRECTIVE MAINTENANCE	3.00E-04	IDABSDS1TM
7	3.13E-07	2.14	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER IN 1 HOUR		4.20E-01	OTH-R1
			CCF OF OUTPUT	LOGIC I/O BOARDS		1.41E-04	CCX-PMAMOD1
8	2.15E-07	1.47	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER IN 1 HOUR		4.20E-01	OTH-R1
			CCF OF LOGIC	GROUP PROCESSING		9.69E-05	CCX-PMA030
9	1.77E-07	1.21	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD

			FAILURE TO	RECOVER AC POWER IN 1 HOUR			4.20E-01	OTH-R1
			FAILURE OF	MIMIC BUS	SELECTOR BOARD		8.00E-05	PMAXS00ASA
10	1.42E-07	.97	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS		WITH RCS DRAI	5.28E-03	IEV-LOSPD
			OFFSITE	AC POWER	RECOVERED IN	1 HOUR	5.80E-01	SUC-R1S
			CCF OF ACTUATION LOGIC GROUPS				4.63E-05	CCX-
PMAMOD1X								
11	1.19E-07	.81	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS		WITH RCS FILL	1.82E-02	IEV-LOSPND
			OFFSITE	AC POWER	RECOVERED IN	2 HOURS	7.60E-01	SUC-R2S
			CCF OF THE POWER INTERFACE OUTPUT BOARDS IN PMS				8.62E-06	CCX-EP-SAM
12	1.04E-07	.71	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS		WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER IN 1 HOUR			4.20E-01	OTH-R1
			COMMON CAUSE	FAILURE OF THE	BATTERIES	IDSA-DB-1A/1B	4.70E-05	CCX-BY-PN
13	9.19E-08	.63	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS		WITH RCS DRAI	5.28E-03	IEV-LOSPD
			OFFSITE	AC POWER	RECOVERED IN	1 HOUR	5.80E-01	SUC-R1S
			CCF OF ADS 4TH STAGE SQUIB VALVES TO OPEN				3.00E-05	ADX-EV-SA
14	9.19E-08	.63	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS		WITH RCS DRAI	5.28E-03	IEV-LOSPD
			OFFSITE	AC POWER	RECOVERED IN	1 HOUR	5.80E-01	SUC-R1S
			CCF OF GRAVITY	INJECTION CHECK	VALVES TO OPEN		3.00E-05	IWX-CV-AO
15	7.96E-08	.54	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS		WITH RCS DRAI	5.28E-03	IEV-LOSPD
			OFFSITE	AC POWER	RECOVERED IN	1 HOUR	5.80E-01	SUC-R1S
			IWX-EV4-SA				2.60E-05	IWX-EV4-SA
16	7.96E-08	.54	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS		WITH RCS DRAI	5.28E-03	IEV-LOSPD
			OFFSITE	AC POWER	RECOVERED IN	1 HOUR	5.80E-01	SUC-R1S
			IWX-MV-CO1				2.60E-05	IWX-MV-CO1
17	6.65E-08	.46	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS		WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER IN 1 HOUR			4.20E-01	OTH-R1
			CCF OF GRAVITY	INJECTION CHECK	VALVES TO OPEN		3.00E-05	IWX-CV-AO
18	6.65E-08	.46	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS		WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER IN 1 HOUR			4.20E-01	OTH-R1
			CCF OF ADS 4TH STAGE SQUIB VALVES TO OPEN				3.00E-05	ADX-EV-SA
19	5.77E-08	.39	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS		WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER IN 1 HOUR			4.20E-01	OTH-R1

			IWX-EV4-SA			2.60E-05	IWX-EV4-SA
20	5.77E-08	.39	LOSS-OF-OFFSITE	POWER-INITIATING-EVENT-OCCURS	WITH-RCS-DRAI	5.28E-03	IEV-LOSPD
			FAILURE-TO	RECOVER-AC-POWER-IN-1-HOUR		4.20E-01	OTH-R1
			IWX-MV-CO1			2.60E-05	IWX-MV-CO1
21	5.32E-08	.36	LOSS-OF-OFFSITE	POWER-INITIATING-EVENT-OCCURS	WITH-RCS-DRAI	5.28E-03	IEV-LOSPD
			FAILURE-TO	RECOVER-AC-POWER-IN-1-HOUR		4.20E-01	OTH-R1
			COMMON-CAUSE	FAILURE-OF-THE	INVERTER	2.40E-05	CCX-IV-XR
22	3.77E-08	.26	LOSS-OF-OFFSITE	POWER-INITIATING-EVENT-OCCURS	WITH-RCS-FILL	1.82E-02	IEV-LOSPND
			FAILURE-TO	RECOVER-AC-POWER-IN-2-HOURS		2.40E-01	OTH-R2
			CCF-OF-THE-POWER-INTERFACE-OUTPUT-BOARDS-IN-PMS			8.62E-06	CCX-EP-SAM
23	3.67E-08	.25	LOSS-OF-OFFSITE	POWER-INITIATING-EVENT-OCCURS	WITH-RCS-DRAI	5.28E-03	IEV-LOSPD
			OFFSITE	AC-POWER	RECOVERED-IN	1-HOUR	5.80E-01	SUC-R1S
			CCF-OF-STRAINERS-IN-IRWST-TANK			1.20E-05	IWX-FL-GP
24	3.67E-08	.25	LOSS-OF-OFFSITE	POWER-INITIATING-EVENT-OCCURS	WITH-RCS-DRAI	5.28E-03	IEV-LOSPD
			OFFSITE	AC-POWER	RECOVERED-IN	1-HOUR	5.80E-01	SUC-R1S
			REX-FL-GP			1.20E-05	REX-FL-GP
25	3.44E-08	.24	LOSS-OF-CCS/SWS	WITH-RCS-FILLED	INITIATING-EVENT-OCCURS	3.99E-03	IEV-CCWND
			CCF-OF-THE-POWER-INTERFACE-OUTPUT-BOARDS-IN-PMS			8.62E-06	CCX-EP-SAM
26	3.32E-08	.23	LOSS-OF-CCS/SWS	WITH-RCS-DRAINED-INITIATING-EVENT-OCCURS		7.16E-04	IEV-CCWD
			CCF-OF-ACTUATION-LOGIC-GROUPS			4.63E-05	CCX-
PMAMOD1X							
27	2.66E-08	.18	LOSS-OF-OFFSITE	POWER-INITIATING-EVENT-OCCURS	WITH-RCS-DRAI	5.28E-03	IEV-LOSPD
			FAILURE-TO	RECOVER-AC-POWER-IN-1-HOUR		4.20E-01	OTH-R1
			CCF-OF-STRAINERS-IN-IRWST-TANK			1.20E-05	IWX-FL-GP
28	2.66E-08	.18	LOSS-OF-OFFSITE	POWER-INITIATING-EVENT-OCCURS	WITH-RCS-DRAI	5.28E-03	IEV-LOSPD
			FAILURE-TO	RECOVER-AC-POWER-IN-1-HOUR		4.20E-01	OTH-R1
			REX-FL-GP			1.20E-05	REX-FL-GP
29	2.64E-08	.18	LOSS-OF-OFFSITE	POWER-INITIATING-EVENT-OCCURS	WITH-RCS-DRAI	5.28E-03	IEV-LOSPD
			OFFSITE	AC-POWER	RECOVERED-IN	1-HOUR	5.80E-01	SUC-R1S
			CCF-OF-THE-POWER-INTERFACE-OUTPUT-BOARDS-IN-PMS			8.62E-06	CCX-EP-SAM
30	2.44E-08	.17	LOSS-OF-OFFSITE	POWER-INITIATING-EVENT-OCCURS	WITH-RCS-DRAI	5.28E-03	IEV-LOSPD

			FAILURE TO	RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			SOFTWARE CCF OF	OUTPUT LOGIC I/Os	1.10E-05	CCX-PMAMOD1-SW
31	2.15E-08	.15	LOSS OF CCS/SWS	WITH RCS DRAINED INITIATING EVENT OCCURS	7.16E-04	IEV-CCWD
			CCF OF ADS 4TH STAGE SQUIB VALVES TO OPEN		3.00E-05	ADX-EV-SA
32	2.15E-08	.15	LOSS OF CCS/SWS	WITH RCS DRAINED INITIATING EVENT OCCURS	7.16E-04	IEV-CCWD
			CCF OF GRAVITY	INJECTION CHECK VALVES TO OPEN	3.00E-05	IWX-CV-AO
33	1.91E-08	.13	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			CCF OF THE POWER INTERFACE OUTPUT BOARDS IN PMS		8.62E-06	CCX-EP-SAM
34	1.86E-08	.13	LOSS OF CCS/SWS	WITH RCS DRAINED INITIATING EVENT OCCURS	7.16E-04	IEV-CCWD
			IWX-MV-CO1		2.60E-05	IWX-MV-CO1
35	1.86E-08	.13	LOSS OF CCS/SWS	WITH RCS DRAINED INITIATING EVENT OCCURS	7.16E-04	IEV-CCWD
			IWX-EV4-SA		2.60E-05	IWX-EV4-SA
36	1.66E-08	.11	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS WITH RCS FILL	1.82E-02	IEV-LOSPND
			OFFSITE	AC POWER RECOVERED IN 2 HOURS	7.60E-01	SUC-R2S
			SOFTWARE CCF	OF ALL CARDS	1.20E-06	CCX-SFTW
37	1.45E-08	.10	OVERDRAINING OF	RCS DURING DRAIN DOWN TO MID LOOP INITIATING EV	5.28E-06	IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE RNS PIPE RUPTURE	5.50E-02	RHN-MAN04
			COND. PROB. OF	IWN-MAN00 (OP. FAILS TO ACTUATE IRWST INJ)	5.00E-02	IWN-MAN00G
38	1.11E-08	.08	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS WITH RCS DRAI	5.28E-03	IEV-LOSPD
			OFFSITE	AC POWER RECOVERED IN 1 HOUR	5.80E-01	SUC-R1S
			CCF OF ORIFICES		3.63E-06	CCX-ORY-SPX
39	9.88E-09	.07	LOSS OF CCS/SWS	WITH RCS DRAINED INITIATING EVENT OCCURS	7.16E-04	IEV-CCWD
			CCF OF LOGIC	GROUP PROCESSING	1.38E-05	CCX-PMA030X
40	8.79E-09	.06	LOSS OF RNS WITH RCS FILLED	INITIATING EVENT OCCURS	1.02E-03	IEV-RNSND
			CCF OF THE POWER INTERFACE OUTPUT BOARDS IN PMS		8.62E-06	CCX-EP-SAM
41	8.59E-09	.06	LOSS OF CCS/SWS	WITH RCS DRAINED INITIATING EVENT OCCURS	7.16E-04	IEV-CCWD
			REX-FL-GP		1.20E-05	REX-FL-GP
42	8.59E-09	.06	LOSS OF CCS/SWS	WITH RCS DRAINED INITIATING EVENT OCCURS	7.16E-04	IEV-CCWD

			CCF OF STRAINERS IN IRWST TANK			1.20E-05	IWX-FL-GP
43	8.05E-09	.06	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS		WITH RCS DRAI	5.28E-03	IEV-LOSPD
			OFFSITE AC POWER	RECOVERED IN	1 HOUR	5.80E-01	SUC-R1S
			CCF OF PRESSURE TRANSMITTERS			2.63E-06	CCX-XMTRX
44	8.05E-09	.06	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS		WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR			4.20E-01	OTH-R1
			CCF OF ORIFICES			3.63E-06	CCX-ORY-SPX
45	7.88E-09	.05	LOSS OF CCS/SWS WITH RCS DRAINED INITIATING EVENT OCCURS			7.16E-04	IEV-CCWD
			SOFTWARE CCF OF OUTPUT LOGIC I/Os			1.10E-05	CCX-
PMAMOD1-SW							
46	6.17E-09	.04	LOSS OF CCS/SWS WITH RCS DRAINED INITIATING EVENT OCCURS			7.16E-04	IEV-CCWD
			CCF OF THE POWER INTERFACE OUTPUT BOARDS IN PMS			8.62E-06	CCX-EP-SAM
47	6.16E-09	.04	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS		WITH RCS DRAI	5.28E-03	IEV-LOSPD
			OFFSITE AC POWER	RECOVERED IN	1 HOUR	5.80E-01	SUC-R1S
			IWX-XMTR			2.01E-04	IWX-XMTR
			REN-MAN04			1.00E-02	REN-MAN04
48	5.83E-09	.04	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS		WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR			4.20E-01	OTH-R1
			CCF OF PRESSURE TRANSMITTERS			2.63E-06	CCX-XMTRX
49	5.74E-09	.04	OVERDRAINING OF RCS DURING DRAIN DOWN TO MID-LOOP INITIATING EV			5.28E-06	IEV-RCSOD
			RHN-MAN04-SUCC			9.45E-01	RHN-MAN04-
SUCC							
			OPERATOR FAILS TO ACTUATE IRWST INJECTION			1.15E-03	IWN-MAN00
50	5.24E-09	.04	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS		WITH RCS FILL	1.82E-02	IEV-LOSPND
			FAILURE TO RECOVER AC POWER IN 2 HOURS			2.40E-01	OTH-R2
			SOFTWARE CCF OF ALL CARDS			1.20E-06	CCX-SFTW
51	4.79E-09	.03	LOSS OF CCS/SWS WITH RCS FILLED INITIATING EVENT OCCURS			3.99E-03	IEV-CCWND
			SOFTWARE CCF OF ALL CARDS			1.20E-06	CCX-SFTW
52	4.49E-09	.03	LOSS OF RNS WITH RCS DRAINED INITIATING EVENT OCCURS			9.69E-05	IEV-RNSD
			CCF OF ACTUATION LOGIC GROUPS			4.63E-05	CCX-
PMAMOD1X							

53	4.46E-09	.03	LOSS-OF-OFFSITE	POWER-INITIATING-EVENT-OCCURS		WITH-RCS-DRAI	5.28E-03	IEV-LOSPD
			FAILURE-TO	RECOVER-AC-POWER-IN-1-HOUR			4.20E-01	OTH-R1
			IWX-XMTR				2.01E-04	IWX-XMTR
			REN-MAN04				1.00E-02	REN-MAN04
54	3.67E-09	.03	LOSS-OF-OFFSITE	POWER-INITIATING-EVENT-OCCURS		WITH-RCS-DRAI	5.28E-03	IEV-LOSPD
			OFFSITE	AC-POWER	RECOVERED-IN	1-HOUR	5.80E-01	SUC-R1S
			SOFTWARE-CCF	OF-ALL-CARDS			1.20E-06	CCX-SFTW
55	2.91E-09	.02	LOSS-OF-RNS-WITH-RCS-DRAINED		INITIATING-EVENT-OCCURS		9.69E-05	IEV-RNSD
			CCF-OF-GRAVITY	INJECTION-CHECK	VALVES-TO-OPEN		3.00E-05	IWX-CV-AO
56	2.91E-09	.02	LOSS-OF-RNS-WITH-RCS-DRAINED		INITIATING-EVENT-OCCURS		9.69E-05	IEV-RNSD
			CCF-OF-ADS-4TH-STAGE-SQUIB-VALVES-TO-OPEN				3.00E-05	ADX-EV-SA
57	2.66E-09	.02	LOSS-OF-OFFSITE	POWER-INITIATING-EVENT-OCCURS		WITH-RCS-DRAI	5.28E-03	IEV-LOSPD
			FAILURE-TO	RECOVER-AC-POWER-IN-1-HOUR			4.20E-01	OTH-R1
			SOFTWARE-CCF	OF-ALL-CARDS			1.20E-06	CCX-SFTW
58	2.60E-09	.02	LOSS-OF-CCS/SWS	WITH-RCS-DRAINED-INITIATING-EVENT-OCCURS			7.16E-04	IEV-CCWD
			CCF-OF-ORIFICES				3.63E-06	CCX-ORY-SPX
59	2.52E-09	.02	LOSS-OF-RNS-WITH-RCS-DRAINED		INITIATING-EVENT-OCCURS		9.69E-05	IEV-RNSD
			IWX-MV-CO1				2.60E-05	IWX-MV-CO1
60	2.52E-09	.02	LOSS-OF-RNS-WITH-RCS-DRAINED		INITIATING-EVENT-OCCURS		9.69E-05	IEV-RNSD
			IWX-EV4-SA				2.60E-05	IWX-EV4-SA
61	2.20E-09	.02	LOSS-OF-OFFSITE	POWER-INITIATING-EVENT-OCCURS		WITH-RCS-DRAI	5.28E-03	IEV-LOSPD
			OFFSITE	AC-POWER	RECOVERED-IN	1-HOUR	5.80E-01	SUC-R1S
			MECHANICAL	FAILURE-CAUSES	MOV-121A-TO	FAIL-TO-OPEN	3.00E-03	IRWMOD05S
			IRWST-DISCHARGE	LINE-"B"	STRAINER	PLUGGED	2.40E-04	IWB-PLUG
62	2.11E-09	.01	LOSS-OF-CCS/SWS	WITH-RCS-DRAINED-INITIATING-EVENT-OCCURS			7.16E-04	IEV-CCWD
			CCF-OF-THE-POWER-INTERFACE-OUTPUT-BOARDS-IN-PMS				2.94E-06	CCX-EP-SAMX
63	1.88E-09	.01	LOSS-OF-CCS/SWS	WITH-RCS-DRAINED-INITIATING-EVENT-OCCURS			7.16E-04	IEV-CCWD
			CCF-OF-PRESSURE	TRANSMITTERS			2.63E-06	CCX-XMTRX
64	1.60E-09	.01	LOSS-OF-OFFSITE	POWER-INITIATING-EVENT-OCCURS		WITH-RCS-DRAI	5.28E-03	IEV-LOSPD
			FAILURE-TO	RECOVER-AC-POWER-IN-1-HOUR			4.20E-01	OTH-R1
			MECHANICAL	FAILURE-CAUSES	MOV-121A-TO	FAIL-TO-OPEN	3.00E-03	IRWMOD05S

			IRWST DISCHARGE	LINE "B"	STRAINER	PLUGGED	2.40E-04	IWB-PLUG
65	1.44E-09	.01	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT OCCURS		7.16E-04	IEV-CCWD
			IWX-XMTR				2.01E-04	IWX-XMTR
			REN-MAN04				1.00E-02	REN-MAN04
66	1.34E-09	.01	LOSS OF RNS WITH RCS DRAINED		INITIATING EVENT OCCURS		9.69E-05	IEV-RNSD
			CCF OF LOGIC	GROUP PROCESSING			1.38E-05	CCX-PMA030X
67	1.26E-09	.01	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT OCCURS		7.16E-04	IEV-CCWD
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		6.53E-04	PMAMOD11X
			BUS UNAVAILABLE	DUE TO	UNSCHEDULED	MAINTENANCE	2.70E-03	EG1BS121TM
68	1.26E-09	.01	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT OCCURS		7.16E-04	IEV-CCWD
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		6.53E-04	PMAMOD11X
			UNAVAILABILITY	OF BUS ECS ES 1	DUE TO UNSCHEDUL MAINTENANCE		2.70E-03	EG1BS001TM
69	1.26E-09	.01	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT OCCURS		7.16E-04	IEV-CCWD
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		6.53E-04	PMAMOD11X
			BUS UNAVAILABLE	DUE TO	UNSCHEDULED	MAINTENANCE	2.70E-03	EG1BS012TM
70	1.22E-09	.01	LOSS OF RNS WITH RCS FILLED		INITIATING EVENT OCCURS		1.02E-03	IEV-RNSND
			SOFTWARE CCF	OF ALL CARDS			1.20E-06	CCX-SFTW
71	1.16E-09	.01	LOSS OF RNS WITH RCS DRAINED		INITIATING EVENT OCCURS		9.69E-05	IEV-RNSD
			CCF OF STRAINERS IN IRWST TANK				1.20E-05	IWX-FL-GP
72	1.16E-09	.01	LOSS OF RNS WITH RCS DRAINED		INITIATING EVENT OCCURS		9.69E-05	IEV-RNSD
			REX-FL-GP				1.20E-05	REX-FL-GP
73	1.07E-09	.01	LOSS OF RNS WITH RCS DRAINED		INITIATING EVENT OCCURS		9.69E-05	IEV-RNSD
			SOFTWARE CCF OF	OUTPUT LOGIC	I/Os		1.10E-05	CCX-
PMAMOD1-SW								
74	9.98E-10	.01	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT OCCURS		7.16E-04	IEV-CCWD
			FAILURE OF INV.,	STATIC SWITCH	AND ASSOC.	BREAKERS	5.16E-04	IDAMOD05
			BUS UNAVAILABLE	DUE TO	UNSCHEDULED	MAINTENANCE	2.70E-03	EG1BS012TM
75	9.98E-10	.01	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT OCCURS		7.16E-04	IEV-CCWD
			FAILURE OF INV.,	STATIC SWITCH	AND ASSOC.	BREAKERS	5.16E-04	IDAMOD05
			UNAVAILABILITY	OF BUS ECS ES 1	DUE TO UNSCHEDUL MAINTENANCE		2.70E-03	EG1BS001TM

76	9.98E-10	.01	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			FAILURE OF INV.,	STATIC SWITCH	AND ASSOC.	BREAKERS	5.16E-04	IDAMOD05
			BUS UNAVAILABLE	DUE TO	UNSCHEDULED	MAINTENANCE	2.70E-03	EG1BS121TM
77	8.59E-10	.01	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			SOFTWARE CCF	OF ALL CARDS			1.20E-06	CCX-SFTW
78	8.35E-10	.01	LOSS OF RNS WITH RCS DRAINED		INITIATING EVENT	OCCURS	9.69E-05	IEV-RNSD
			CCF OF THE POWER INTERFACE OUTPUT BOARDS IN PMS				8.62E-06	CCX-EP-SAM
79	7.55E-10	.01	LOSS OF CCS/SWS	WITH RCS FILLED	INITIATING EVENT	OCCURS	3.99E-03	IEV-CCWND
			CCF OF ORIFICES				2.77E-04	CCX-ORY-SP
			OPERATOR FAILS	TO RECOGNIZE THE NEED FOR RCS		DEPRESSURIZAT	6.83E-04	LPM-MAN05
80	6.44E-10	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			MECHANICAL	FAILURE CAUSES	MOV 121A TO	FAIL TO OPEN	3.00E-03	IRWMOD05S
			BUS UNAVAILABLE	DUE TO TEST OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDCBSDS1TM
81	6.44E-10	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			MECHANICAL	FAILURE CAUSES	MOV 121A TO	FAIL TO OPEN	3.00E-03	IRWMOD05S
			BUS UNAVAILABLE	DUE TO TEST OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDCBSDK1TM
82	6.44E-10	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			MECHANICAL	FAILURE CAUSES	MOV 121A TO	FAIL TO OPEN	3.00E-03	IRWMOD05S
			BUS UNAVAILABLE	DUE TO TEST OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDCBSDD1TM
83	6.13E-10	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			LOSS OF DIST.	PANEL OR BREAKER A07 SPURIOUSLY		OPENS	3.17E-04	IDAMOD04
			BUS UNAVAILABLE	DUE TO	UNSCHEDULED	MAINTENANCE	2.70E-03	EG1BS012TM
84	6.13E-10	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			LOSS OF DIST.	PANEL OR BREAKER A07 SPURIOUSLY		OPENS	3.17E-04	IDAMOD04
			UNAVAILABILITY	OF BUS ECS ES 1	DUE TO UNSCHEDUL	MAINTENANCE	2.70E-03	EG1BS001TM
85	6.13E-10	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			LOSS OF DIST.	PANEL OR BREAKER A07 SPURIOUSLY		OPENS	3.17E-04	IDAMOD04
			BUS UNAVAILABLE	DUE TO	UNSCHEDULED	MAINTENANCE	2.70E-03	EG1BS121TM
86	5.80E-10	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			BUS UNAVAILABLE	DUE TO TEST OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDABSDS1TM
			BUS UNAVAILABLE	DUE TO	UNSCHEDULED	MAINTENANCE	2.70E-03	EG1BS012TM

~~87~~	~~5.80E-10~~	~~.00~~	~~LOSS OF CCS/SWS WITH RCS DRAINED INITIATING EVENT OCCURS~~	~~7.16E-04~~	~~IEV-CCWD~~
			~~BUS UNAVAILABLE DUE TO TEST OR CORRECTIVE MAINTENANCE~~	~~3.00E-04~~	~~IDABSDS1TM~~
			~~UNAVAILABILITY OF BUS ECS ES 1 DUE TO UNSCHEDUL MAINTENANCE~~	~~2.70E-03~~	~~EC1BS001TM~~
~~88~~	~~5.80E-10~~	~~.00~~	~~LOSS OF CCS/SWS WITH RCS DRAINED INITIATING EVENT OCCURS~~	~~7.16E-04~~	~~IEV-CCWD~~
			~~BUS UNAVAILABLE DUE TO TEST OR CORRECTIVE MAINTENANCE~~	~~3.00E-04~~	~~IDABSDS1TM~~
			~~BUS UNAVAILABLE DUE TO UNSCHEDULED MAINTENANCE~~	~~2.70E-03~~	~~EC1BS121TM~~
~~89~~	~~5.48E-10~~	~~.00~~	~~LOSS OF CCS/SWS WITH RCS FILLED INITIATING EVENT OCCURS~~	~~3.99E-03~~	~~IEV-CCWND~~
			~~CGF OF PRESSURE TRANSMITTERS~~	~~2.01E-04~~	~~CCX-XMTR195~~
			~~OPERATOR FAILS TO RECOGNIZE THE NEED FOR RCS DEPRESSURIZAT~~	~~6.83E-04~~	~~LPM-MAN05~~
~~90~~	~~5.32E-10~~	~~.00~~	~~LOCA/RNS V024 OPENS INITIATING EVENT OCCURS WITH RCS DRAI~~	~~1.15E-05~~	~~IEV-LOCA24D~~
			~~CGF OF ACTUATION LOGIC GROUPS~~	~~4.63E-05~~	~~CCX-~~
~~PMAMOD1X~~					
~~91~~	~~5.19E-10~~	~~.00~~	~~LOCA/RNS V024 OPENS INITIATING EVENT OCCURS WITH RCS FILL~~	~~1.73E-05~~	~~IEV-~~
~~LOCA24ND~~					
			~~CGF OF ADS 4TH STAGE SQUIB VALVES TO OPEN~~	~~3.00E-05~~	~~ADX-EV-SA~~
~~92~~	~~5.19E-10~~	~~.00~~	~~LOCA/RNS V024 OPENS INITIATING EVENT OCCURS WITH RCS FILL~~	~~1.73E-05~~	~~IEV-~~
~~LOCA24ND~~					
			~~CGF OF GRAVITY INJECTION CHECK VALVES TO OPEN~~	~~3.00E-05~~	~~IWX-CV-AO~~
~~93~~	~~5.16E-10~~	~~.00~~	~~LOSS OF CCS/SWS WITH RCS DRAINED INITIATING EVENT OCCURS~~	~~7.16E-04~~	~~IEV-CCWD~~
			~~MECHANICAL FAILURE CAUSES MOV 121A TO FAIL TO OPEN~~	~~3.00E-03~~	~~IRWMOD05S~~
			~~IRWST DISCHARGE LINE "B" STRAINER PLUGGED~~	~~2.40E-04~~	~~IWB-PLUG~~
~~94~~	~~4.50E-10~~	~~.00~~	~~LOCA/RNS V024 OPENS INITIATING EVENT OCCURS WITH RCS FILL~~	~~1.73E-05~~	~~IEV-~~
~~LOCA24ND~~					
			~~IWX-EV4-SA~~	~~2.60E-05~~	~~IWX-EV4-SA~~
~~95~~	~~3.52E-10~~	~~.00~~	~~LOSS OF RNS WITH RCS DRAINED INITIATING EVENT OCCURS~~	~~9.69E-05~~	~~IEV-RNSD~~
			~~CGF OF ORIFICES~~	~~3.63E-06~~	~~CCX-ORY-SPX~~
~~96~~	~~3.45E-10~~	~~.00~~	~~LOCA/RNS V024 OPENS INITIATING EVENT OCCURS WITH RCS DRAI~~	~~1.15E-05~~	~~IEV-LOCA24D~~
			~~CGF OF ADS 4TH STAGE SQUIB VALVES TO OPEN~~	~~3.00E-05~~	~~ADX-EV-SA~~
~~97~~	~~3.45E-10~~	~~.00~~	~~LOCA/RNS V024 OPENS INITIATING EVENT OCCURS WITH RCS DRAI~~	~~1.15E-05~~	~~IEV-LOCA24D~~
			~~CGF OF GRAVITY INJECTION CHECK VALVES TO OPEN~~	~~3.00E-05~~	~~IWX-CV-AO~~
~~98~~	~~3.19E-10~~	~~.00~~	~~LOSS OF CCS/SWS WITH RCS DRAINED INITIATING EVENT OCCURS~~	~~7.16E-04~~	~~IEV-CCWD~~

			FAILURE-UPON	DEMAND-OF-LOGIC	GROUP-PROCESSING		1.65E-04	PMA0301BSAX
			UNAVAILABILITY	OF-BUS-ECS-ES-1	DUE-TO-UNSCHEDUL	MAINTENANCE	2.70E-03	EC1BS001TM
99	3.19E-10	.00	LOSS-OF-CCS/SWS	WITH-RCS-DRAINED	INITIATING-EVENT-OCCURS		7.16E-04	IEV-CCWD
			FAILURE-UPON	DEMAND-OF-LOGIC	GROUP-PROCESSING		1.65E-04	PMA0301ASAX
			BUS-UNAVAILABLE	DUE-TO	UNSCHEDULED	MAINTENANCE	2.70E-03	EC1BS121TM
100	3.19E-10	.00	LOSS-OF-CCS/SWS	WITH-RCS-DRAINED	INITIATING-EVENT-OCCURS		7.16E-04	IEV-CCWD
			FAILURE-UPON	DEMAND-OF-LOGIC	GROUP-PROCESSING		1.65E-04	PMA0301BSAX
			BUS-UNAVAILABLE	DUE-TO	UNSCHEDULED	MAINTENANCE	2.70E-03	EC1BS012TM
101	3.19E-10	.00	LOSS-OF-CCS/SWS	WITH-RCS-DRAINED	INITIATING-EVENT-OCCURS		7.16E-04	IEV-CCWD
			FAILURE-UPON	DEMAND-OF-LOGIC	GROUP-PROCESSING		1.65E-04	PMA0301ASAX
			UNAVAILABILITY	OF-BUS-ECS-ES-1	DUE-TO-UNSCHEDUL	MAINTENANCE	2.70E-03	EC1BS001TM
102	3.19E-10	.00	LOSS-OF-CCS/SWS	WITH-RCS-DRAINED	INITIATING-EVENT-OCCURS		7.16E-04	IEV-CCWD
			FAILURE-UPON	DEMAND-OF-LOGIC	GROUP-PROCESSING		1.65E-04	PMA0301BSAX
			BUS-UNAVAILABLE	DUE-TO	UNSCHEDULED	MAINTENANCE	2.70E-03	EC1BS121TM
103	3.19E-10	.00	LOSS-OF-CCS/SWS	WITH-RCS-DRAINED	INITIATING-EVENT-OCCURS		7.16E-04	IEV-CCWD
			FAILURE-UPON	DEMAND-OF-LOGIC	GROUP-PROCESSING		1.65E-04	PMA0301ASAX
			BUS-UNAVAILABLE	DUE-TO	UNSCHEDULED	MAINTENANCE	2.70E-03	EC1BS012TM
104	3.05E-10	.00	LOSS-OF-CCS/SWS	WITH-RCS-DRAINED	INITIATING-EVENT-OCCURS		7.16E-04	IEV-CCWD
			FAILURE-OF	PMS-OUTPUT	LOGIC-I/Os		6.53E-04	PMAMOD11X
			FAILURE-OF	PMS-OUTPUT	LOGIC-I/Os		6.53E-04	PMAMOD12X
105	2.99E-10	.00	LOCA/RNS-V024	OPENS-INITIATING-EVENT-OCCURS		WITH-RCS-DRAI	1.15E-05	IEV-LOCA24D
			IWX-EV4-SA				2.60E-05	IWX-EV4-SA
106	2.99E-10	.00	LOCA/RNS-V024	OPENS-INITIATING-EVENT-OCCURS		WITH-RCS-DRAI	1.15E-05	IEV-LOCA24D
			IWX-MV-CO1				2.60E-05	IWX-MV-CO1
107	2.85E-10	.00	LOSS-OF-RNS-WITH-RCS-DRAINED	INITIATING-EVENT-OCCURS			9.69E-05	IEV-RNSD
			CCF-OF-THE-POWER-INTERFACE-OUTPUT-BOARDS-IN-PMS				2.94E-06	CCX-EP-SAMX
108	2.81E-10	.00	LOSS-OF-CCS/SWS	WITH-RCS-FILLED	INITIATING-EVENT-OCCURS		3.99E-03	IEV-CCWND
			COMMON-MODE	FAILURE-OF-INPUT-LOGIC-GROUPS			1.03E-04	CCX-INPUT-
LOGIC								
			OPERATOR-FAILS	TO-RECOGNIZE-THE-NEED-FOR-RCS		DEPRESSURIZAT	6.83E-04	LPM-MAN05
109	2.55E-10	.00	LOSS-OF-RNS-WITH-RCS-DRAINED	INITIATING-EVENT-OCCURS			9.69E-05	IEV-RNSD

			CCF-OF-PRESSURE	TRANSMITTERS			2.63E-06	CCX-XMTRX
110	2.48E-10	.00	OVERDRAINING-OF	RCS-DURING-DRAIN-DOWN-TO-MID-LOOP	INITIATING-EV		5.28E-06	IEV-RCSOD
			RHN-MAN04-SUCG				9.45E-01	RHN-MAN04-SUCG
			CCF-OF-MUX	LOGIC-GROUPS			4.98E-05	CCX-PMAMOD4
111	2.31E-10	.00	OVERDRAINING-OF	RCS-DURING-DRAIN-DOWN-TO-MID-LOOP	INITIATING-EV		5.28E-06	IEV-RCSOD
			RHN-MAN04-SUCG				9.45E-01	RHN-MAN04-SUCG
			CCF-OF-ACTUATION	LOGIC-GROUPS			4.63E-05	CCX-PMAMOD1X
112	2.20E-10	.00	LOSS-OF-OFFSITE	POWER-INITIATING-EVENT-OCCURS		WITH-RCS-DRAI	5.28E-03	IEV-LOSPD
			OFFSITE	AC-POWER	RECOVERED-IN	1-HOUR	5.80E-01	SUC-R1S
			IRWST-DISCHARGE	LINE-"B"	STRAINER	PLUGGED	2.40E-04	IWB-PLUG
			BUS-UNAVAILABLE	DUE-TO-TEST-OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDBBSDK1TM
113	2.20E-10	.00	LOSS-OF-OFFSITE	POWER-INITIATING-EVENT-OCCURS		WITH-RCS-DRAI	5.28E-03	IEV-LOSPD
			OFFSITE	AC-POWER	RECOVERED-IN	1-HOUR	5.80E-01	SUC-R1S
			IRWST-DISCHARGE	LINE-"B"	STRAINER	PLUGGED	2.40E-04	IWB-PLUG
			BUS-UNAVAILABLE	DUE-TO-TEST-OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDBBSDD1TM
114	2.20E-10	.00	LOSS-OF-OFFSITE	POWER-INITIATING-EVENT-OCCURS		WITH-RCS-DRAI	5.28E-03	IEV-LOSPD
			OFFSITE	AC-POWER	RECOVERED-IN	1-HOUR	5.80E-01	SUC-R1S
			IRWST-DISCHARGE	LINE-"B"	STRAINER	PLUGGED	2.40E-04	IWB-PLUG
			BUS-UNAVAILABLE	DUE-TO-TEST-OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDBBSDS1TM
115	2.08E-10	.00	LOCA/RNS-V024	OPENS-INITIATING-EVENT-OCCURS		WITH-RCS-FILL	1.73E-05	IEV-LOCA24ND
			REX-FL-GP				1.20E-05	REX-FL-GP
116	2.08E-10	.00	LOCA/RNS-V024	OPENS-INITIATING-EVENT-OCCURS		WITH-RCS-FILL	1.73E-05	IEV-LOCA24ND
			CCF-OF-STRAINERS	IN-IRWST-TANK			1.20E-05	IWX-FL-GP
117	1.95E-10	.00	LOSS-OF-RNS-WITH-RCS-DRAINED		INITIATING-EVENT-OCCURS		9.69E-05	IEV-RNSD
			IWX-XMTR				2.01E-04	IWX-XMTR
			REN-MAN04				1.00E-02	REN-MAN04
118	1.93E-10	.00	LOSS-OF-RNS-WITH-RCS-FILLED		INITIATING-EVENT-OCCURS		1.02E-03	IEV-RNSND
			CCF-OF-ORIFICES				2.77E-04	CCX-ORY-SP

			OPERATOR FAILS	TO RECOGNIZE THE NEED FOR RCS		DEPRESSURIZAT	6.83E-04	LPM-MAN05
119	1.76E-10	.00	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS		WITH RCS DRAI	5.28E-03	IEV-LOSPD
			OFFSITE	AC POWER	RECOVERED IN	1 HOUR	5.80E-01	SUC-R1S
			IRWST DISCHARGE	LINE "A"	STRAINER	PLUGGED	2.40E-04	IWA-PLUG
			IRWST DISCHARGE	LINE "B"	STRAINER	PLUGGED	2.40E-04	IWB-PLUG
120	1.76E-10	.00	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS		WITH RCS DRAI	5.28E-03	IEV-LOSPD
			OFFSITE	AC POWER	RECOVERED IN	1 HOUR	5.80E-01	SUC-R1S
			REA-PLUG				2.40E-04	REA-PLUG
			REB-PLUG				2.40E-04	REB-PLUG
121	1.71E-10	.00	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05	IEV-RNSD
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		6.53E-04	PMAMOD11X
			BUS UNAVAILABLE	DUE TO	UNSCHEDULED	MAINTENANCE	2.70E-03	EC1BS012TM
122	1.71E-10	.00	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05	IEV-RNSD
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		6.53E-04	PMAMOD11X
			BUS UNAVAILABLE	DUE TO	UNSCHEDULED	MAINTENANCE	2.70E-03	EC1BS121TM
123	1.71E-10	.00	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05	IEV-RNSD
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		6.53E-04	PMAMOD11X
			UNAVAILABILITY	OF BUS ECS ES 1	DUE TO UNSCHEDUL	MAINTENANCE	2.70E-03	EC1BS001TM
124	1.65E-10	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			MECHANICAL	FAILURE CAUSES	MOV 121A TO	FAIL TO OPEN	3.00E-03	IRWMOD05S
			CHECK VALVE	123B	FAILS TO OPEN		8.76E-03	IWBCV123AO
			CHECK VALVE	125B	FAILS TO OPEN		8.76E-03	IWBCV125AO
125	1.65E-10	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			MECHANICAL	FAILURE CAUSES	MOV 121A TO	FAIL TO OPEN	3.00E-03	IRWMOD05S
			CHECK VALVE	122B	FAILS TO OPEN		8.76E-03	IWBCV122AO
			CHECK VALVE	125B	FAILS TO OPEN		8.76E-03	IWBCV125AO
126	1.65E-10	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			MECHANICAL	FAILURE CAUSES	MOV 121A TO	FAIL TO OPEN	3.00E-03	IRWMOD05S
			CHECK VALVE	123B	FAILS TO OPEN		8.76E-03	IWBCV123AO
			CHECK VALVE	124B	FAILS TO OPEN		8.76E-03	IWBCV124AO
127	1.65E-10	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			MECHANICAL	FAILURE CAUSES	MOV 121A TO	FAIL TO OPEN	3.00E-03	IRWMOD05S
			CHECK VALVE	122B	FAILS TO OPEN		8.76E-03	IWBCV122AO

			CHECK VALVE	124B	FAILS TO OPEN		8.76E-03	IWBCV124AO
128	1.60E-10	.00	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS		WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER IN 1 HOUR			4.20E-01	OTH-R1
			IRWST DISCHARGE	LINE "B"	STRAINER	PLUGGED	2.40E-04	IWB-PLUG
			BUS UNAVAILABLE	DUE TO TEST OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDBBSDD1TM
129	1.60E-10	.00	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS		WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER IN 1 HOUR			4.20E-01	OTH-R1
			IRWST DISCHARGE	LINE "B"	STRAINER	PLUGGED	2.40E-04	IWB-PLUG
			BUS UNAVAILABLE	DUE TO TEST OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDBBSDK1TM
130	1.60E-10	.00	LOSS OF OFFSITE	POWER INITIATING EVENT OCCURS		WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER IN 1 HOUR			4.20E-01	OTH-R1
			IRWST DISCHARGE	LINE "B"	STRAINER	PLUGGED	2.40E-04	IWB-PLUG
			BUS UNAVAILABLE	DUE TO TEST OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDBBSDS1TM
131	1.59E-10	.00	LOCA/RNS-V024	OPENS INITIATING EVENT OCCURS		WITH RCS DRAI	1.15E-05	IEV-LOCA24D
			CCF OF LOGIC	GROUP PROCESSING			1.38E-05	CCX-PMA030X
132	1.55E-10	.00	LOSS OF CCS/SWS	WITH RCS DRAINED INITIATING EVENT OCCURS			7.16E-04	IEV-CCWD
			FAILURE OF	MIMIC BUS	SELECTOR BOARD		8.00E-05	PMAXS00ASAX
			BUS UNAVAILABLE	DUE TO	UNSCHEDULED	MAINTENANCE	2.70E-03	EC1BS012TM
133	1.55E-10	.00	LOSS OF CCS/SWS	WITH RCS DRAINED INITIATING EVENT OCCURS			7.16E-04	IEV-CCWD
			FAILURE OF	MIMIC BUS	SELECTOR BOARD		8.00E-05	PMAXS00ASAX
			UNAVAILABILITY	OF BUS ECS ES 1	DUE TO UNSCHEDUL	MAINTENANCE	2.70E-03	EC1BS001TM
134	1.55E-10	.00	LOSS OF CCS/SWS	WITH RCS DRAINED INITIATING EVENT OCCURS			7.16E-04	IEV-CCWD
			FAILURE OF	MIMIC BUS	SELECTOR BOARD		8.00E-05	PMAXS00ASAX
			BUS UNAVAILABLE	DUE TO	UNSCHEDULED	MAINTENANCE	2.70E-03	EC1BS121TM
135	1.50E-10	.00	OVERDRAINING OF	RCS DURING DRAIN DOWN TO MID LOOP INITIATING EV			5.28E-06	IEV-RCSOD
			RHN-MAN04-SUCC				9.45E-01	RHN-MAN04-
SUCC								
			CCF OF ADS 4TH STAGE SQUIB VALVES TO OPEN				3.00E-05	ADX-EV-SA
136	1.50E-10	.00	OVERDRAINING OF	RCS DURING DRAIN DOWN TO MID LOOP INITIATING EV			5.28E-06	IEV-RCSOD
			RHN-MAN04-SUCC				9.45E-01	RHN-MAN04-
SUCC								
			CCF OF GRAVITY	INJECTION CHECK	VALVES TO OPEN		3.00E-05	IWX-CV-AO

~~137~~	~~1.49E-10~~	~~.00~~	~~LOCA/RNS-V024~~	~~OPENS INITIATING EVENT OCCURS~~	~~WITH RCS FILL~~	~~1.73E-05~~	~~IEV-LOCA24ND~~
			~~CCF OF THE POWER INTERFACE OUTPUT BOARDS IN PMS~~			~~8.62E-06~~	~~CCX-EP-SAM~~
~~138~~	~~1.48E-10~~	~~.00~~	~~LOSS OF CCS/SWS~~	~~WITH RCS DRAINED INITIATING EVENT OCCURS~~		~~7.16E-04~~	~~IEV-CCWD~~
			~~FAILURE OF~~	~~PMS OUTPUT~~	~~LOGIC I/Os~~	~~6.53E-04~~	~~PMAMOD11X~~
			~~FAILURE OF DIST.~~	~~PANEL 1DSA-EA-2~~	~~OR BREAKER A06~~	~~3.17E-04~~	~~IDAMOD08~~
~~139~~	~~1.48E-10~~	~~.00~~	~~LOSS OF CCS/SWS~~	~~WITH RCS DRAINED INITIATING EVENT OCCURS~~		~~7.16E-04~~	~~IEV-CCWD~~
			~~FAILURE OF~~	~~PMS OUTPUT~~	~~LOGIC I/Os~~	~~6.53E-04~~	~~PMAMOD12X~~
			~~LOSS OF DIST.~~	~~PANEL OR BREAKER A07 SPURIOUSLY~~	~~OPENS~~	~~3.17E-04~~	~~IDAMOD04~~
~~140~~	~~1.40E-10~~	~~.00~~	~~LOSS OF RNS WITH RCS FILLED~~	~~INITIATING EVENT OCCURS~~		~~1.02E-03~~	~~IEV-RNSND~~
			~~CCF OF PRESSURE~~	~~TRANSMITTERS~~		~~2.01E-04~~	~~CCX-XMTR195~~
			~~OPERATOR FAILS~~	~~TO RECOGNIZE THE NEED FOR RCS~~	~~DEPRESSURIZAT~~	~~6.83E-04~~	~~LPM-MAN05~~
~~141~~	~~1.39E-10~~	~~.00~~	~~LOCA/RNS PIPE~~	~~RUPTURE WITH RCS~~	~~FILLED INIT. EVENT OCCURS~~	~~1.61E-05~~	~~IEV-LOCAPRND~~
			~~CCF OF THE POWER INTERFACE OUTPUT BOARDS IN PMS~~			~~8.62E-06~~	~~CCX-EP-SAM~~
~~142~~	~~1.38E-10~~	~~.00~~	~~LOCA/RNS-V024~~	~~OPENS INITIATING EVENT OCCURS~~	~~WITH RCS DRAI~~	~~1.15E-05~~	~~IEV-LOCA24D~~
			~~REX-FL-GP~~			~~1.20E-05~~	~~REX-FL-GP~~
~~143~~	~~1.38E-10~~	~~.00~~	~~LOCA/RNS-V024~~	~~OPENS INITIATING EVENT OCCURS~~	~~WITH RCS DRAI~~	~~1.15E-05~~	~~IEV-LOCA24D~~
			~~CCF OF STRAINERS IN IRWST TANK~~			~~1.20E-05~~	~~IWX-FL-GP~~
~~144~~	~~1.35E-10~~	~~.00~~	~~LOSS OF RNS WITH RCS DRAINED~~	~~INITIATING EVENT OCCURS~~		~~9.69E-05~~	~~IEV-RNSD~~
			~~FAILURE OF INV., STATIC SWITCH~~	~~AND ASSOC.~~	~~BREAKERS~~	~~5.16E-04~~	~~IDAMOD05~~
			~~BUS UNAVAILABLE DUE TO~~	~~UNSCHEDULED~~	~~MAINTENANCE~~	~~2.70E-03~~	~~EC1BS121TM~~
~~145~~	~~1.35E-10~~	~~.00~~	~~LOSS OF RNS WITH RCS DRAINED~~	~~INITIATING EVENT OCCURS~~		~~9.69E-05~~	~~IEV-RNSD~~
			~~FAILURE OF INV., STATIC SWITCH~~	~~AND ASSOC.~~	~~BREAKERS~~	~~5.16E-04~~	~~IDAMOD05~~
			~~BUS UNAVAILABLE DUE TO~~	~~UNSCHEDULED~~	~~MAINTENANCE~~	~~2.70E-03~~	~~EC1BS012TM~~
~~146~~	~~1.35E-10~~	~~.00~~	~~LOSS OF RNS WITH RCS DRAINED~~	~~INITIATING EVENT OCCURS~~		~~9.69E-05~~	~~IEV-RNSD~~
			~~FAILURE OF INV., STATIC SWITCH~~	~~AND ASSOC.~~	~~BREAKERS~~	~~5.16E-04~~	~~IDAMOD05~~
			~~UNAVAILABILITY OF BUS ECS ES 1~~	~~DUE TO UNSCHEDUL~~	~~MAINTENANCE~~	~~2.70E-03~~	~~EC1BS001TM~~
~~147~~	~~1.30E-10~~	~~.00~~	~~OVERDRAINING OF RCS DURING DRAIN DOWN TO MID-LOOP INITIATING EV~~			~~5.28E-06~~	~~IEV-RCSOD~~
			~~RHN-MAN04-SUCC~~			~~9.45E-01~~	~~RHN-MAN04-SUCG~~
			~~IWX-EV4-SA~~			~~2.60E-05~~	~~IWX-EV4-SA~~

~~148~~	~~1.30E-10~~	~~.00~~	~~OVERDRAINING OF~~	~~RCS DURING DRAIN DOWN TO MID LOOP INITIATING EV~~			~~5.28E-06~~	~~IEV-RCSOD~~
			~~RHN-MAN04-SUCC~~				~~9.45E-01~~	~~RHN-MAN04-~~
~~SUCC~~								
			~~IWX-MV-CO1~~				~~2.60E-05~~	~~IWX-MV-CO1~~
~~149~~	~~1.28E-10~~	~~.00~~	~~LOSS OF OFFSITE~~	~~POWER INITIATING EVENT OCCURS~~		~~WITH RCS DRAI~~	~~5.28E-03~~	~~IEV-LOSPD~~
			~~FAILURE TO~~	~~RECOVER AC POWER IN 1 HOUR~~			~~4.20E-01~~	~~OTH-R1~~
			~~REA-PLUG~~				~~2.40E-04~~	~~REA-PLUG~~
			~~REB-PLUG~~				~~2.40E-04~~	~~REB-PLUG~~
~~150~~	~~1.28E-10~~	~~.00~~	~~LOSS OF OFFSITE~~	~~POWER INITIATING EVENT OCCURS~~		~~WITH RCS DRAI~~	~~5.28E-03~~	~~IEV-LOSPD~~
			~~FAILURE TO~~	~~RECOVER AC POWER IN 1 HOUR~~			~~4.20E-01~~	~~OTH-R1~~
			~~IRWST DISCHARGE~~	~~LINE "A"~~	~~STRAINER~~	~~PLUGGED~~	~~2.40E-04~~	~~IWA-PLUG~~
			~~IRWST DISCHARGE~~	~~LINE "B"~~	~~STRAINER~~	~~PLUGGED~~	~~2.40E-04~~	~~IWB-PLUG~~
~~151~~	~~1.27E-10~~	~~.00~~	~~LOCA/RNS-V024~~	~~OPENS INITIATING EVENT OCCURS~~		~~WITH RCS DRAI~~	~~1.15E-05~~	~~IEV-LOCA24D~~
			~~SOFTWARE CCF OF~~	~~OUTPUT LOGIC~~	~~I/Os~~		~~1.10E-05~~	~~CCX-~~
~~PMAMOD1-SW~~								
~~152~~	~~1.25E-10~~	~~.00~~	~~LOSS OF CCS/SWS~~	~~WITH RCS DRAINED INITIATING EVENT OCCURS~~			~~7.16E-04~~	~~IEV-CCWD~~
			~~MECHANICAL~~	~~FAILURE CAUSES~~	~~MOV-121A TO~~	~~FAIL TO OPEN~~	~~3.00E-03~~	~~IRWMOD05S~~
			~~FAILURE OF POWER~~	~~INTERFACE OUTPUT BOARD~~			~~5.83E-05~~	
~~IRAEP121BSAX~~								
~~153~~	~~1.16E-10~~	~~.00~~	~~LOSS OF RNS WITH RCS DRAINED~~		~~INITIATING EVENT OCCURS~~		~~9.69E-05~~	~~IEV-RNSD~~
			~~SOFTWARE CCF~~	~~OF ALL CARDS~~			~~1.20E-06~~	~~CCX-SFTW~~
~~154~~	~~1.05E-10~~	~~.00~~	~~LOSS OF OFFSITE~~	~~POWER INITIATING EVENT OCCURS~~		~~WITH RCS FILL~~	~~1.82E-02~~	~~IEV-LOSPND~~
			~~FAILURE OF PRHR~~	~~DUE TO COMMON~~	~~CAUSE OF AOVs~~		~~1.92E-04~~	~~PXX-AV-LA~~
			~~CCF OF GRAVITY~~	~~INJECTION CHECK~~	~~VALVES TO OPEN~~		~~3.00E-05~~	~~IWX-CV-AO~~
~~155~~	~~9.91E-11~~	~~.00~~	~~LOCA/RNS-V024~~	~~OPENS INITIATING EVENT OCCURS~~		~~WITH RCS DRAI~~	~~1.15E-05~~	~~IEV-LOCA24D~~
			~~CCF OF THE POWER~~	~~INTERFACE OUTPUT BOARDS IN PMS~~			~~8.62E-06~~	~~CCX-EP-SAM~~
~~156~~	~~9.09E-11~~	~~.00~~	~~LOSS OF CCS/SWS~~	~~WITH RCS DRAINED INITIATING EVENT OCCURS~~			~~7.16E-04~~	~~IEV-CCWD~~
			~~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~~	~~EG1BS012TM~~
~~157~~	~~9.09E-11~~	~~.00~~	~~LOSS OF CCS/SWS~~	~~WITH RCS DRAINED INITIATING EVENT OCCURS~~			~~7.16E-04~~	~~IEV-CCWD~~
			~~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~~	~~EG1BS121TM~~

~~158~~	~~9.09E-11~~	~~.00~~	~~LOSS OF CCS/SWS~~	~~WITH RCS DRAINED~~	~~INITIATING EVENT~~	~~OCCURS~~	~~7.16E-04~~	~~IEV-CCWD~~
			~~COMMON CAUSE~~	~~FAILURE OF THE~~	~~BATTERIES~~	~~IDSA-DB-1A/1B~~	~~4.70E-05~~	~~CCX-BY-PN~~
			~~UNAVAILABILITY~~	~~OF BUS ECS-ES-1~~	~~DUE TO UNSCHEDUL~~	~~MAINTENANCE~~	~~2.70E-03~~	~~EC1BS001TM~~
~~159~~	~~8.72E-11~~	~~.00~~	~~LOSS OF RNS WITH~~	~~RCS DRAINED~~	~~INITIATING EVENT~~	~~OCCURS~~	~~9.69E-05~~	~~IEV-RNSD~~
			~~MECHANICAL~~	~~FAILURE CAUSES~~	~~MOV 121A TO~~	~~FAIL TO OPEN~~	~~3.00E-03~~	~~IRWMOD05S~~
			~~BUS UNAVAILABLE~~	~~DUE TO TEST OR~~	~~CORRECTIVE~~	~~MAINTENANCE~~	~~3.00E-04~~	~~IDCBSDD1TM~~
~~160~~	~~8.72E-11~~	~~.00~~	~~LOSS OF RNS WITH~~	~~RCS DRAINED~~	~~INITIATING EVENT~~	~~OCCURS~~	~~9.69E-05~~	~~IEV-RNSD~~
			~~MECHANICAL~~	~~FAILURE CAUSES~~	~~MOV 121A TO~~	~~FAIL TO OPEN~~	~~3.00E-03~~	~~IRWMOD05S~~
			~~BUS UNAVAILABLE~~	~~DUE TO TEST OR~~	~~CORRECTIVE~~	~~MAINTENANCE~~	~~3.00E-04~~	~~IDCBSDS1TM~~
~~161~~	~~8.72E-11~~	~~.00~~	~~LOSS OF RNS WITH~~	~~RCS DRAINED~~	~~INITIATING EVENT~~	~~OCCURS~~	~~9.69E-05~~	~~IEV-RNSD~~
			~~MECHANICAL~~	~~FAILURE CAUSES~~	~~MOV 121A TO~~	~~FAIL TO OPEN~~	~~3.00E-03~~	~~IRWMOD05S~~
			~~BUS UNAVAILABLE~~	~~DUE TO TEST OR~~	~~CORRECTIVE~~	~~MAINTENANCE~~	~~3.00E-04~~	~~IDCBSDK1TM~~
~~162~~	~~8.53E-11~~	~~.00~~	~~LOCA/RNS-V024~~	~~OPENS INITIATING~~	~~EVENT OCCURS~~	~~WITH RCS FILL~~	~~1.73E-05~~	~~IEV-~~
~~LOCA24ND~~								
			~~RC1OR195SP~~				~~7.22E-03~~	~~RC1OR195SP~~
			~~OPERATOR FAILS~~	~~TO RECOGNIZE THE~~	~~NEED FOR RCS~~	~~DEPRESSURIZAT~~	~~6.83E-04~~	~~LPM-MAN05~~
~~163~~	~~8.29E-11~~	~~.00~~	~~LOSS OF RNS WITH~~	~~RCS DRAINED~~	~~INITIATING EVENT~~	~~OCCURS~~	~~9.69E-05~~	~~IEV-RNSD~~
			~~LOSS OF DIST.~~	~~PANEL OR BREAKER~~	~~A07 SPURIOUSLY~~	~~OPENS~~	~~3.17E-04~~	~~IDAMOD04~~
			~~BUS UNAVAILABLE~~	~~DUE TO~~	~~UNSCHEDULED~~	~~MAINTENANCE~~	~~2.70E-03~~	~~EC1BS121TM~~
~~164~~	~~8.29E-11~~	~~.00~~	~~LOSS OF RNS WITH~~	~~RCS DRAINED~~	~~INITIATING EVENT~~	~~OCCURS~~	~~9.69E-05~~	~~IEV-RNSD~~
			~~LOSS OF DIST.~~	~~PANEL OR BREAKER~~	~~A07 SPURIOUSLY~~	~~OPENS~~	~~3.17E-04~~	~~IDAMOD04~~
			~~UNAVAILABILITY~~	~~OF BUS ECS-ES-1~~	~~DUE TO UNSCHEDUL~~	~~MAINTENANCE~~	~~2.70E-03~~	~~EC1BS001TM~~
~~165~~	~~8.29E-11~~	~~.00~~	~~LOSS OF RNS WITH~~	~~RCS DRAINED~~	~~INITIATING EVENT~~	~~OCCURS~~	~~9.69E-05~~	~~IEV-RNSD~~
			~~LOSS OF DIST.~~	~~PANEL OR BREAKER~~	~~A07 SPURIOUSLY~~	~~OPENS~~	~~3.17E-04~~	~~IDAMOD04~~
			~~BUS UNAVAILABLE~~	~~DUE TO~~	~~UNSCHEDULED~~	~~MAINTENANCE~~	~~2.70E-03~~	~~EC1BS012TM~~
~~166~~	~~7.85E-11~~	~~.00~~	~~LOSS OF RNS WITH~~	~~RCS DRAINED~~	~~INITIATING EVENT~~	~~OCCURS~~	~~9.69E-05~~	~~IEV-RNSD~~
			~~BUS UNAVAILABLE~~	~~DUE TO TEST OR~~	~~CORRECTIVE~~	~~MAINTENANCE~~	~~3.00E-04~~	~~IDABSDS1TM~~
			~~UNAVAILABILITY~~	~~OF BUS ECS-ES-1~~	~~DUE TO UNSCHEDUL~~	~~MAINTENANCE~~	~~2.70E-03~~	~~EC1BS001TM~~
~~167~~	~~7.85E-11~~	~~.00~~	~~LOSS OF RNS WITH~~	~~RCS DRAINED~~	~~INITIATING EVENT~~	~~OCCURS~~	~~9.69E-05~~	~~IEV-RNSD~~
			~~BUS UNAVAILABLE~~	~~DUE TO TEST OR~~	~~CORRECTIVE~~	~~MAINTENANCE~~	~~3.00E-04~~	~~IDABSDS1TM~~
			~~BUS UNAVAILABLE~~	~~DUE TO~~	~~UNSCHEDULED~~	~~MAINTENANCE~~	~~2.70E-03~~	~~EC1BS121TM~~

~~168~~	~~7.85E-11~~	~~.00~~	~~LOSS OF RNS WITH RCS DRAINED~~	~~INITIATING EVENT OCCURS~~			~~9.69E-05~~	~~IEV-RNSD~~
			~~BUS UNAVAILABLE DUE TO TEST OR~~	~~CORRECTIVE~~	~~MAINTENANCE~~		~~3.00E-04~~	~~IDABSDS1TM~~
			~~BUS UNAVAILABLE DUE TO~~	~~UNSCHEDULED~~	~~MAINTENANCE~~		~~2.70E-03~~	~~EC1BS012TM~~
~~169~~	~~7.79E-11~~	~~.00~~	~~LOSS OF CCS/SWS WITH RCS DRAINED~~	~~INITIATING EVENT OCCURS~~			~~7.16E-04~~	~~IEV-CCWD~~
			~~ORIFICE FAILURE DUE TO PLUGGING~~				~~9.46E-05~~	~~IW2OR160SPX~~
			~~OPERATOR FAILS TO ACTUATE IRWST~~	~~INJECTION~~			~~1.15E-03~~	~~IWN-MAN00~~
~~170~~	~~7.79E-11~~	~~.00~~	~~LOSS OF CCS/SWS WITH RCS DRAINED~~	~~INITIATING EVENT OCCURS~~			~~7.16E-04~~	~~IEV-CCWD~~
			~~ORIFICE FAILURE DUE TO PLUGGING~~				~~9.46E-05~~	~~IW1OR170SPX~~
			~~OPERATOR FAILS TO ACTUATE IRWST~~	~~INJECTION~~			~~1.15E-03~~	~~IWN-MAN00~~
~~171~~	~~7.71E-11~~	~~.00~~	~~LOSS OF CCS/SWS WITH RCS DRAINED~~	~~INITIATING EVENT OCCURS~~			~~7.16E-04~~	~~IEV-CCWD~~
			~~FAILURE OF PMS OUTPUT~~	~~LOGIC I/Os~~			~~6.53E-04~~	~~PMAMOD12X~~
			~~FAILURE UPON DEMAND OF LOGIC~~	~~GROUP PROCESSING~~			~~1.65E-04~~	~~PMA0301ASAX~~
~~172~~	~~7.71E-11~~	~~.00~~	~~LOSS OF CCS/SWS WITH RCS DRAINED~~	~~INITIATING EVENT OCCURS~~			~~7.16E-04~~	~~IEV-CCWD~~
			~~FAILURE OF PMS OUTPUT~~	~~LOGIC I/Os~~			~~6.53E-04~~	~~PMAMOD11X~~
			~~FAILURE UPON DEMAND OF LOGIC~~	~~GROUP PROCESSING~~			~~1.65E-04~~	~~PMA0302ASAX~~
~~173~~	~~7.71E-11~~	~~.00~~	~~LOSS OF CCS/SWS WITH RCS DRAINED~~	~~INITIATING EVENT OCCURS~~			~~7.16E-04~~	~~IEV-CCWD~~
			~~FAILURE OF PMS OUTPUT~~	~~LOGIC I/Os~~			~~6.53E-04~~	~~PMAMOD11X~~
			~~FAILURE UPON DEMAND OF LOGIC~~	~~GROUP PROCESSING~~			~~1.65E-04~~	~~PMA0302BSAX~~
~~174~~	~~7.71E-11~~	~~.00~~	~~LOSS OF CCS/SWS WITH RCS DRAINED~~	~~INITIATING EVENT OCCURS~~			~~7.16E-04~~	~~IEV-CCWD~~
			~~FAILURE UPON DEMAND OF LOGIC~~	~~GROUP PROCESSING~~			~~1.65E-04~~	~~PMA0301BSAX~~
			~~FAILURE OF PMS OUTPUT~~	~~LOGIC I/Os~~			~~6.53E-04~~	~~PMAMOD12X~~
~~175~~	~~7.20E-11~~	~~.00~~	~~LOSS OF CCS/SWS WITH RCS DRAINED~~	~~INITIATING EVENT OCCURS~~			~~7.16E-04~~	~~IEV-CCWD~~
			~~LOSS OF DIST. PANEL OR BREAKER A07~~	~~SPURIOUSLY~~	~~OPENS~~		~~3.17E-04~~	~~IDAMOD04~~
			~~FAILURE OF DIST. PANEL 1DSA-EA-2~~	~~OR BREAKER A06~~			~~3.17E-04~~	~~IDAMOD08~~
~~176~~	~~7.18E-11~~	~~.00~~	~~LOSS OF RNS WITH RCS FILLED~~	~~INITIATING EVENT OCCURS~~			~~1.02E-03~~	~~IEV-RNSND~~
			~~COMMON MODE FAILURE OF INPUT~~	~~LOGIC GROUPS~~			~~1.03E-04~~	~~CCX-INPUT-~~
~~LOGIC~~								
			~~OPERATOR FAILS TO RECOGNIZE THE~~	~~NEED FOR RCS~~	~~DEPRESSURIZAT~~		~~6.83E-04~~	~~LPM-MAN05~~
~~177~~	~~7.06E-11~~	~~.00~~	~~LOSS OF CCS/SWS WITH RCS DRAINED~~	~~INITIATING EVENT OCCURS~~			~~7.16E-04~~	~~IEV-CCWD~~
			~~CCF OF ACTUATION LOGIC GROUPS~~				~~8.58E-05~~	~~CCX-~~
~~PMAMOD2X~~								
			~~OPERATOR FAILS TO ACTUATE IRWST~~	~~INJECTION~~			~~1.15E-03~~	~~IWN-MAN00~~

178	6.98E-11	.00	LOSS-OF-RNS-WITH-RCS-DRAINED		INITIATING-EVENT-OCCURS		9.69E-05	IEV-RNSD
			MECHANICAL	FAILURE-CAUSES	MOV-121A-TO	FAIL-TO-OPEN	3.00E-03	IRWMOD05S
			IRWST-DISCHARGE	LINE-"B"	STRAINER	PLUGGED	2.40E-04	IWB-PLUG
179	6.89E-11	.00	OVERDRAINING-OF-	RCS-DURING-DRAIN-DOWN-TO-MID-LOOP	INITIATING-EV		5.28E-06	IEV-RCSOD
			RHN-MAN04-SUCC				9.45E-01	RHN-MAN04-
SUCC								
			CGF-OF-LOGIC	GROUP-PROCESSING			1.38E-05	CCX-PMA030X
180	6.44E-11	.00	LOSS-OF-CCS/SWS	WITH-RCS-DRAINED-INITIATING-EVENT-OCCURS			7.16E-04	IEV-CCWD
			BUS-UNAVAILABLE	DUE-TO-TEST-OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDBBSDS1TM
			BUS-UNAVAILABLE	DUE-TO-TEST-OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDCBSDK1TM
181	6.44E-11	.00	LOSS-OF-CCS/SWS	WITH-RCS-DRAINED-INITIATING-EVENT-OCCURS			7.16E-04	IEV-CCWD
			BUS-UNAVAILABLE	DUE-TO-TEST-OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDBBSDK1TM
			BUS-UNAVAILABLE	DUE-TO-TEST-OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDCBSDK1TM
182	6.44E-11	.00	LOSS-OF-CCS/SWS	WITH-RCS-DRAINED-INITIATING-EVENT-OCCURS			7.16E-04	IEV-CCWD
			BUS-UNAVAILABLE	DUE-TO-TEST-OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDBBSDK1TM
			BUS-UNAVAILABLE	DUE-TO-TEST-OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDCBSDS1TM
183	6.44E-11	.00	LOSS-OF-CCS/SWS	WITH-RCS-DRAINED-INITIATING-EVENT-OCCURS			7.16E-04	IEV-CCWD
			BUS-UNAVAILABLE	DUE-TO-TEST-OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDBBSDD1TM
			BUS-UNAVAILABLE	DUE-TO-TEST-OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDCBSDK1TM
184	6.44E-11	.00	LOSS-OF-CCS/SWS	WITH-RCS-DRAINED-INITIATING-EVENT-OCCURS			7.16E-04	IEV-CCWD
			BUS-UNAVAILABLE	DUE-TO-TEST-OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDBBSDS1TM
			BUS-UNAVAILABLE	DUE-TO-TEST-OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDCBSDS1TM
185	6.44E-11	.00	LOSS-OF-CCS/SWS	WITH-RCS-DRAINED-INITIATING-EVENT-OCCURS			7.16E-04	IEV-CCWD
			BUS-UNAVAILABLE	DUE-TO-TEST-OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDBBSDS1TM
			BUS-UNAVAILABLE	DUE-TO-TEST-OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDCBSDD1TM
186	6.44E-11	.00	LOSS-OF-CCS/SWS	WITH-RCS-DRAINED-INITIATING-EVENT-OCCURS			7.16E-04	IEV-CCWD
			BUS-UNAVAILABLE	DUE-TO-TEST-OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDBBSDD1TM
			BUS-UNAVAILABLE	DUE-TO-TEST-OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDCBSDS1TM
187	6.44E-11	.00	LOSS-OF-CCS/SWS	WITH-RCS-DRAINED-INITIATING-EVENT-OCCURS			7.16E-04	IEV-CCWD
			BUS-UNAVAILABLE	DUE-TO-TEST-OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDBBSDD1TM
			BUS-UNAVAILABLE	DUE-TO-TEST-OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDCBSDD1TM
188	6.44E-11	.00	LOSS-OF-CCS/SWS	WITH-RCS-DRAINED-INITIATING-EVENT-OCCURS			7.16E-04	IEV-CCWD

			BUS UNAVAILABLE	DUE TO TEST OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDBBSDK1TM
			BUS UNAVAILABLE	DUE TO TEST OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDCBSDD1TM
189	6.18E-11	.00	LOCA/RNS-V024	OPENS INITIATING EVENT OCCURS		WITH RCS FILL	1.73E-05	IEV-
LOCA24ND								
			RC1TL195UF				5.23E-03	RC1TL195UF
			OPERATOR FAILS	TO RECOGNIZE THE NEED FOR RCS		DEPRESSURIZAT	6.83E-04	LPM-MAN05
190	5.99E-11	.00	OVERDRAINING OF	RCS DURING DRAIN DOWN TO MID-LOOP INITIATING EV			5.28E-06	IEV-RCSOD
			RHN-MAN04-SUCC				9.45E-01	RHN-MAN04-
SUCC								
			REX-FL-GP				1.20E-05	REX-FL-GP
191	5.99E-11	.00	OVERDRAINING OF	RCS DURING DRAIN DOWN TO MID-LOOP INITIATING EV			5.28E-06	IEV-RCSOD
			RHN-MAN04-SUCC				9.45E-01	RHN-MAN04-
SUCC								
			CCF OF STRAINERS IN IRWST TANK				1.20E-05	IWX-FL-GP
192	5.63E-11	.00	LOSS OF CCS/SWS	WITH RCS DRAINED INITIATING EVENT OCCURS			7.16E-04	IEV-CCWD
			LEVEL	TRANSMITTER	FAILURE		6.84E-05	IW2TL160UFX
			OPERATOR FAILS	TO ACTUATE IRWST INJECTION			1.15E-03	IWN-MAN00
193	5.63E-11	.00	LOSS OF CCS/SWS	WITH RCS DRAINED INITIATING EVENT OCCURS			7.16E-04	IEV-CCWD
			LEVEL	TRANSMITTER	FAILURE		6.84E-05	IW1TL170UFX
			OPERATOR FAILS	TO ACTUATE IRWST INJECTION			1.15E-03	IWN-MAN00
194	5.49E-11	.00	OVERDRAINING OF	RCS DURING DRAIN DOWN TO MID-LOOP INITIATING EV			5.28E-06	IEV-RCSOD
			RHN-MAN04-SUCC				9.45E-01	RHN-MAN04-
SUCC								
			CCF OF SOFTWARE	FOR MUX LOGIC	GROUPS		1.10E-05	CCX-
PMAMOD4-SW								
195	5.49E-11	.00	OVERDRAINING OF	RCS DURING DRAIN DOWN TO MID-LOOP INITIATING EV			5.28E-06	IEV-RCSOD
			RHN-MAN04-SUCC				9.45E-01	RHN-MAN04-
SUCC								
			SOFTWARE CCF OF	OUTPUT LOGIC	I/Os		1.10E-05	CCX-
PMAMOD1-SW								
196	5.16E-11	.00	LOSS OF CCS/SWS	WITH RCS DRAINED INITIATING EVENT OCCURS			7.16E-04	IEV-CCWD
			IRWST DISCHARGE	LINE "A"	STRAINER	PLUGGED	2.40E-04	IWA-PLUG
			BUS UNAVAILABLE	DUE TO TEST OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDCBSDS1TM

~~197~~	~~5.16E-11~~	~~.00~~	~~LOSS OF CCS/SWS~~	~~WITH RCS DRAINED~~	~~INITIATING EVENT~~	~~OCCURS~~	~~7.16E-04~~	~~IEV-CCWD~~
			~~IRWST DISCHARGE~~	~~LINE "A"~~	~~STRAINER~~	~~PLUGGED~~	~~2.40E-04~~	~~IWA-PLUG~~
			~~BUS UNAVAILABLE~~	~~DUE TO TEST OR~~	~~CORRECTIVE~~	~~MAINTENANCE~~	~~3.00E-04~~	~~IDCBSDK1TM~~
~~198~~	~~5.16E-11~~	~~.00~~	~~LOSS OF CCS/SWS~~	~~WITH RCS DRAINED~~	~~INITIATING EVENT~~	~~OCCURS~~	~~7.16E-04~~	~~IEV-CCWD~~
			~~IRWST DISCHARGE~~	~~LINE "B"~~	~~STRAINER~~	~~PLUGGED~~	~~2.40E-04~~	~~IWB-PLUG~~
			~~BUS UNAVAILABLE~~	~~DUE TO TEST OR~~	~~CORRECTIVE~~	~~MAINTENANCE~~	~~3.00E-04~~	~~IDBBSDD1TM~~
~~199~~	~~5.16E-11~~	~~.00~~	~~LOSS OF CCS/SWS~~	~~WITH RCS DRAINED~~	~~INITIATING EVENT~~	~~OCCURS~~	~~7.16E-04~~	~~IEV-CCWD~~
			~~IRWST DISCHARGE~~	~~LINE "B"~~	~~STRAINER~~	~~PLUGGED~~	~~2.40E-04~~	~~IWB-PLUG~~
			~~BUS UNAVAILABLE~~	~~DUE TO TEST OR~~	~~CORRECTIVE~~	~~MAINTENANCE~~	~~3.00E-04~~	~~IDBBSDK1TM~~
~~200~~	~~5.16E-11~~	~~.00~~	~~LOSS OF CCS/SWS~~	~~WITH RCS DRAINED~~	~~INITIATING EVENT~~	~~OCCURS~~	~~7.16E-04~~	~~IEV-CCWD~~
			~~IRWST DISCHARGE~~	~~LINE "B"~~	~~STRAINER~~	~~PLUGGED~~	~~2.40E-04~~	~~IWB-PLUG~~
			~~BUS UNAVAILABLE~~	~~DUE TO TEST OR~~	~~CORRECTIVE~~	~~MAINTENANCE~~	~~3.00E-04~~	~~IDBBSDS1TM~~

Table 2-2. List of Basic Events "Dropped" to Make the Sensitivity Case 2

```
; SENDATA 1 1
; 04/09/03, 12:46:39

h:\ap1000~2\38-1\case-2r1\cmtot.wlk

Case 1
h:\ap1000~2\38-1\case-2r1\cmtot.wll

DG1-LOGIC R
MDAS R
REC-MANDAS R
REC-MANDASC R
RHN-MAN03 R
RNAEPRNPSA R
RNAMOD06S R
RNBEPRNPSA R
RNBMOD07S R
RNX-CV-GO R
RNX-KV-GO R
RNX-PM-ER R
RNX-PM-FS R
ZO1DG001TM R
ZO1MOD01 R
ZO1MOD03 R
ZO1MOD04 R
ZO2DG002TM R
ZO2MOD01 R
ZO2MOD03 R
ZO2MOD04 R
ZOX-BL-ER R
ZOX-BL-ES R
ZOX-DG-DR R
ZOX-DG-DS R
ZOX-FL-GP R
ZOX-PD-ER R
ZOX-PD-ES R
DAS R
ZON-MAN01 R
~~; SENDATA 1 1~~
~~; 03/12/03, 15:31:51~~

~~h:\ap1000~2\38-1\case-2\cmtot.wlk~~

~~Case 1~~
~~h:\ap1000~2\38-1\case-2\cmtot.wll~~
```

~~DG1-LOGIC-R~~
~~MDAS-R~~
~~REC-MANDAS-R~~
~~REC-MANDASC-R~~
~~RHN-MAN03-R~~
~~RHN-MAN05-R~~
~~RHN-MAN05C-R~~
~~RN23MOD5S-R~~
~~RNAEPRNPSA-R~~
~~RNAMOD06S-R~~
~~RNBEPRNPSA-R~~
~~RNBMOD07S-R~~
~~RNDEP023SA-R~~
~~RNX-CV-CO-R~~
~~RNX-KV-CO-R~~
~~RNX-PM-ER-R~~
~~RNX-PM-FS-R~~
~~ZO1DG001TM-R~~
~~ZO1MOD01-R~~
~~ZO1MOD03-R~~
~~ZO1MOD04-R~~
~~ZO2DG002TM-R~~
~~ZO2MOD01-R~~
~~ZO2MOD03-R~~
~~ZO2MOD04-R~~
~~ZOX-BL-ER-R~~
~~ZOX-BL-ES-R~~
~~ZOX-DG-DR-R~~
~~ZOX-DG-DS-R~~
~~ZOX-FL-GP-R~~
~~ZOX-PD-ER-R~~
~~ZOX-PD-ES-R~~
~~DAS-R~~
~~ZON-MAN01-R~~

Case 3 HEP's Set Equal to 0.5

In this sensitivity analysis, the HEPs appearing in the shutdown CDF cutsets are set equal to 0.5, if they are less than that value. The operator actions used in IEV-RCSOD (RCS-MANODS1 and RCS-MANODS2) are also set equal to 0.5. The shutdown CDF becomes 5.533E-05/year. The top 200 cutsets are shown in Table 3-1. The basic events whose probabilities are changed are shown in Table 3-2.

Table 3-1 ***** DOMINANT CUTSETS ***** Page: 1

Title: AP1000 PRA SHUTDOWN SENSITIVITY CASE 3
File: case-3.wlk (Case 1)
Reduced Sum of Cutsets: 5.5330E-05

NUMBER	CUTSET PROB	PERCENT	BASIC EVENT NAME	EVENT PROB.	IDENTIFIER
1	2.66E-05	48.08	OVERDRAINING OF RCS DURING DRAIN DOWN TO MID-LOOP INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC	5.00E-01	RHN-MAN04-SUCC
			OPERATOR FAILS TO ACTUATE IRWST INJECTION	5.00E-01	IWN-MAN00
			COND. PROB. OF RHN-MAN05 (OP. FAILS TO OPEN RNS MOV V023)	5.00E-01	RHN-MAN05C
2	2.66E-05	48.08	OVERDRAINING OF RCS DURING DRAIN DOWN TO MID-LOOP INITIATING EV	2.13E-04	IEV-RCSOD
			OPERATOR FAILS TO ISOLATE RNS PIPE RUPTURE	5.00E-01	RHN-MAN04
			COND. PROB. OF IWN-MAN00 (OP. FAILS TO ACTUATE IRWST INJ)	5.00E-01	IWN-MAN00C
			COND. PROB. OF RHN-MAN05 (OP. FAILS TO OPEN RNS MOV V023)	5.00E-01	RHN-MAN05C
3	2.80E-07	.51	LOSS OF CCS/SWS WITH RCS FILLED INITIATING EVENT OCCURS	3.99E-03	IEV-CCWND
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATI	5.06E-01	REC-MANDASC
			CCF OF ORIFICES	2.77E-04	CCX-ORY-SP
			OPERATOR FAILS TO RECOGNIZE THE NEED FOR RCS DEPRESSURIZAT	5.00E-01	LPM-MAN05
4	2.03E-07	.37	LOSS OF CCS/SWS WITH RCS FILLED INITIATING EVENT OCCURS	3.99E-03	IEV-CCWND
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATI	5.06E-01	REC-MANDASC
			CCF OF PRESSURE TRANSMITTERS	2.01E-04	CCX-XMTR195
			OPERATOR FAILS TO RECOGNIZE THE NEED FOR RCS DEPRESSURIZAT	5.00E-01	LPM-MAN05
5	1.40E-07	.25	LOSS OF CCS/SWS WITH RCS FILLED INITIATING EVENT OCCURS	3.99E-03	IEV-CCWND
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATI	5.06E-01	REC-MANDASC
			CCF OF ORIFICES	2.77E-04	CCX-ORY-SP
			PRN-MAN01	5.00E-01	PRN-MAN01
			OPERATOR FAILS TO ACTUATE ADS BEFORE CORE DAMAGE	5.00E-01	ADN-MAN01
6	1.18E-07	.21	OVERDRAINING OF RCS DURING DRAIN DOWN TO MID-LOOP INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC	5.00E-01	RHN-MAN04-SUCC
			OPERATOR FAILS TO ACTUATE IRWST INJECTION	5.00E-01	IWN-MAN00
			MECHANICAL FAILURE CAUSES MOV 023 TO FAIL-TO-OPEN	2.21E-03	RN23MOD5S

7	1.18E-07	.21	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04 IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01 RHN-MAN04
			COND. PROB. OF	IWN-MAN00 (OP. FAILS TO ACTUATE IRWST INJ)			5.00E-01 IWN-MAN00C
			MECHANICAL	FAILURE CAUSES	MOV 023 TO	FAIL-TO-OPEN	2.21E-03 RN23MOD5S
8	1.04E-07	.19	LOSS OF CCS/SWS	WITH RCS FILLED	INITIATING EVENT OCCURS		3.99E-03 IEV-CCWND
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL DAS ACTUATI		5.06E-01 REC-MANDASC
			COMMON MODE	FAILURE OF INPUT	LOGIC GROUPS		1.03E-04 CCX-INPUT-
LOGIC							
			OPERATOR FAILS	TO RECOGNIZE THE	NEED FOR RCS	DEPRESSURIZAT	5.00E-01 LPM-MAN05
9	1.01E-07	.18	LOSS OF CCS/SWS	WITH RCS FILLED	INITIATING EVENT OCCURS		3.99E-03 IEV-CCWND
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL DAS ACTUATI		5.06E-01 REC-MANDASC
			CCF OF PRESSURE	TRANSMITTERS			2.01E-04 CCX-XMTR195
			PRN-MAN01				5.00E-01 PRN-MAN01
			OPERATOR FAILS	TO ACTUATE ADS	BEFORE CORE	DAMAGE	5.00E-01 ADN-MAN01
10	7.20E-08	.13	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT OCCURS		7.16E-04 IEV-CCWD
			IWX-XMTR				2.01E-04 IWX-XMTR
			REN-MAN04				5.00E-01 REN-MAN04
11	7.15E-08	.13	LOSS OF RNS WITH	RCS FILLED	INITIATING EVENT OCCURS		1.02E-03 IEV-RNSND
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL DAS ACTUATI		5.06E-01 REC-MANDASC
			CCF OF ORIFICES				2.77E-04 CCX-ORY-SP
			OPERATOR FAILS	TO RECOGNIZE THE	NEED FOR RCS	DEPRESSURIZAT	5.00E-01 LPM-MAN05
12	5.19E-08	.09	LOSS OF RNS WITH	RCS FILLED	INITIATING EVENT OCCURS		1.02E-03 IEV-RNSND
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL DAS ACTUATI		5.06E-01 REC-MANDASC
			CCF OF PRESSURE	TRANSMITTERS			2.01E-04 CCX-XMTR195
			OPERATOR FAILS	TO RECOGNIZE THE	NEED FOR RCS	DEPRESSURIZAT	5.00E-01 LPM-MAN05
13	2.66E-08	.05	LOSS OF RNS WITH	RCS FILLED	INITIATING EVENT OCCURS		1.02E-03 IEV-RNSND
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL DAS ACTUATI		5.06E-01 REC-MANDASC
			COMMON MODE	FAILURE OF INPUT	LOGIC GROUPS		1.03E-04 CCX-INPUT-
LOGIC							
			OPERATOR FAILS	TO RECOGNIZE THE	NEED FOR RCS	DEPRESSURIZAT	5.00E-01 LPM-MAN05
14	2.15E-08	.04	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT OCCURS		7.16E-04 IEV-CCWD
			CCF OF ADS 4TH STAGE SQUIB VALVES		TO OPEN		3.00E-05 ADX-EV-SA
15	1.87E-08	.03	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT OCCURS		7.16E-04 IEV-CCWD

			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL DAS ACTUATI		5.06E-01	REC-MANDASC
			COMMON MODE	FAILURE OF INPUT	LOGIC GROUPS		1.03E-04	CCX-INPUT-
LOGIC								
			OPERATOR FAILS	TO ACTUATE ADS	BEFORE CORE	DAMAGE	5.00E-01	ADN-MAN01
16	1.86E-08	.03	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT OCCURS		7.16E-04	IEV-CCWD
			IWX-MV-GO1				2.60E-05	IWX-MV-GO1
17	1.86E-08	.03	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT OCCURS		7.16E-04	IEV-CCWD
			IWX-EV4-SA				2.60E-05	IWX-EV4-SA
18	1.72E-08	.03	LOSS OF CCS/SWS	WITH RCS FILLED	INITIATING EVENT OCCURS		3.99E-03	IEV-CCWND
			FAILURE OF	MANUAL DAS	ACTUATION		5.00E-01	REC-MANDAS
			CCF OF THE POWER	INTERFACE OUTPUT	BOARDS IN PMS		8.62E-06	CCX-EP-SAM
19	1.71E-08	.03	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT OCCURS		7.16E-04	IEV-CCWD
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL DAS ACTUATI		5.06E-01	REC-MANDASC
			ORIFICE FAILURE	DUE TO PLUGGING			9.46E-05	IW1OR170SPX
			OPERATOR FAILS	TO ACTUATE ADS	BEFORE CORE	DAMAGE	5.00E-01	ADN-MAN01
20	1.71E-08	.03	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT OCCURS		7.16E-04	IEV-CCWD
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL DAS ACTUATI		5.06E-01	REC-MANDASC
			ORIFICE FAILURE	DUE TO PLUGGING			9.46E-05	IW2OR160SPX
			OPERATOR FAILS	TO ACTUATE ADS	BEFORE CORE	DAMAGE	5.00E-01	ADN-MAN01
21	1.69E-08	.03	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT OCCURS		7.16E-04	IEV-CCWD
			ORIFICE FAILURE	DUE TO PLUGGING			9.46E-05	IW2OR160SPX
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			COND. PROB. OF	RHN-MAN05 (OP.	FAILS TO OPEN	RNS MOV V023)	5.00E-01	RHN-MAN05C
22	1.69E-08	.03	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT OCCURS		7.16E-04	IEV-CCWD
			ORIFICE FAILURE	DUE TO PLUGGING			9.46E-05	IW1OR170SPX
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			COND. PROB. OF	RHN-MAN05 (OP.	FAILS TO OPEN	RNS MOV V023)	5.00E-01	RHN-MAN05C
23	1.66E-08	.03	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT OCCURS		7.16E-04	IEV-CCWD
			CCF OF ACTUATION	LOGIC GROUPS			4.63E-05	CCX-
PMAMOD1X								
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
24	1.60E-08	.03	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-

SUCC								
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			BUS UNAVAILABLE	DUE TO TEST OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDDBSDD1TM
25	1.60E-08	.03	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01	RHN-MAN04
			COND. PROB. OF	IWN-MAN00 (OP. FAILS TO ACTUATE IRWST INJ)			5.00E-01	IWN-MAN00C
			BUS UNAVAILABLE	DUE TO TEST OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDDBSDS1TM
26	1.60E-08	.03	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01	RHN-MAN04
			COND. PROB. OF	IWN-MAN00 (OP. FAILS TO ACTUATE IRWST INJ)			5.00E-01	IWN-MAN00C
			BUS UNAVAILABLE	DUE TO TEST OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDDBSDK1TM
27	1.60E-08	.03	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			BUS UNAVAILABLE	DUE TO TEST OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDDBSDK1TM
28	1.60E-08	.03	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01	RHN-MAN04
			COND. PROB. OF	IWN-MAN00 (OP. FAILS TO ACTUATE IRWST INJ)			5.00E-01	IWN-MAN00C
			BUS UNAVAILABLE	DUE TO TEST OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDDBSDD1TM
29	1.60E-08	.03	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			BUS UNAVAILABLE	DUE TO TEST OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDDBSDS1TM
30	1.54E-08	.03	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			CCF OF ACTUATION	LOGIC GROUPS			8.58E-05	CCX-
PMAMOD2X								
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			COND. PROB. OF	RHN-MAN05 (OP.	FAILS TO OPEN	RNS MOV V023)	5.00E-01	RHN-MAN05C
31	1.28E-08	.02	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			IRWST DISCHARGE	LINE "B"	STRAINER	PLUGGED	2.40E-04	IWB-PLUG

32	1.28E-08	.02	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01	RHN-MAN04
			COND. PROB. OF	IWN-MAN00 (OP.	FAILS TO ACTUATE	IRWST INJ)	5.00E-01	IWN-MAN00C
			IRWST DISCHARGE	LINE "B"	STRAINER	PLUGGED	2.40E-04	IWB-PLUG
33	1.24E-08	.02	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL	DAS ACTUATI	5.06E-01	REC-MANDASC
			LEVEL	TRANSMITTER	FAILURE		6.84E-05	IW2TL160UFX
			OPERATOR FAILS	TO ACTUATE ADS	BEFORE CORE	DAMAGE	5.00E-01	ADN-MAN01
34	1.24E-08	.02	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL	DAS ACTUATI	5.06E-01	REC-MANDASC
			LEVEL	TRANSMITTER	FAILURE		6.84E-05	IW1TL170UFX
			OPERATOR FAILS	TO ACTUATE ADS	BEFORE CORE	DAMAGE	5.00E-01	ADN-MAN01
35	1.22E-08	.02	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			LEVEL	TRANSMITTER	FAILURE		6.84E-05	IW2TL160UFX
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			COND. PROB. OF	RHN-MAN05 (OP.	FAILS TO OPEN	RNS MOV V023)	5.00E-01	RHN-MAN05C
36	1.22E-08	.02	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			LEVEL	TRANSMITTER	FAILURE		6.84E-05	IW1TL170UFX
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			COND. PROB. OF	RHN-MAN05 (OP.	FAILS TO OPEN	RNS MOV V023)	5.00E-01	RHN-MAN05C
37	1.07E-08	.02	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			CCF OF GRAVITY	INJECTION CHECK	VALVES TO OPEN		3.00E-05	IWX-CV-AO
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
38	1.07E-08	.02	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01	RHN-MAN04
			IWX-XMTR				2.01E-04	IWX-XMTR
			REN-MAN04				5.00E-01	REN-MAN04
39	1.07E-08	.02	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			IWX-XMTR				2.01E-04	IWX-XMTR
			REN-MAN04				5.00E-01	REN-MAN04
40	9.74E-09	.02	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05	IEV-RNSD

			IWX-XMTR				2.01E-04	IWX-XMTR
			REN-MAN04				5.00E-01	REN-MAN04
41	9.11E-09	.02	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01	RHN-MAN04
			COND. PROB. OF	IWN-MAN00 (OP. FAILS TO ACTUATE IRWST INJ)			5.00E-01	IWN-MAN00C
			FAILURE OF	OUTPUT DRIVER			1.71E-04	RNDEP023SA
42	9.11E-09	.02	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			FAILURE OF	OUTPUT DRIVER			1.71E-04	RNDEP023SA
43	8.59E-09	.02	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			REX-FL-GP				1.20E-05	REX-FL-GP
44	8.59E-09	.02	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			CCF OF STRAINERS	IN IRWST TANK			1.20E-05	IWX-FL-GP
45	8.30E-09	.02	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS FILL	1.82E-02	IEV-LOSPND
			OFFSITE	AC POWER	RECOVERED IN	2 HOURS	7.60E-01	SUC-R2S
			SOFTWARE CCF	OF ALL CARDS			1.20E-06	CCX-SFTW
			FAILURE OF	MANUAL DAS	ACTUATION		5.00E-01	REC-MANDAS
46	7.51E-09	.01	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			CMF OF OUTPUT	LOGIC I/Os			1.41E-04	CCX-PMDMOD1
47	7.51E-09	.01	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01	RHN-MAN04
			COND. PROB. OF	IWN-MAN00 (OP. FAILS TO ACTUATE IRWST INJ)			5.00E-01	IWN-MAN00C
			CMF OF OUTPUT	LOGIC I/Os			1.41E-04	CCX-PMDMOD1
48	6.26E-09	.01	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			BATTERY	DB1	UNAVAILABLE		2.70E-03	ED1MOD03
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		2.09E-03	PMAMOD11
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN RNS MOV V023		5.00E-01	RHN-MAN05

49	5.53E-09	.01	LOSS OF CCS/SWS	WITH RCS FILLED	INITIATING EVENT	OCCURS	3.99E-03	IEV-CCWND
			FAILURE OF	MANUAL DAS	REACTOR TRIP	HARDWARE	1.00E-02	MDAS
			CCF OF ORIFICES				2.77E-04	CCX-ORY-SP
			OPERATOR FAILS	TO RECOGNIZE THE	NEED FOR RCS	DEPRESSURIZAT	5.00E-01	LPM-MAN05
50	5.16E-09	.01	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			CMF OF OUTPUT	LOGIC GROUPS			9.69E-05	CCX-PMD030
51	5.16E-09	.01	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01	RHN-MAN04
			COND. PROB. OF	IWN-MAN00 (OP.	FAILS TO ACTUATE	IRWST INJ)	5.00E-01	IWN-MAN00C
			CMF OF OUTPUT	LOGIC GROUPS			9.69E-05	CCX-PMD030
52	4.94E-09	.01	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			CCF OF LOGIC	GROUP PROCESSING			1.38E-05	CCX-PMA030X
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
53	4.64E-09	.01	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			CCF OF INPUT	LOGIC GROUPS			2.59E-05	CCX-INPUT-
LOGICX								
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			COND. PROB. OF	RHN-MAN05 (OP.	FAILS TO OPEN	RNS MOV V023)	5.00E-01	RHN-MAN05C
54	4.63E-09	.01	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			CCF TO START	OF ENGINE-DRIVEN	FUEL PUMPS		2.00E-03	ZOX-PD-ES
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		2.09E-03	PMAMOD11
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
55	4.40E-09	.01	LOSS OF RNS WITH	RCS FILLED	INITIATING EVENT	OCCURS	1.02E-03	IEV-RNSND
			FAILURE OF	MANUAL DAS	ACTUATION		5.00E-01	REC-MANDAS
			CCF OF THE POWER	INTERFACE OUTPUT	BOARDS IN PMS		8.62E-06	CCX-EP-SAM
56	4.01E-09	.01	LOSS OF CCS/SWS	WITH RCS FILLED	INITIATING EVENT	OCCURS	3.99E-03	IEV-CCWND
			FAILURE OF	MANUAL DAS	REACTOR TRIP	HARDWARE	1.00E-02	MDAS
			CCF OF PRESSURE	TRANSMITTERS			2.01E-04	CCX-XMTR195
			OPERATOR FAILS	TO RECOGNIZE THE	NEED FOR RCS	DEPRESSURIZAT	5.00E-01	LPM-MAN05
57	3.94E-09	.01	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD

			SOFTWARE CCF OF	OUTPUT LOGIC	I/Os		1.10E-05	CCX-
PMAMOD1-SW								
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
58	3.67E-09	.01	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			OFFSITE	AC POWER	RECOVERED IN	1 HOUR	5.80E-01	SUC-R1S
			SOFTWARE CCF	OF ALL CARDS			1.20E-06	CCX-SFTW
59	3.47E-09	.01	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			BATTERY	DB1	UNAVAILABLE		2.70E-03	ED1MOD03
			FAILURE UPON	DEMAND OF LOGIC	GROUP PROCESSING		1.16E-03	PMA0301ASA
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
60	3.47E-09	.01	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			BATTERY	DB1	UNAVAILABLE		2.70E-03	ED1MOD03
			FAILURE UPON	DEMAND OF LOGIC	GROUP PROCESSING		1.16E-03	PMA0301BSA
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
61	3.20E-09	.01	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			CCF OF ADS 4TH STAGE SQUIB VALVES		TO OPEN		3.00E-05	ADX-EV-SA
62	3.20E-09	.01	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01	RHN-MAN04
			CCF OF ADS 4TH STAGE SQUIB VALVES		TO OPEN		3.00E-05	ADX-EV-SA
63	3.09E-09	.01	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			FAILURE OF	MANUAL DAS	ACTUATION		5.00E-01	REC-MANDAS
			CCF OF THE POWER	INTERFACE OUTPUT	BOARDS IN PMS		8.62E-06	CCX-EP-SAM
64	2.91E-09	.01	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05	IEV-RNSD
			CCF OF ADS 4TH STAGE SQUIB VALVES		TO OPEN		3.00E-05	ADX-EV-SA
65	2.78E-09	.01	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			COMMON CAUSE	FAILURE	4KV BREAKERS TO	OPEN	1.20E-03	ECX-CB-GO
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		2.09E-03	PMAMOD11
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05

66	2.78E-09	.01	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL	DAS ACTUATI	5.06E-01	REC-MANDASC
			COMMON MODE	FAILURE OF INPUT	LOGIC GROUPS		1.03E-04	CCX-INPUT-
LOGIC								
			OPERATOR FAILS	TO ACTUATE ADS	BEFORE CORE	DAMAGE	5.00E-01	ADN-MAN01
67	2.77E-09	.01	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01	RHN-MAN04
			IWX-MV-G01				2.60E-05	IWX-MV-G01
68	2.77E-09	.01	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01	RHN-MAN04
			IWX-EV4-SA				2.60E-05	IWX-EV4-SA
69	2.77E-09	.01	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			IWX-EV4-SA				2.60E-05	IWX-EV4-SA
70	2.77E-09	.01	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			IWX-MV-G01				2.60E-05	IWX-MV-G01
71	2.76E-09	.00	LOSS OF CCS/SWS	WITH RCS FILLED	INITIATING EVENT	OCCURS	3.99E-03	IEV-CCWND
			FAILURE OF	MANUAL DAS	REACTOR TRIP	HARDWARE	1.00E-02	MDAS
			CCF OF ORIFICES				2.77E-04	CCX-ORY-SP
			PRN-MAN01				5.00E-01	PRN-MAN01
			OPERATOR FAILS	TO ACTUATE ADS	BEFORE CORE	DAMAGE	5.00E-01	ADN-MAN01
72	2.66E-09	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			SOFTWARE CCF	OF ALL CARDS			1.20E-06	CCX-SFTW
73	2.65E-09	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			CCF OF MUX	LOGIC GROUPS			4.98E-05	CCX-PMAMOD4
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05

74	2.65E-09	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01	RHN-MAN04
			CCF OF MUX	LOGIC GROUPS			4.98E-05	CCX-PMAMOD4
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
75	2.65E-09	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01	RHN-MAN04
			COND. PROB. OF	IWN-MAN00 (OP. FAILS TO ACTUATE IRWST INJ)			5.00E-01	IWN-MAN00C
			CMF OF MUX	LOGIC GROUPS			4.98E-05	CCX-PMDMOD4
76	2.65E-09	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			CMF OF MUX	LOGIC GROUPS			4.98E-05	CCX-PMDMOD4
77	2.62E-09	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS FILL	1.82E-02	IEV-LOSPND
			FAILURE TO	RECOVER AC POWER	IN 2 HOURS		2.40E-01	OTH-R2
			SOFTWARE CCF	OF ALL CARDS			1.20E-06	CCX-SFTW
			FAILURE OF	MANUAL DAS	ACTUATION		5.00E-01	REC-MANDAS
78	2.60E-09	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			CCF OF ORIFICES				3.63E-06	CCX-ORY-SPX
79	2.57E-09	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			CCF TO START	OF ENGINE-DRIVEN	FUEL PUMPS		2.00E-03	ZOX-PD-ES
			FAILURE UPON	DEMAND OF LOGIC	GROUP PROCESSING		1.16E-03	PMA0301ASA
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
80	2.57E-09	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			CCF TO START	OF ENGINE-DRIVEN	FUEL PUMPS		2.00E-03	ZOX-PD-ES
			FAILURE UPON	DEMAND OF LOGIC	GROUP PROCESSING		1.16E-03	PMA0301BSA
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
81	2.55E-09	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL	DAS ACTUATI	5.06E-01	REC-MANDASC
			ORIFICE FAILURE	DUE TO PLUGGING			9.46E-05	IW2OR160SPX
			OPERATOR FAILS	TO ACTUATE ADS	BEFORE CORE	DAMAGE	5.00E-01	ADN-MAN01

82	2.55E-09	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04 IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01 RHN-MAN04-
SUCC							
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL	DAS ACTUATI	5.06E-01 REC-MANDASC
			ORIFICE FAILURE	DUE TO PLUGGING			9.46E-05 IW1OR170SPX
			OPERATOR FAILS	TO ACTUATE ADS	BEFORE CORE	DAMAGE	5.00E-01 ADN-MAN01
83	2.53E-09	.00	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05 IEV-RNSD
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL	DAS ACTUATI	5.06E-01 REC-MANDASC
			COMMON MODE	FAILURE OF INPUT	LOGIC GROUPS		1.03E-04 CCX-INPUT-
LOGIC							
			OPERATOR FAILS	TO ACTUATE ADS	BEFORE CORE	DAMAGE	5.00E-01 ADN-MAN01
84	2.52E-09	.00	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05 IEV-RNSD
			IWX-MV-GO1				2.60E-05 IWX-MV-GO1
85	2.52E-09	.00	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05 IEV-RNSD
			IWX-EV4-SA				2.60E-05 IWX-EV4-SA
86	2.47E-09	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04 IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01 RHN-MAN04-
SUCC							
			CCF OF ACTUATION	LOGIC GROUPS			4.63E-05 CCX-
PMAMOD1X							
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01 RHN-MAN05
87	2.47E-09	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04 IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01 RHN-MAN04
			CCF OF ACTUATION	LOGIC GROUPS			4.63E-05 CCX-
PMAMOD1X							
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01 RHN-MAN05
88	2.39E-09	.00	LOSS OF CCS/SWS	WITH RCS FILLED	INITIATING EVENT	OCCURS	3.99E-03 IEV-CCWND
			SOFTWARE CCF	OF ALL CARDS			1.20E-06 CCX-SFTW
			FAILURE OF	MANUAL DAS	ACTUATION		5.00E-01 REC-MANDAS
89	2.32E-09	.00	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05 IEV-RNSD
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL	DAS ACTUATI	5.06E-01 REC-MANDASC
			ORIFICE FAILURE	DUE TO PLUGGING			9.46E-05 IW2OR160SPX
			OPERATOR FAILS	TO ACTUATE ADS	BEFORE CORE	DAMAGE	5.00E-01 ADN-MAN01

90	2.32E-09	.00	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05	IEV-RNSD
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL	DAS ACTUATI	5.06E-01	REC-MANDASC
			ORIFICE FAILURE	DUE TO PLUGGING			9.46E-05	IW1OR170SPX
			OPERATOR FAILS	TO ACTUATE ADS	BEFORE CORE	DAMAGE	5.00E-01	ADN-MAN01
91	2.29E-09	.00	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05	IEV-RNSD
			ORIFICE FAILURE	DUE TO PLUGGING			9.46E-05	IW2OR160SPX
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			COND. PROB. OF	RHN-MAN05 (OP.	FAILS TO OPEN	RNS MOV V023)	5.00E-01	RHN-MAN05C
92	2.29E-09	.00	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05	IEV-RNSD
			ORIFICE FAILURE	DUE TO PLUGGING			9.46E-05	IW1OR170SPX
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			COND. PROB. OF	RHN-MAN05 (OP.	FAILS TO OPEN	RNS MOV V023)	5.00E-01	RHN-MAN05C
93	2.24E-09	.00	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05	IEV-RNSD
			CCF OF ACTUATION	LOGIC GROUPS			4.63E-05	CCX-
PMAMOD1X								
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
94	2.08E-09	.00	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05	IEV-RNSD
			CCF OF ACTUATION	LOGIC GROUPS			8.58E-05	CCX-
PMAMOD2X								
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			COND. PROB. OF	RHN-MAN05 (OP.	FAILS TO OPEN	RNS MOV V023)	5.00E-01	RHN-MAN05C
95	2.05E-09	.00	LOSS OF CCS/SWS	WITH RCS FILLED	INITIATING EVENT	OCCURS	3.99E-03	IEV-CCWND
			FAILURE OF	MANUAL DAS	REACTOR TRIP	HARDWARE	1.00E-02	MDAS
			COMMON MODE	FAILURE OF INPUT	LOGIC GROUPS		1.03E-04	CCX-INPUT-
LOGIC								
			OPERATOR FAILS	TO RECOGNIZE THE	NEED FOR RCS	DEPRESSURIZAT	5.00E-01	LPM-MAN05
96	2.00E-09	.00	LOSS OF CCS/SWS	WITH RCS FILLED	INITIATING EVENT	OCCURS	3.99E-03	IEV-CCWND
			FAILURE OF	MANUAL DAS	REACTOR TRIP	HARDWARE	1.00E-02	MDAS
			CCF OF PRESSURE	TRANSMITTERS			2.01E-04	CCX-XMTR195
			PRN-MAN01				5.00E-01	PRN-MAN01
			OPERATOR FAILS	TO ACTUATE ADS	BEFORE CORE	DAMAGE	5.00E-01	ADN-MAN01
97	1.97E-09	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			CCF OF SOFTWARE	FOR INPUT LOGIC	GROUPS		1.10E-05	CCX-IN-
LOGIC-SW								
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00

			COND. PROB. OF	RHN-MAN05 (OP.	FAILS TO OPEN	RNS MOV V023)	5.00E-01	RHN-MAN05C
98	1.97E-09	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			CCF OF SOFTWARE	FOR ACTUATION	LOGIC GROUPS		1.10E-05	CCX-
PMAMOD2-SW								
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			COND. PROB. OF	RHN-MAN05 (OP.	FAILS TO OPEN	RNS MOV V023)	5.00E-01	RHN-MAN05C
99	1.88E-09	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			CCF OF PRESSURE	TRANSMITTERS			2.63E-06	CCX-XMTRX
100	1.84E-09	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL	DAS ACTUATI	5.06E-01	REC-MANDASC
			LEVEL	TRANSMITTER	FAILURE		6.84E-05	IW2TL160UFX
			OPERATOR FAILS	TO ACTUATE ADS	BEFORE CORE	DAMAGE	5.00E-01	ADN-MAN01
101	1.84E-09	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL	DAS ACTUATI	5.06E-01	REC-MANDASC
			LEVEL	TRANSMITTER	FAILURE		6.84E-05	IW1TL170UFX
			OPERATOR FAILS	TO ACTUATE ADS	BEFORE CORE	DAMAGE	5.00E-01	ADN-MAN01
102	1.74E-09	.00	LOCA/RNS-V024	OPENS INITIATING	EVENT OCCURS	WITH RCS FILL	1.73E-05	IEV-
LOCA24ND								
			IWX-XMTR				2.01E-04	IWX-XMTR
			REN-MAN04				5.00E-01	REN-MAN04
103	1.69E-09	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			COMMON CAUSE	FAILURE	4KV BREAKER TO	CLOSE	7.30E-04	ECX-CB-GC
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		2.09E-03	PMAMOD11
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
104	1.68E-09	.00	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05	IEV-RNSD
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL	DAS ACTUATI	5.06E-01	REC-MANDASC
			LEVEL	TRANSMITTER	FAILURE		6.84E-05	IW1TL170UFX
			OPERATOR FAILS	TO ACTUATE ADS	BEFORE CORE	DAMAGE	5.00E-01	ADN-MAN01
105	1.68E-09	.00	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05	IEV-RNSD

			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL	DAS ACTUATI	5.06E-01	REC-MANDASC
			LEVEL	TRANSMITTER	FAILURE		6.84E-05	IW2TL160UFX
			OPERATOR FAILS	TO ACTUATE ADS	BEFORE CORE	DAMAGE	5.00E-01	ADN-MAN01
106	1.66E-09	.00	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05	IEV-RNSD
			LEVEL	TRANSMITTER	FAILURE		6.84E-05	IW2TL160UFX
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			COND. PROB. OF	RHN-MAN05 (OP.	FAILS TO OPEN	RNS MOV V023)	5.00E-01	RHN-MAN05C
107	1.66E-09	.00	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05	IEV-RNSD
			LEVEL	TRANSMITTER	FAILURE		6.84E-05	IW1TL170UFX
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			COND. PROB. OF	RHN-MAN05 (OP.	FAILS TO OPEN	RNS MOV V023)	5.00E-01	RHN-MAN05C
108	1.60E-09	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			CCF OF GRAVITY	INJECTION CHECK	VALVES TO OPEN		3.00E-05	IWX-CV-AO
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
109	1.60E-09	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01	RHN-MAN04
			CCF OF GRAVITY	INJECTION CHECK	VALVES TO OPEN		3.00E-05	IWX-CV-AO
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
110	1.54E-09	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			BATTERY	DB1	UNAVAILABLE		2.70E-03	ED1MOD03
			FAILURE OF INV.,	STATIC SWITCH	AND ASSOC.	BREAKERS	5.16E-04	IDAMOD05
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
111	1.54E-09	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			COMMON CAUSE	FAILURE	4KV BREAKERS TO	OPEN	1.20E-03	ECX-CB-GO
			FAILURE UPON	DEMAND OF LOGIC	GROUP PROCESSING		1.16E-03	PMA0301ASA
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
112	1.54E-09	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			COMMON CAUSE	FAILURE	4KV BREAKERS TO	OPEN	1.20E-03	ECX-CB-GO
			FAILURE UPON	DEMAND OF LOGIC	GROUP PROCESSING		1.16E-03	PMA0301BSA
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05

113	1.45E-09	.00	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05	IEV-RNSD
			CCF OF GRAVITY	INJECTION CHECK	VALVES TO OPEN		3.00E-05	IWX-CV-AO
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
114	1.41E-09	.00	LOSS OF RNS WITH	RCS FILLED	INITIATING EVENT	OCCURS	1.02E-03	IEV-RNSND
			FAILURE OF	MANUAL DAS	REACTOR TRIP	HARDWARE	1.00E-02	MDAS
			CCF OF ORIFICES				2.77E-04	CCX-ORY-SP
			OPERATOR FAILS	TO RECOGNIZE THE	NEED FOR RCS	DEPRESSURIZAT	5.00E-01	LPM-MAN05
115	1.28E-09	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			CCF OF STRAINERS	IN IRWST TANK			1.20E-05	IWX-FL-GP
116	1.28E-09	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			REX-FL-GP				1.20E-05	REX-FL-GP
117	1.28E-09	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01	RHN-MAN04
			REX-FL-GP				1.20E-05	REX-FL-GP
118	1.28E-09	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01	RHN-MAN04
			CCF OF STRAINERS	IN IRWST TANK			1.20E-05	IWX-FL-GP
119	1.21E-09	.00	LOCA/RNS-V024	OPENS INITIATING	EVENT OCCURS	WITH RCS FILL	1.73E-05	IEV-
LOCA24ND								
			CCF OF ORIFICES				2.77E-04	CCX-ORY-SP
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL	DAS ACTUATI	5.06E-01	REC-MANDASC
			OPERATOR FAILS	TO ACTUATE ADS	BEFORE CORE	DAMAGE	5.00E-01	ADN-MAN01
120	1.21E-09	.00	LOCA/RNS-V024	OPENS INITIATING	EVENT OCCURS	WITH RCS FILL	1.73E-05	IEV-
LOCA24ND								
			CCF OF ORIFICES				2.77E-04	CCX-ORY-SP
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL	DAS ACTUATI	5.06E-01	REC-MANDASC
			OPERATOR FAILS	TO RECOGNIZE THE	NEED FOR RCS	DEPRESSURIZAT	5.00E-01	LPM-MAN05
121	1.16E-09	.00	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05	IEV-RNSD
			REX-FL-GP				1.20E-05	REX-FL-GP

122	1.16E-09	.00	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05	IEV-RNSD
			CCF OF STRAINERS	IN IRWST TANK			1.20E-05	IWX-FL-GP
123	1.16E-09	.00	LOCA/RNS-V024	OPENS INITIATING	EVENT OCCURS	WITH RCS DRAI	1.15E-05	IEV-LOCA24D
			IWX-XMTR				2.01E-04	IWX-XMTR
			REN-MAN04				5.00E-01	REN-MAN04
124	1.14E-09	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			CCF TO START	OF ENGINE-DRIVEN	FUEL PUMPS		2.00E-03	ZOX-PD-ES
			FAILURE OF INV.,	STATIC SWITCH	AND ASSOC.	BREAKERS	5.16E-04	IDAMOD05
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
125	1.14E-09	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			PUMP MP 01B	SEGMENT HARDWARE	FAILURE OR	DIVERTED FLOW	2.44E-02	SWBMOD02
			D/G FAILS TO	START & RUN OR	BKR 102 FAILS TO	CLOSE	2.02E-02	ZO1MOD01
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		2.09E-03	PMAMOD11
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
126	1.13E-09	.00	LOCA/RNS PIPE	RUPTURE WITH RCS	FILLED INIT.	EVENT OCCURS	1.61E-05	IEV-
LOCAPRND								
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL	DAS ACTUATI	5.06E-01	REC-MANDASC
			CCF OF ORIFICES				2.77E-04	CCX-ORY-SP
			OPERATOR FAILS	TO RECOGNIZE THE	NEED FOR RCS	DEPRESSURIZAT	5.00E-01	LPM-MAN05
127	1.05E-09	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			CCF OF THE POWER	INTERFACE OUTPUT	BOARDS IN PMS		2.94E-06	CCX-EP-SAMX
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
128	1.03E-09	.00	LOSS OF RNS WITH	RCS FILLED	INITIATING EVENT	OCCURS	1.02E-03	IEV-RNSND
			FAILURE OF	MANUAL DAS	REACTOR TRIP	HARDWARE	1.00E-02	MDAS
			CCF OF PRESSURE	TRANSMITTERS			2.01E-04	CCX-XMTR195
			OPERATOR FAILS	TO RECOGNIZE THE	NEED FOR RCS	DEPRESSURIZAT	5.00E-01	LPM-MAN05
129	1.02E-09	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			COMMON CAUSE	FAILURE	STANDBY DG TO	RUN	4.40E-04	ZOX-DG-DR
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		2.09E-03	PMAMOD11
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05

130	9.49E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			BATTERY	DB1	UNAVAILABLE		2.70E-03	ED1MOD03
			LOSS OF DIST.	PANEL OR BREAKER	A07 SPURIOUSLY	OPENS	3.17E-04	IDAMOD04
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
131	9.46E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			D/G FAILS TO	START & RUN OR	BKR 102 FAILS TO	CLOSE	2.02E-02	ZO1MOD01
			D/G FAILS TO	START & RUN OR	BKR 202 FAILS TO	CLOSE	2.02E-02	ZO2MOD01
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		2.09E-03	PMAMOD11
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
132	9.39E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			COMMON CAUSE	FAILURE	4KV BREAKER TO	CLOSE	7.30E-04	ECX-CB-GC
			FAILURE UPON	DEMAND OF LOGIC	GROUP PROCESSING		1.16E-03	PMA0301ASA
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
133	9.39E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			COMMON CAUSE	FAILURE	4KV BREAKER TO	CLOSE	7.30E-04	ECX-CB-GC
			FAILURE UPON	DEMAND OF LOGIC	GROUP PROCESSING		1.16E-03	PMA0301BSA
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
134	8.98E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			BATTERY	DB1	UNAVAILABLE		2.70E-03	ED1MOD03
			BUS UNAVAILABLE	DUE TO TEST OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDABSDS1TM
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
135	8.80E-10	.00	LOCA/RNS-V024	OPENS INITIATING	EVENT OCCURS	WITH RCS FILL	1.73E-05	IEV-
LOCA24ND								
			CCF OF PRESSURE	TRANSMITTERS			2.01E-04	CCX-XMTR195
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL	DAS ACTUATI	5.06E-01	REC-MANDASC
			OPERATOR FAILS	TO ACTUATE ADS	BEFORE CORE	DAMAGE	5.00E-01	ADN-MAN01
136	8.80E-10	.00	LOCA/RNS-V024	OPENS INITIATING	EVENT OCCURS	WITH RCS FILL	1.73E-05	IEV-
LOCA24ND								
			CCF OF PRESSURE	TRANSMITTERS			2.01E-04	CCX-XMTR195
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL	DAS ACTUATI	5.06E-01	REC-MANDASC
			OPERATOR FAILS	TO RECOGNIZE THE	NEED FOR RCS	DEPRESSURIZAT	5.00E-01	LPM-MAN05

137	8.59E-10	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			SOFTWARE CCF	OF ALL CARDS			1.20E-06	CCX-SFTW
138	8.19E-10	.00	LOCA/RNS PIPE	RUPTURE WITH RCS	FILLED INIT.	EVENT OCCURS	1.61E-05	IEV-
LOCAPRND								
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL	DAS ACTUATI	5.06E-01	REC-MANDASC
			CCF OF PRESSURE	TRANSMITTERS			2.01E-04	CCX-XMTR195
			OPERATOR FAILS	TO RECOGNIZE THE	NEED FOR RCS	DEPRESSURIZAT	5.00E-01	LPM-MAN05
139	8.09E-10	.00	LOCA/RNS PIPE	RUPTURE WITH RCS	FILLED INIT.	EVENT OCCURS	1.61E-05	IEV-
LOCAPRND								
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01	RHN-MAN04
			IWX-XMTR				2.01E-04	IWX-XMTR
			REN-MAN04				5.00E-01	REN-MAN04
140	7.35E-10	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			CCF OF LOGIC	GROUP PROCESSING			1.38E-05	CCX-PMA030X
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
141	7.35E-10	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01	RHN-MAN04
			CCF OF LOGIC	GROUP PROCESSING			1.38E-05	CCX-PMA030X
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
142	7.35E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			FIXED	COMPONENTS	FAILURE		3.17E-04	ED1MOD113
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		2.09E-03	PMAMOD11
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
143	7.35E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			FIXED	COMPONENTS	FAILURE		3.17E-04	ED1MOD11
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		2.09E-03	PMAMOD11
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
144	7.16E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			PUMP 01B FAILS &	ST CK V007B & C	B FTC & RE FTC &	CB ECS221 SPO	1.53E-02	RNBMOD07S

			D/G FAILS TO	START & RUN OR	BKR 102 FAILS TO	CLOSE	2.02E-02	ZO1MOD01
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		2.09E-03	PMAMOD11
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
145	7.03E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			CCF TO START	OF ENGINE-DRIVEN	FUEL PUMPS		2.00E-03	ZOX-PD-ES
			LOSS OF DIST.	PANEL OR BREAKER	A07 SPURIOUSLY	OPENS	3.17E-04	IDAMOD04
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
146	6.95E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			PUMP MP 01B	SEGMENT HARDWARE	FAILURE OR	DIVERTED FLOW	2.44E-02	SWBMOD02
			BREAKER 100	FAILS TO OPEN		[#3	1.23E-02	EC1CB100VO
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		2.09E-03	PMAMOD11
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
147	6.87E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			COMMON CAUSE	FAILURE	4KV BREAKERS TO	OPEN	1.20E-03	ECX-CB-GO
			FAILURE OF INV.,	STATIC SWITCH	AND ASSOC.	BREAKERS	5.16E-04	IDAMOD05
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
148	6.69E-10	.00	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05	IEV-RNSD
			CCF OF LOGIC	GROUP PROCESSING			1.38E-05	CCX-PMA030X
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
149	6.65E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			CCF TO START	OF ENGINE-DRIVEN	FUEL PUMPS		2.00E-03	ZOX-PD-ES
			BUS UNAVAILABLE	DUE TO TEST OR	CORRECTIVE	MAINTENANCE	3.00E-04	IDABSDS1TM
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
150	6.49E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			COMMON CAUSE	FAILURE	STANDBY DG TO	START	2.80E-04	ZOX-DG-DS
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		2.09E-03	PMAMOD11
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
151	6.39E-10	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01	RHN-MAN04
			COND. PROB. OF	IWN-MAN00 (OP. FAILS TO ACTUATE IRWST INJ)			5.00E-01	IWN-MAN00C

			FUSE DISCONNECT	SWITCH (FD19)	SPURIOUSLY OPENS		1.20E-05	IDDFD019RQ
152	6.39E-10	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01	RHN-MAN04
			COND. PROB. OF	IWN-MAN00 (OP.	FAILS TO ACTUATE IRWST INJ)		5.00E-01	IWN-MAN00C
			FUSE DISCONNECT	SWITCH (FD20)	SPURIOUSLY OPENS		1.20E-05	IDDFD020RQ
153	6.39E-10	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			FUSE DISCONNECT	SWITCH (FD19)	SPURIOUSLY OPENS		1.20E-05	IDDFD019RQ
154	6.39E-10	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			FUSE DISCONNECT	SWITCH (FD20)	SPURIOUSLY OPENS		1.20E-05	IDDFD020RQ
155	6.34E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			PUMP MP 01B	SEGMENT HARDWARE	FAILURE OR	DIVERTED FLOW	2.44E-02	SWBMOD02
			D/G FAILS TO	START & RUN OR	BKR 102 FAILS TO	CLOSE	2.02E-02	ZO1MOD01
			FAILURE UPON	DEMAND OF LOGIC	GROUP PROCESSING		1.16E-03	PMA0301ASA
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
156	6.34E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			PUMP MP 01B	SEGMENT HARDWARE	FAILURE OR	DIVERTED FLOW	2.44E-02	SWBMOD02
			D/G FAILS TO	START & RUN OR	BKR 102 FAILS TO	CLOSE	2.02E-02	ZO1MOD01
			FAILURE UPON	DEMAND OF LOGIC	GROUP PROCESSING		1.16E-03	PMA0301BSA
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
157	6.31E-10	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		6.53E-04	PMAMOD11X
			BUS UNAVAILABLE	DUE TO	UNSCHEDULED	MAINTENANCE	2.70E-03	EC1BS121TM
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
158	6.31E-10	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		6.53E-04	PMAMOD11X
			UNAVAILABILITY	OF BUS ECS ES 1	DUE TO UNSCHEDUL	MAINTENANCE	2.70E-03	EC1BS001TM
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05

159	6.31E-10	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		6.53E-04	PMAMOD11X
			BUS UNAVAILABLE	DUE TO	UNSCHEDULED	MAINTENANCE	2.70E-03	EC1BS012TM
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
160	6.27E-10	.00	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05	IEV-RNSD
			CCF OF INPUT	LOGIC GROUPS			2.59E-05	CCX-INPUT-
LOGICX								
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			COND. PROB. OF	RHN-MAN05 (OP.	FAILS TO OPEN	RNS MOV V023)	5.00E-01	RHN-MAN05C
161	6.12E-10	.00	LOSS OF RNS WITH	RCS FILLED	INITIATING EVENT	OCCURS	1.02E-03	IEV-RNSND
			SOFTWARE CCF	OF ALL CARDS			1.20E-06	CCX-SFTW
			FAILURE OF	MANUAL DAS	ACTUATION		5.00E-01	REC-MANDAS
162	6.02E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			BATTERY	DB1	UNAVAILABLE		2.70E-03	ED1MOD03
			IWX-XMTR				2.01E-04	IWX-XMTR
			REN-MAN04				5.00E-01	REN-MAN04
163	5.86E-10	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			SOFTWARE CCF OF	OUTPUT LOGIC	I/Os		1.10E-05	CCX-
PMAMOD1-SW								
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
164	5.86E-10	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01	RHN-MAN04
			COND. PROB. OF	IWN-MAN00 (OP. FAILS TO ACTUATE IRWST INJ)			5.00E-01	IWN-MAN00C
			CCX-PMDMOD4-SW				1.10E-05	CCX-
PMDMOD4-SW								
165	5.86E-10	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			CCX-PMDMOD4-SW				1.10E-05	CCX-
PMDMOD4-SW								

166	5.86E-10	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04 IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01 RHN-MAN04-
SUCC							
			CCF OF SOFTWARE	FOR MUX LOGIC	GROUPS		1.10E-05 CCX-
PMAMOD4-SW							
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01 RHN-MAN05
167	5.86E-10	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04 IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01 RHN-MAN04
			COND. PROB. OF	IWN-MAN00 (OP. FAILS TO ACTUATE IRWST INJ)			5.00E-01 IWN-MAN00C
			CCX-PMDMOD1-SW				1.10E-05 CCX-
PMDMOD1-SW							
168	5.86E-10	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04 IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01 RHN-MAN04
			CCF OF SOFTWARE	FOR MUX LOGIC	GROUPS		1.10E-05 CCX-
PMAMOD4-SW							
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01 RHN-MAN05
169	5.86E-10	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04 IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01 RHN-MAN04
			SOFTWARE CCF OF	OUTPUT LOGIC	I/Os		1.10E-05 CCX-
PMAMOD1-SW							
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01 RHN-MAN05
170	5.86E-10	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04 IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01 RHN-MAN04-
SUCC							
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01 IWN-MAN00
			CCX-PMDMOD1-SW				1.10E-05 CCX-
PMDMOD1-SW							
171	5.76E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03 IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01 OTH-R1
			BREAKER 100	FAILS TO OPEN		[#3	1.23E-02 EC1CB100VO
			D/G FAILS TO	START & RUN OR	BKR 202 FAILS TO	CLOSE	2.02E-02 ZO2MOD01
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		2.09E-03 PMAMOD11
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01 RHN-MAN05
172	5.76E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03 IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01 OTH-R1
			D/G FAILS TO	START & RUN OR	BKR 102 FAILS TO	CLOSE	2.02E-02 ZO1MOD01

			BREAKER 200	FAILS TO OPEN		[#5	1.23E-02	EC2CB200VO
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		2.09E-03	PMAMOD11
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
173	5.66E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			COMMON CAUSE	FAILURE	STANDBY DG TO	RUN	4.40E-04	ZOX-DG-DR
			FAILURE UPON	DEMAND OF LOGIC	GROUP PROCESSING		1.16E-03	PMA0301BSA
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
174	5.66E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			COMMON CAUSE	FAILURE	STANDBY DG TO	RUN	4.40E-04	ZOX-DG-DR
			FAILURE UPON	DEMAND OF LOGIC	GROUP PROCESSING		1.16E-03	PMA0301ASA
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
175	5.64E-10	.00	LOCA/RNS PIPE	RUPTURE WITH RCS	FILLED INIT.	EVENT OCCURS	1.61E-05	IEV-
LOCAPRND								
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01	RHN-MAN04
			CCF OF ORIFICES				2.77E-04	CCX-ORY-SP
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL	DAS ACTUATI	5.06E-01	REC-MANDASC
			ADN-MAN01C				5.00E-01	ADN-MAN01C
176	5.61E-10	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			PMAMOD21X				1.16E-03	PMAMOD21X
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			BUS UNAVAILABLE	DUE TO	UNSCHEDULED	MAINTENANCE	2.70E-03	EC1BS012TM
			COND. PROB. OF	RHN-MAN05 (OP.	FAILS TO OPEN	RNS MOV V023)	5.00E-01	RHN-MAN05C
177	5.61E-10	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			PMAMOD21X				1.16E-03	PMAMOD21X
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			BUS UNAVAILABLE	DUE TO	UNSCHEDULED	MAINTENANCE	2.70E-03	EC1BS121TM
			COND. PROB. OF	RHN-MAN05 (OP.	FAILS TO OPEN	RNS MOV V023)	5.00E-01	RHN-MAN05C
178	5.61E-10	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			PMAMOD21X				1.16E-03	PMAMOD21X
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00
			UNAVAILABILITY	OF BUS ECS ES 1	DUE TO UNSCHEDUL	MAINTENANCE	2.70E-03	EC1BS001TM
			COND. PROB. OF	RHN-MAN05 (OP.	FAILS TO OPEN	RNS MOV V023)	5.00E-01	RHN-MAN05C
179	5.33E-10	.00	LOSS OF RNS WITH	RCS DRAINED	INITIATING EVENT	OCCURS	9.69E-05	IEV-RNSD

			SOFTWARE CCF OF	OUTPUT LOGIC	I/Os		1.10E-05	CCX-
PMAMOD1-SW								
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
180	5.25E-10	.00	LOSS OF RNS WITH	RCS FILLED	INITIATING EVENT	OCCURS	1.02E-03	IEV-RNSND
			FAILURE OF	MANUAL DAS	REACTOR TRIP	HARDWARE	1.00E-02	MDAS
			COMMON MODE	FAILURE OF INPUT	LOGIC GROUPS		1.03E-04	CCX-INPUT-
LOGIC								
			OPERATOR FAILS	TO RECOGNIZE THE	NEED FOR RCS	DEPRESSURIZAT	5.00E-01	LPM-MAN05
181	5.25E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			D/G FAILS TO	START & RUN OR	BKR 102 FAILS TO	CLOSE	2.02E-02	ZO1MOD01
			D/G FAILS TO	START & RUN OR	BKR 202 FAILS TO	CLOSE	2.02E-02	ZO2MOD01
			FAILURE UPON	DEMAND OF LOGIC	GROUP PROCESSING		1.16E-03	PMA0301BSA
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
182	5.25E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			D/G FAILS TO	START & RUN OR	BKR 102 FAILS TO	CLOSE	2.02E-02	ZO1MOD01
			D/G FAILS TO	START & RUN OR	BKR 202 FAILS TO	CLOSE	2.02E-02	ZO2MOD01
			FAILURE UPON	DEMAND OF LOGIC	GROUP PROCESSING		1.16E-03	PMA0301ASA
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
183	5.19E-10	.00	LOCA/RNS-V024	OPENS INITIATING	EVENT OCCURS	WITH RCS FILL	1.73E-05	IEV-
LOCA24ND								
			CCF OF ADS 4TH STAGE SQUIB VALVES		TO OPEN		3.00E-05	ADX-EV-SA
184	5.19E-10	.00	LOCA/RNS-V024	OPENS INITIATING	EVENT OCCURS	WITH RCS FILL	1.73E-05	IEV-
LOCA24ND								
			CCF OF GRAVITY	INJECTION CHECK	VALVES TO OPEN		3.00E-05	IWX-CV-AO
185	5.16E-10	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			MECHANICAL	FAILURE CAUSES	MOV 121A TO	FAIL-TO-OPEN	3.00E-03	IRWMOD05S
			IRWST DISCHARGE	LINE "B"	STRAINER	PLUGGED	2.40E-04	IWB-PLUG
186	4.99E-10	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			FAILURE OF INV.,	STATIC SWITCH	AND ASSOC.	BREAKERS	5.16E-04	IDAMOD05
			UNAVAILABILITY	OF BUS ECS ES 1	DUE TO UNSCHEDUL	MAINTENANCE	2.70E-03	EC1BS001TM
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
187	4.99E-10	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD

			FAILURE OF INV.,	STATIC SWITCH	AND ASSOC.	BREAKERS	5.16E-04	IDAMOD05
			BUS UNAVAILABLE	DUE TO	UNSCHEDULED	MAINTENANCE	2.70E-03	EC1BS121TM
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
188	4.99E-10	.00	LOSS OF CCS/SWS	WITH RCS DRAINED	INITIATING EVENT	OCCURS	7.16E-04	IEV-CCWD
			FAILURE OF INV.,	STATIC SWITCH	AND ASSOC.	BREAKERS	5.16E-04	IDAMOD05
			BUS UNAVAILABLE	DUE TO	UNSCHEDULED	MAINTENANCE	2.70E-03	EC1BS012TM
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
189	4.87E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			PUMP SUBLOOP B	HARDWARE FAILURE	OR DIVERTED FLOW		1.04E-02	CCBMOD01S
			D/G FAILS TO	START & RUN OR	BKR 102 FAILS TO	CLOSE	2.02E-02	ZO1MOD01
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		2.09E-03	PMAMOD11
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
190	4.66E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			FAILURE OF	PLS OUTPUT	LOGIC I/Os		2.09E-03	PL5MOD11
			IWX-XMTR				2.01E-04	IWX-XMTR
			REN-MAN04				5.00E-01	REN-MAN04
191	4.59E-10	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5.00E-01	RHN-MAN04
			COND. PROB. OF	IWN-MAN00 (OP. FAILS TO ACTUATE IRWST INJ)			5.00E-01	IWN-MAN00C
			CCF OF THE POWER	INTERFACE OUTPUT	BOARDS IN PMS		8.62E-06	CCX-EP-SAM
192	4.59E-10	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			OPERATOR FAILS	TO ISOLATE	RNS PIPE RUPTURE		5:00E-01	RHN-MAN04
			FAILURE OF	MANUAL DAS	ACTUATION		5.00E-01	REC-MANDAS
			CCF OF THE POWER	INTERFACE OUTPUT	BOARDS IN PMS		8.62E-06	CCX-EP-SAM
193	4.59E-10	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			FAILURE OF	MANUAL DAS	ACTUATION		5.00E-01	REC-MANDAS
			CCF OF THE POWER	INTERFACE OUTPUT	BOARDS IN PMS		8.62E-06	CCX-EP-SAM
194	4.59E-10	.00	OVERDRAINING OF	RCS DURING DRAIN	DOWN TO MID-LOOP	INITIATING EV	2.13E-04	IEV-RCSOD
			RHN-MAN04-SUCC				5.00E-01	RHN-MAN04-
SUCC								
			OPERATOR FAILS	TO ACTUATE IRWST	INJECTION		5.00E-01	IWN-MAN00

			CCF OF THE POWER	INTERFACE OUTPUT	BOARDS IN PMS		8.62E-06	CCX-EP-SAM
195	4.51E-10	.00	LOCA/RNS-V024	OPENS INITIATING	EVENT OCCURS	WITH RCS FILL	1.73E-05	IEV-
LOCA24ND								
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL	DAS ACTUATI	5.06E-01	REC-MANDASC
			COMMON MODE	FAILURE OF INPUT	LOGIC GROUPS		1.03E-04	CCX-INPUT-
LOGIC								
			OPERATOR FAILS	TO ACTUATE ADS	BEFORE CORE	DAMAGE	5.00E-01	ADN-MAN01
196	4.51E-10	.00	LOCA/RNS-V024	OPENS INITIATING	EVENT OCCURS	WITH RCS FILL	1.73E-05	IEV-
LOCA24ND								
			COND. PROB. OF	REC-MANDAS	(FAILURE OF MANUAL	DAS ACTUATI	5.06E-01	REC-MANDASC
			COMMON MODE	FAILURE OF INPUT	LOGIC GROUPS		1.03E-04	CCX-INPUT-
LOGIC								
			OPERATOR FAILS	TO RECOGNIZE THE	NEED FOR RCS	DEPRESSURIZAT	5.00E-01	LPM-MAN05
197	4.50E-10	.00	LOCA/RNS-V024	OPENS INITIATING	EVENT OCCURS	WITH RCS FILL	1.73E-05	IEV-
LOCA24ND								
			IWX-EV4-SA				2.60E-05	IWX-EV4-SA
198	4.46E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			CCF TO START	OF ENGINE-DRIVEN	FUEL PUMPS		2.00E-03	ZOX-PD-ES
			IWX-XMTR				2.01E-04	IWX-XMTR
			REN-MAN04				5.00E-01	REN-MAN04
199	4.36E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			PUMP 01B FAILS &	ST CK V007B & C	B FTC & RE FTC &	CB ECS221 SPO	1.53E-02	RNBMOD07S
			BREAKER 100	FAILS TO OPEN		[#3	1.23E-02	EC1CB100VO
			FAILURE OF	PMS OUTPUT	LOGIC I/Os		2.09E-03	PMAMOD11
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05
200	4.22E-10	.00	LOSS OF OFFSITE	POWER INITIATING	EVENT OCCURS	WITH RCS DRAI	5.28E-03	IEV-LOSPD
			FAILURE TO	RECOVER AC POWER	IN 1 HOUR		4.20E-01	OTH-R1
			BATTERY	DB1	UNAVAILABLE		2.70E-03	ED1MOD03
			CCF OF OUTPUT	LOGIC I/O BOARDS			1.41E-04	CCX-PMAMOD1
			OPERATOR FAILS	TO RECOGNIZE	NEED AND TO OPEN	RNS MOV V023	5.00E-01	RHN-MAN05

Table 3-2. Basic Events Whose Probabilities are Changed

	Base	Changed
17 ADN-MAN01	4.93E-04	5.00E-01
18 ADN-MAN01C	5.00E-02	5.00E-01
26 CCB-MAN01	1.07E-03	5.00E-01
206 IWN-MAN00	1.15E-03	5.00E-01
207 IWN-MAN00C	5.00E-02	5.00E-01
215 LPM-MAN05	6.83E-04	5.00E-01
285 PRN-MAN01	4.08E-04	5.00E-01
296 REC-MANDAS	1.16E-02	5.00E-01
297 REC-MANDASC	5.06E-01	5.06E-01
298 REN-MAN04	1.00E-02	5.00E-01
300 RHN-MAN03	2.26E-03	5.00E-01
301 RHN-MAN04	5.50E-02	5.00E-01
302 RHN-MAN04-SUCC	9.45E-01	5.00E-01
303 RHN-MAN05	1.60E-03	5.00E-01
304 RHN-MAN05C	1.50E-01	5.00E-01
323 SWB-MAN02	1.60E-03	5.00E-01
337 ZON-MAN01	2.67E-03	5.00E-01
176 IEV-RCSOD	5.28E-06	2.13E-04
RCS-MANODS1	4.04E-04	0.5
RCS-MANODS2	1.39E-02	0.5

These two HEPs are used in calculation of IEV-RCSOD Frequency.
See PRA-GSC-249 Rev. 1 pages 33 and 34

IEV-RCSOD (AP1000) = (1.07/0.9) * IEV-RCSOD(AP600)

	Base Case	HEP = 0.5
IEV-RCSOD(AP600) = 0.9*(SC-1 + SC-2)		
SC -1 = 2.91E-04 * RCS-MANOD1S =	1.18E-07	1.46E-04
SC -2 = 3 43E-06 + 1.0E-04 * RCS-MANOD2S =	4.82E-06	5.34E-05
IEV-RCSOD(AP600) =	4.44E-06	1.79E-04
IEV-RCSOD (AP1000) =	5.28E-06	2.13E-04

Case 4 No credit for Standby Non-Safety Systems – Credit for Manual DAS

This case is very similar to Case 2, except credit is taken for manual DAS actuuation, which has adminsitrative controls placed on it. Other than this credit, the same standby systems as in case 2 were assumed to be unavailable when an initiating event occurs. The standby systems assumed to be unavailable in response to a shutdown event are:

1. CVS
2. SFW
3. RNS
4. Automatic DAS (manual DAS is credited)
5. DGs

Note that CVS and SFW are not credited in the shutdown PRA and thus do not appear in the core damage cutsets.

Motor operated valve MOV23 in the RNS path can be used for gravity injection by an operator action, if the normal IRWST injection fails. This function of the valve is safety–related and is already credited in the AP1000 shutdown PRA event trees, in the node GIRNS (Gravity Injection via RNS). This path is also credited in the current sensitivity analysis.

The sensitivity analysis results in a plant CDF of 9.73E-07/year. This is a modest 21% decrease in CDF calculated in case 2 where credit is not taken for manual DAS actuation.

Table 4-1 Contains the top CDF cutsets for this case. The list of basic events set to failure to generate this case is given in Tbale 4-2 to allow duplication of this case. The contribution of initiating events to plant CDF is given in Table 4-3.

Table 4-3 Contribution of Initiating Events to Plant CDF - Shutdown sensitivity Case 4

Plant CDF = 9.73E-07
Number of Initiating Events = 10

Initiating Event	% Contribution	IEV Frequency	IEV CDF	CDP	
		a	b	b/a	
1 IEV-LOSPD	88.76	5.28E-03	8.63E-07	1.68E-04	drained
2 IEV-CCWD	8.67	7.16E-04	8.43E-08	9.82E-06	drained
3 IEV-RNSD	1.17	9.69E-05	1.14E-08	1.26E-04	drained

4 IEV-LOSPND	0.42	1.82E-02	4.13E-09	1.02E-05	
5 IEV-RCSOD	0.39	5.28E-06	3.75E-09	1.26E-04	drained
6 IEV-LOCA24ND	0.22	1.73E-05	2.10E-09	1.02E-05	
7 IEV-CCWND	0.18	3.99E-03	1.77E-09	7.19E-04	
8 IEV-LOCA24D	0.14	1.15E-05	1.35E-09	1.42E-04	drained
9 IEV-RNSND	0.05	1.02E-03	4.52E-10	1.26E-04	
10 IEV-LOCAPRND	0.01	1.61E-05	1.17E-10	1.76E-05	
Sum =	100	2.94E-02	9.73E-07	1.45E-03	

Estimation of Large Release Frequency

The large release frequency (LRF) associated with the CDF in this sensitivity case is estimated as 3.84E-07/year. For this estimate a conditional containment failure probability of 0.349 is estimated and used.

Table 4-1 AP1000 Shutdown PRA Sensitivity Case 4 CDF Cutsets

Title: AP1000 Shutdown PRA Sensitivity Case No SB NS Systems- Man. DAS Credited
File: cmtot.wl1
Reduced Sum of Cutsets: 9.7330E-07

NUMBER	CUTSET PROB	PERCENT	BASIC EVENT NAME	EVENT PROB.	IDENTIFIER
1	1.04E-07	10.69	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			COMMON CAUSE FAILURE OF THE BATTERIES IDSA-DB-1A/1B	4.70E-05	CCX-BY-PN
2	9.19E-08	9.44	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			OFFSITE AC POWER RECOVERED IN 1 HOUR	5.80E-01	SUC-R1S
			CCF OF ADS 4TH S AGE SQUIB VALVES TO OPEN	3.00E-05	ADX-EV-SA
3	7.96E-08	8.18	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			OFFSITE AC POWER RECOVERED IN 1 HOUR	5.80E-01	SUC-R1S
			IWX-EV4-SA	2.60E-05	IWX-EV4-SA
4	7.96E-08	8.18	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			OFFSITE AC POWER RECOVERED IN 1 HOUR	5.80E-01	SUC-R1S
			IWX-MV-GO1	2.60E-05	IWX-MV-GO1
5	6.65E-08	6.83	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			CCF OF ADS 4TH S AGE SQUIB VALVES TO OPEN	3.00E-05	ADX-EV-SA
6	5.77E-08	5.93	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1

			IWX-MV-G01	2.60E-05	IWX-MV-G01
7	5.77E-08	5.93	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			IWX-EV4-SA	2.60E-05	IWX-EV4-SA
8	5.32E-08	5.47	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			COMMON CAUSE FAILURE OF THE INVERTER	2.40E-05	CCX-IV-XR
9	3.67E-08	3.77	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			OFFSITE AC POWER RECOVERED IN 1 HOUR	5.80E-01	SUC-R1S
			REX-FL-GP	1.20E-05	REX-FL-GP
10	3.67E-08	3.77	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			OFFSITE AC POWER RECOVERED IN 1 HOUR	5.80E-01	SUC-R1S
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
11	2.66E-08	2.73	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			REX-FL-GP	1.20E-05	REX-FL-GP
12	2.66E-08	2.73	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
13	2.15E-08	2.21	LOSS OF CCS/SWS WITH RCS DRAINED INITIATING EVENT OCCURS	7.16E-04	IEV-CCWD
			CCF OF ADS 4TH S AGE SQUIB VALVES TO OPEN	3.00E-05	ADX-EV-SA
14	1.91E-08	1.96	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			CCF OF THE POWER INTERFACE OUTPUT BOARDS IN PMS	8.62E-06	CCX-EP-SAM

15	1.86E-08	1.91	LOSS OF CCS/SWS WITH RCS DRAINED INITIATING EVENT OCCURS	7.16E-04	IEV-CCWD
			IWX-MV-GO1	2.60E-05	IWX-MV-GO1
16	1.86E-08	1.91	LOSS OF CCS/SWS WITH RCS DRAINED INITIATING EVENT OCCURS	7.16E-04	IEV-CCWD
			IWX-EV4-SA	2.60E-05	IWX-EV4-SA
17	1.11E-08	1.14	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			OFFSITE AC POWER RECOVERED IN 1 HOUR	5.80E-01	SUC-R1S
			CCF OF ORIFICES	3.63E-06	CCX-ORY-SPX
18	1.02E-08	1.05	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			FAILURE OF PMS OUTPUT LOGIC I/Os	2.09E-03	PMAMOD11
			MECHANICAL FAILURE CAUSES MOV 023 TO FAIL-TO-OPEN	2.21E-03	RN23MOD5S
19	8.59E-09	0.88	LOSS OF CCS/SWS WITH RCS DRAINED INITIATING EVENT OCCURS	7.16E-04	IEV-CCWD
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
20	8.59E-09	0.88	LOSS OF CCS/SWS WITH RCS DRAINED INITIATING EVENT OCCURS	7.16E-04	IEV-CCWD
			REX-FL-GP	1.20E-05	REX-FL-GP
21	8.05E-09	0.83	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			OFFSITE AC POWER RECOVERED IN 1 HOUR	5.80E-01	SUC-R1S
			CCF OF PRESSURE TRANSMITTERS	2.63E-06	CCX-XMTRX
22	8.05E-09	0.83	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			CCF OF ORIFICES	3.63E-06	CCX-ORY-SPX
23	7.42E-09	0.76	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1

			FAILURE OF PMS OUTPUT LOGIC I/Os	2.09E-03	PMAMOD11
			OPERATOR FAILS TO RECOGNIZE NEED AND TO OPEN RNS MOV V023	1.60E-03	RHN-MAN05
24	6.16E-09	0.63	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			OFFSITE AC POWER RECOVERED IN 1 HOUR	5.80E-01	SUC-R1S
			IWX-XMTR	2.01E-04	IWX-XMTR
			REN-MAN04	1.00E-02	REN-MAN04
25	5.83E-09	0.6	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			CCF OF PRESSURE TRANSMITTERS	2.63E-06	CCX-XMTRX
26	5.69E-09	0.58	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			FAILURE UPON DEMAND OF LOGIC GROUP PROCESSING	1.16E-03	PMA0301ASA
			MECHANICAL FAILURE CAUSES MOV 023 TO FAIL-TO-OPEN	2.21E-03	RN23MOD5S
27	5.69E-09	0.58	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			FAILURE UPON DEMAND OF LOGIC GROUP PROCESSING	1.16E-03	PMA0301BSA
			MECHANICAL FAILURE CAUSES MOV 023 TO FAIL-TO-OPEN	2.21E-03	RN23MOD5S
28	4.46E-09	0.46	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			IWX-XMTR	2.01E-04	IWX-XMTR
			REN-MAN04	1.00E-02	REN-MAN04
29	4.12E-09	0.42	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			FAILURE UPON DEMAND OF LOGIC GROUP PROCESSING	1.16E-03	PMA0301BSA
			OPERATOR FAILS TO RECOGNIZE NEED AND TO OPEN RNS MOV V023	1.60E-03	RHN-MAN05

30	4.12E-09	0.42	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			FAILURE UPON DEMAND OF LOGIC GROUP PROCESSING	1.16E-03	PMA0301ASA
			OPERATOR FAILS TO RECOGNIZE NEED AND TO OPEN RNS MOV V023	1.60E-03	RHN-MAN05
31	3.67E-09	0.38	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			OFFSITE AC POWER RECOVERED IN 1 HOUR	5.80E-01	SUC-R1S
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
32	2.91E-09	0.3	LOSS OF RNS WITH RCS DRAINED INITIATING EVENT OCCURS	9.69E-05	IEV-RNSD
			CCF OF ADS 4TH S AGE SQUIB VALVES TO OPEN	3.00E-05	ADX-EV-SA
33	2.66E-09	0.27	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
34	2.60E-09	0.27	LOSS OF CCS/SWS WITH RCS DRAINED INITIATING EVENT OCCURS	7.16E-04	IEV-CCWD
			CCF OF ORIFICES	3.63E-06	CCX-ORY-SPX
35	2.53E-09	0.26	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			FAILURE OF INV., STATIC SWITCH AND ASSOC. BREAKERS	5.16E-04	IDAMOD05
			MECHANICAL FAILURE CAUSES MOV 023 TO FAIL-TO-OPEN	2.21E-03	RN23MOD5S
36	2.52E-09	0.26	LOSS OF RNS WITH RCS DRAINED INITIATING EVENT OCCURS	9.69E-05	IEV-RNSD
			IWX-EV4-SA	2.60E-05	IWX-EV4-SA
37	2.52E-09	0.26	LOSS OF RNS WITH RCS DRAINED INITIATING EVENT OCCURS	9.69E-05	IEV-RNSD
			IWX-MV-GO1	2.60E-05	IWX-MV-GO1
38	2.20E-09	0.23	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			OFFSITE AC POWER RECOVERED IN 1 HOUR	5.80E-01	SUC-R1S

			MECHANICAL FAILURE CAUSES MOV 121A TO FAIL-TO-OPEN	3.00E-03	IRWMOD05S
			IRWST DISCHARGE LINE "B" STRAINER PLUGGED	2.40E-04	IWB-PLUG
39	2.18E-09	0.22	OVERDRAINING OF RCS DURING DRAIN DOWN TO MID-LOOP INITIATING EVENT	5.28E-06	IEV-RCSOD
			OPERATOR FAILS TO ISOLATE RNS PIPE RUPTURE	5.50E-02	RHN-MAN04
			COND. PROB. OF IWN-MAN00 (OP. F ILS TO ACTUATE I WST INJ)	5.00E-02	IWN-MAN00C
			COND. PROB. OF RHN-MAN05 (OP. FAILS TO OPEN RNS MOV V023)	1.50E-01	RHN-MAN05C
40	1.88E-09	0.19	LOSS OF CCS/SWS WITH RCS DRAINED INITIATING EVENT OCCURS	7.16E-04	IEV-CCWD
			CCF OF PRESSURE TRANSMITTERS	2.63E-06	CCX-XMTRX
41	1.83E-09	0.19	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			FAILURE OF INV., STATIC SWITCH AND ASSOC. BREAKERS	5.16E-04	IDAMOD05
			OPERATOR FAILS TO RECOGNIZE NEED AND TO OPEN RNS MOV V023	1.60E-03	RHN-MAN05
42	1.60E-09	0.16	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			MECHANICAL FAILURE CAUSES MOV 121A TO FAIL-TO-OPEN	3.00E-03	IRWMOD05S
			IRWST DISCHARGE LINE "B" STRAINER PLUGGED	2.40E-04	IWB-PLUG
43	1.55E-09	0.16	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			LOSS OF DIST. PANEL OR BREAKER A07 SPURIOUSLY OPENS	3.17E-04	IDAMOD04
			MECHANICAL FAILURE CAUSES MOV 023 TO FAIL-TO-OPEN	2.21E-03	RN23MOD5S
44	1.47E-09	0.15	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			BUS UNAVAILABLE DUE TO TEST OR CORRECTIVE MAINTENANCE	3.00E-04	IDABSDS1TM
			MECHANICAL FAILURE CAUSES MOV 023 TO FAIL-TO-OPEN	2.21E-03	RN23MOD5S
45	1.44E-09	0.15	LOSS OF CCS/SWS WITH RCS DRAINED INITIATING EVENT OCCURS	7.16E-04	IEV-CCWD

			IWX-XMTR	2.01E-04	IWX-XMTR
			REN-MAN04	1.00E-02	REN-MAN04
46	1.39E-09	0.14	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			FAILURE OF PMS OUTPUT LOGIC I/Os	2.09E-03	PMAMOD11
			BUS UNAVAILABLE DUE TO TEST OR CORRECTIVE MAINTENANCE	3.00E-04	IDDBSDK1TM
47	1.39E-09	0.14	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			FAILURE OF PMS OUTPUT LOGIC I/Os	2.09E-03	PMAMOD11
			BUS UNAVAILABLE DUE TO TEST OR CORRECTIVE MAINTENANCE	3.00E-04	IDDBSDD1TM
48	1.39E-09	0.14	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED	5.28E-03	IEV-LOSPD
			FAILURE TO RECOVER AC POWER IN 1 HOUR	4.20E-01	OTH-R1
			FAILURE OF PMS OUTPUT LOGIC I/Os	2.09E-03	PMAMOD11
			BUS UNAVAILABLE DUE TO TEST OR CORRECTIVE MAINTENANCE	3.00E-04	IDDBSDS1TM
49	1.38E-09	0.14	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS FILLED	1.82E-02	IEV-LOSPND
			OFFSITE AC POWER RECOVERED IN 2 HOURS	7.60E-01	SUC-R2S
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
			CCF OF THE POWER INTERFACE OUTPUT BOARDS IN PMS	8.62E-06	CCX-EP-SAM
50	1.19E-09	0.12	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS FILLED	1.82E-02	IEV-LOSPND
			OFFSITE AC POWER RECOVERED IN 2 HOURS	7.60E-01	SUC-R2S
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF OF THE POWER INTERFACE OUTPUT BOARDS IN PMS	8.62E-06	CCX-EP-SAM

Table 4-2. List of Basic Events "Dropped" to Make the Sensitivity Case 4

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; SENDATA 1 1
; 04/10/03, 11:00:10

h:\ap1000~2\38-1\case-3r1\cmtot.wlk

Case 1
h:\ap1000~2\38-1\case-3r1\cmtot.wl1

DG1-LOGIC R
RHN-MAN03 R
RNAEPRNPSA R
RNAMOD06S R
RNBEPRNPSA R
RNBMOD07S R
RNX-CV-GO R
RNX-KV-GO R
RNX-PM-ER R
RNX-PM-FS R
ZO1DG001TM R
ZO1MOD01 R
ZO1MOD03 R
ZO1MOD04 R
ZO2DG002TM R
ZO2MOD01 R
ZO2MOD03 R
ZO2MOD04 R
ZOX-BL-ER R
ZOX-BL-ES R
ZOX-DG-DR R
ZOX-DG-DS R
ZOX-FL-GP R
ZOX-PD-ER R
ZOX-PD-ES R
DAS R
ZON-MAN01 R
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Attachment 2 - Assessment of Containment Closure Failure Probability

This section provides an assessment of the failure probabilities for containment isolation during shutdown modes where containment closure is required. In Modes 5 and 6 when the upper internals are in place, containment closure capability is required. Containment closure capability is defined in the Technical Specifications as having all potential escape paths from containment closed or capable of being close. Therefore, containment can be closed prior to the time steam would be released to the containment following an event, such as a loss of the normal decay heat removal capability through the normal residual heat removal system.

According to the Technical Specification requirements, the capability to close the containment before steam is released to the containment must be confirmed in order for the hatches and/or penetrations to be kept open during the respective plant conditions in Modes 5 and 6. In that regard, the containment would need to be closed during the mid-loop period at the beginning of a refueling since the diagnosis and decision time is greater than the time to steaming in this condition. Containment closure may not be required for the mid-loop period at the end of a refueling since the core decay heat is lower due to decay time and the partial core replacement with new fuel and there is a longer time window for the operators to complete this task prior to steaming. The need for containment closure during the end of refueling mid-loop would need to be confirmed based on the time to steaming for that condition. Figure B 3.6.8-1 is only applicable to conditions before fuel replacement.

In other plant conditions earlier in time during Modes 5 and 6, decay heat level would be higher than during the mid-loop period discussed above; however, steaming to the containment would occur later than for mid-loop conditions in these MODES because there is more water in the reactor, providing a longer time window for the operators to close the hatches and penetrations. Therefore, it is possible that the containment would be open during such periods of higher decay heat levels since there is a longer time window for the operators to complete the task.

The following assumptions are made in this evaluation:

- Equipment and maintenance hatches, personnel hatches, and temporary electrical and instrument penetrations are open.
- The openings include: one main equipment hatch, one maintenance hatch, two personnel hatches, and three spare penetrations.
- More than one temporary line or cable can fit through each spare penetration. Such lines are fitted with quick disconnect attachments.

- Each personnel hatch consists of two doors in series that are normally interlocked to maintain containment integrity. The interlock is defeated to allow both doors to be kept open.

- The openings are closed manually; the equipment and maintenance hatches are closed from inside containment, and the other openings are closed from outside containment.

- The openings are manned by maintenance personnel with responsibilities as follows:
  - 2 persons for closing main equipment hatch
  - 2 persons for closing maintenance hatch
  - 2 persons for closing each personnel hatch
  - 2 persons for disconnecting the lines and closing the spare penetrations

One person can close each opening with the second person serving as backup or assistant.

- Based on the existence of AP1000 shutdown emergency response guidelines, it is assumed that detailed written procedures will be developed and used for closing the openings.

- It is assumed that loss of RNS is the cue for initiating closure of these openings; therefore, there is a time window of approximately 50 minutes to complete these actions. It is further assumed the containment environment is habitable up to 145°F.

- Personnel are required to evacuate the containment before closing the personnel hatches; in that regard, the equipment and maintenance hatches must be closed prior to closing the personnel hatches. It is assumed that it takes about 30 minutes to close the equipment and maintenance hatches, and, during that time, personnel in the containment are evacuated.

- It is assumed the other openings, all of which are closed from outside containment, can be also closed within the actual time of 30 minutes discussed in the previous paragraph.

- Although the loss of RNS is expected to be diagnosed by the control room personnel, it is expected that an alarm would be annunciated in the containment to signify the need for containment closure. To be conservative, it is assumed that cognitive diagnosis for closing the hatches (by the maintenance crew) is required and this diagnosis must be completed within 15 minutes from the alarm. According to previous assumptions, a time window of about 35 minutes remains to physically close the openings.

- On closing each opening, one maintenance crew (MC) member is assigned a low dependency on the other crew member.

- A high stress level is assigned for this task according to THERP 20-16, item 5.

- It is assumed that the hatches and doors for the openings are exercised (when they are first opened) to ensure they can close on demand. Therefore, hardware failures of these openings are judged to be highly unlikely; (i.e., an estimated failure probability less than 1.0E-06 per demand for each opening). However, if 1.0E-05 per demand is conservatively applied for the failure probability of one of these openings to close, then a failure probability of 7.0E-05 per demand is assumed for hardware failure of these openings.

Quantification of the human error probability for this task is as follows:

(D_{HEP}) Diagnosis Error Calculation:

D1: Failure to diagnose need for closing containment hatches within 15 minutes = 4.0E-02 [THERP 20-3 & Figure 12-4] (1)
$D2_{(MC1)}$ Failure to respond to 1 of 1 local alarm = 2.7E-04 [THERP 20-23 ~~(1)~~]
$D2_{(MC2)}$ Low crew dependency assigned to the second crew member = 0.05 [THERP 20-4]
$D2 = D2_{(MC1)} \times D2_{(MC2)}$ = 2.7E-04 x 0.05 = 1.35E-05;

(D_{HEP}) = D1 x D2 < 1.0E-05.

(A_{HEP}) Action Execution Calculation:

A1 a) Omit action to close assigned opening (omission error) = 1.3E-03 [THERP 20-7 (1)]
b) Stress multiplier = 5
$A1_{(MC1)}$ = a x b = 6.5E-03
$A1_{(MC2)}$ = 0.05 [THERP 20-18]

Therefore, action execution failure for one opening is estimated as:
$A1_{HEP} = A1_{(MC1)} \times A1_{(MC2)}$ = 3.25E-04.

Since there are seven openings, the total action execution failure is:
$A_{HEP} = A1_{HEP} \times 7$ = 3.25E-04 x 7 = 2.28E-03.

Therefore, the HEP for closing the containment hatches and temporary penetrations is:
$D_{HEP} + A_{HEP}$ = 2.28E-03.

(1) NUREG CR-1278

Result

The estimated failure probability of the openings for containment closure is the summation of the assumed hardware failure probability (7.0E-05) and the HEP (2.28E-03); that is a failure probability of 2.35E-03.

Fault tree analysis is used to calculate the failure probability of the containment isolation (CIST) as 1.71E-02; this result was used to calculate the frequency associated with the CI release category. This fault tree model does not include the additional failure probability in case the hatches are open. By including the failure probability of 2.35E-03 in the CIST fault tree, the estimated failure probability of containment isolation changes from 1.71E-02 to 1.95E-02 for the cases when the hatches are open. This is an increase of approximately 14 percent. This increase of 14% is judged to be insignificant and has no effect on the PRA results.

Attachment 3c – AP1000 Shutdown Fire Risk Evaluation

1.0 INTRODUCTION

For the AP600 design, a comprehensive shutdown PRA was performed. Also a shutdown fire PRA was performed using conditional core damage probabilities from the Focused PRA model. Since Focused PRA CCDPs were used, the results were conservative. For AP1000 PRA, a detailed fire PRA has been performed and submitted to the NRC. To respond to the NRC question, this document provides an evaluation of the AP1000 shutdown fire risk, using dominant sequences from AP600 shutdown fire PRA and also from AP1000 at-power PRA, both adjusted for AP1000 and shutdown conditions.

Both the AP600 and AP1000 shutdown PRA results showed that the plant risk was dominated by drained operating conditions.

The report starts with general comments about the differences and similarities between AP1000 and AP600. Then, the dominant sequences from AP600 shutdown PRA are adjusted for AP1000 and their CDF is estimated (scenarios 1-7). Next the dominant sequences from AP1000 at-power fire risk are considered and adjusted to estimate their CDF for shutdown fire.

Both the AP600 and AP1000 shutdown PRAs were modeled for two distinct operation states:

- Non-drained conditions
- Drained conditions (also known as mid-loop operations).

This evaluation is performed and presented for shutdown state scenarios for

- non-drained operations
  - outside containment
  - inside containment

- drained operations
  - outside containment
  - inside containment

- main control room (MCR).

The CCDPs from AP1000 shutdown PRA are used whenever applicable. Table 1 below provides these CCDPs.

Table 1 AP1000 Shutdown CCDPs			
Initiating Event	CCDP	Condition	Definition
IEV-CCWD	1.18E-04	DRAINED	LOSS OF CCS/SWS WITH RCS DRAINED INITIATING EVENT OCCURS
IEV-LOSPD	3.29E-06	DRAINED	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS DRAINED
IEV-RNSD	1.18E-04	DRAINED	LOSS OF RNS WITH RCS DRAINED INITIATING EVENT OCCURS
IEV-RCSOD	7.10E-04	DRAINED	OVERDRAINING OF RCS DURING DRAIN DOWN TO MID-LOOP INITIATING EVENT
IEV-LOCA24D	1.18E-04	DRAINED	LOCA/RNS-V024 OPENS INITIATING EVENT OCCURS WITH RCS DRAINED
IEV-LOCA24ND	1.17E-04	NON-DRAINED	LOCA/RNS-V024 OPENS INITIATING EVENT OCCURS WITH RCS FILLED
IEV-CCWND	4.43E-07	NON-DRAINED	LOSS OF CCS/SWS WITH RCS FILLED INITIATING EVENT OCCURS
IEV-LOSPND	2.80E-08	NON-DRAINED	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS WITH RCS FILLED
IEV-RNSND	4.43E-07	NON-DRAINED	LOSS OF RNS WITH RCS FILLED INITIATING EVENT OCCURS
IEV-LOCAPRND	7.24E-06	NON-DRAINED	LOCA/RNS PIPE RUPTURE WITH RCS FILLED INIT. EVENT OCCURS

In this evaluation, the following potential differences between the at-power and shutdown fire events are disposed as follows:

1. The initiating event frequencies
   Shutdown-specific initiating event frequencies are used. The residence times at shutdown conditions are factored into these frequencies.

2. Transient combustible materials
   These materials are controlled by administrative means. If they have an effect on the fire initiating event frequency, it is already accounted for in the actuarially determined frequencies for shutdown fire events. The potential increase in the total combustible loading in a fire area is covered by the modeling assumption that the fire damages all equipment in a given area.

3. Fire Barrier Integrity
   It may be envisioned that some fire doors may be open due to shutdown activities. This is deemed to be compensated by the presence of a large number of workers in such areas, or their adjacent areas and the institution of fire watcher. This would increase the detection and suppression probabilities of a fire event. Thus, the fire propagation probability from one area to another is kept as the same.

4. Equipment availability / success criteria

During shutdown conditions, some equipment may be out of service, still maintaining compliance with tech specs. This is already built into the success criteria and system models in the shutdown PRA.

1.1 GENERAL COMMENTS

Fire Areas – Combustible Loading

The AP1000 At-Power Fire PRA study showed that the AP1000 fire areas were similar to the fire areas defined in AP600 with the significant differences being how the AP600 fire areas were grouped together, and the different combustible loading that lead to higher propagation for AP1000.

Fire Ignition Frequencies

The AP600 Shutdown Fire PRA, outside the containment, assumed that the fire frequency per hour was the same during shutdown operations as it was for at-power operations. A time duration comparison was made between fire risk scenarios at-power and shutdown conditions. It was determined that a factor of 10 existed between being at-power and being at non-drained shutdown conditions; and, a factor of 50 existed between being at-power and being at drained shutdown conditions. The fire initiating events were then reduced by the same factors.

The AP600 Shutdown Fire PRA, inside the containment, used the same process as developed for fire risk conditions outside of containment except that the fire risk due to welding operations is added to the previous calculation and to the duration of each shutdown state.

The at-power fire ignition frequencies are similar for AP1000 and AP600 with the exception of two zones located in the containment with the difference being the location of some of the equipment. The duration of the shutdown states also slightly varies between the two designs.

The fire ignition frequencies for AP1000 shutdown fire scenarios discussed in this evaluation are taken from AP600, and then are adjusted to account for the difference in the number of events and redefinition of fire areas. The frequencies are listed in Table 2.

Spurious actuation of RNS V-024 Valve

A fire within containment fire zones1100 AF 11206, 1100 AF11300A, 1100 AF11500 and 1100AF11300b or fire area 1230 AF 02 (Non 1E-equipment penetration room) may cause a hot short and spuriously actuate valve RNS V024. It is postulated that an actuation caused by a hot short would occur with a probability of 0.06.

2.0 EVALUATION OF AP1000 SHUTDOWN FIRE RISK

Comparison of CCDP for At-Power Shutdown

The conditional core damage frequency (CCDP) for at-power and for shutdown conditions would be equivalent in cases where the fire scenario is the same because the safe shutdown components credited are also identical. AP1000 fire PRA credited only safety-related components to mitigate the accident, whereas the AP1000 fire PRA (at-power) looks at the best-estimate availability of any credible mitigating system. Thus, the CCDPs for AP1000 fire PRA should be in general lower than, or at worst equal to those of AP600 fire PRA scenarios.

In the next sections, the dominant scenarios of the AP600 shutdown fire PRA and of the AP1000 at-power fire PRA were examined. Areas containing electrical cables capable of spuriously actuating RNS V024 were also considered.

Main Scenario Analyses for AP600 Shutdown Fire PRA and AP1000 At-Power Fire PRA:

2.1 Evaluation of Outside-Containment Scenarios

2.1.1 AP600 Shutdown Fire PRA Main Scenarios

The AP600 Shutdown Fire PRA main scenario core damage probabilities were examined to evaluate them qualitatively for the AP1000 shutdown fire PRA. The ignition fire frequencies are evaluated on the basis of the fire frequency calculated for the AP600 and adjusted for the difference in duration of the state for AP1000. They are multiplied, if necessary, by the occurrence of a spurious actuation of one or more ADS valves and/or by the occurrence of fire propagation to a neighboring fire area (in accordance with what was done in the AP1000 at-power fire PRA). Then the fire scenarios from AP1000 fire PRA are also examined for their applicability to the shutdown states.

Based on the actual or evaluated AP600 shutdown fire risk CCDPs, an estimate for the AP1000 fire area CDFs may be made. AP600 shutdown fire risks CCDPs were calculated using a focus PRA model and are conservative. For example there is an approximate factor of 100 between the AP1000 CCDPs calculated and the AP600 CCDPs calculated for a transient scenario having a loss of one 1E-division.

Table 57-24 of AP600 Shutdown Fire PRA was reviewed for the top fire scenario sequences having a CDF above 1E-09. These fire sequences were then used to analyze AP1000 Shutdown Fire PRA. Table 3 contains these seven scenarios.

Table 3 Dominant Fire Scenarios from AP600 Shutdown Fire PRA			
Fire Area	**AP600 Fire Frequency**	**Scenario**	**CDF**
1201 AF 03	1.72E-04	LOCA with Loss of Division D Power	4.07E-09
1202 AF 04	1.72E-04	LOCA with loss of Division A Power	4.07E-09
1202 AF 05	2.63E-04	LOCA with loss of Division A Power	6.22E-09
1222 AF 01	1.04E-04	LOCA with loss of Division A Power	6.22E-09
1222 AF 02	2.12E-04	LOCA with loss of Division A Power	6.22E-09
1230 AF 03	1.11E-04	LOCA LOCA with loss of Division C Power and Control	1.65E-09 2.62E-11
Area 2000 AF 01	4.33E-03	Loss of one 1E-Division + Loss of all non safety related systems LOCA + Loss of one 1E-Division + Loss of all non safety related systems	1.13E-12 1.02E-09

The fire area numbering below is as shown in the AP600 Shutdown Fire PRA. Refer to Table 2 for scenario details and subscenarios (cases) that are derived from the base scenarios.

Scenario 1: Fire Area 1201 AF 03

AP1000 At-Power Fire Area 1201 AF 03 consisted of AP600 Shutdown Fire Area 1201 AF 03 and Fire Area 1211 AF 01. This scenario has four subscenarios as shown in Table 2.

There is no risk associated with Cases 1 and 3 because the RNS is available and it would be necessary for a different initiating event to occur to cause a degraded situation. The calculations for AP600 CDF in Case 1 conservatively takes into account the unavailability of the RNS (if the non-safety systems were modeled the CCDP could be lowered by a factor of 100). Considering the same assumption for Case 3, there is still one train (PRHR, CMT, ADS, Gravity Injection) available with the loss of two divisions of 1E power. In the AP1000 at-power fire PRA, a CCDP factor of 1000 exists between a transient with the loss of one division of 1E power and the loss of two divisions of 1E power. This is because the same systems are needed to reach a safe shutdown state for both the shutdown and for the at-power conditions.

Cases 2 and 4 involve fire scenarios having a LOCA and an additional loss of either one or two safety related power divisions. As mentioned previously and as determined in the AP1000 At-Power Fire PRA, a factor of ten exists between these two fire scenarios corresponding to the number of safety related power divisions lost. In the AP1000 At-Power Fire PRA, a probability of 0.03 is used in the fire scenarios to account for the possibility of not deactivating the electrical cabinets before the occurrence of spurious ADS.

In all four cases, the CDF values are conservative because the AP600 CCDPs values were calculated as a focused PRA and do not take credit for the availability of non-safety related systems.

Scenario 2: Fire Area 1202 AF 04

This area is 1202 AF 04 of AP1000; it also comprises the area 1212 AF 01 of the AP600. The same situation exists for area 1201 AF 03.

The same comments apply as given for Fire Area 1201 AF 03.

Scenario 3: Fire Area 1202 AF 05

This area is 1202 AF 03 in the AP1000 At-Power Fire PRA and also comprises the AP600 Fire Area 1202 AF 03. The same situation exists in this fire area that existed for Fire Area 1201 AF 03.

Comments are the same as for 1201 AF 03.

Scenario 4: Fire Area 1222 AF 01

AP1000 At-Power Fire Area 1222 AF 01 exists as Fire Areas1201 AF 02, 1201 AF 02 and 1231 AF 01 in the AP600 Shutdown Fire PRA. The same situation exists for this fire area as for Fire Area 1201 AF 03.

Comments are the same as for Fire Area 1201 AF 03.

Scenario 5: Fire Area 1222 AF 02

AP600 Shutdown Fire Area is actually AP1000 At-Power Fire Area 1220 AF 01; however, AP1000 also encompasses AP600 Fire Area 1220 AF 01.

AP1000 Fire frequency = AP1000 At-Power Fire Ignition Frequency for Fire Area 1220 AF 01 x (Duration of Hot/Cold Shutdown/Duration of At-Power) + AP1000 At-Power Fire Ignition Frequency for Fire Area 1220 AF 02 x (Duration of AP1000 Shutdown/AP600 Shutdown)

Scenario 6: Fire Area 1230 AF 03

This area is 1230 AF 02 of AP1000. It has four subscenarios as shown in Table 2.

In Case 3, the CCDP evaluation is lower as there is a single loss of a safety-related division of 1E power as compared to a fire scenario having the loss of two safety-related divisions.

For the AP1000 At-Power Fire PRA, the CCDP for similar scenarios have the same order of magnitude.

Scenario 7: Fire Area 2000 AF 01

This scenario has two subscenarios as shown in Table 2. In Case 3, 5.0E-04 is the probability of propagation multiplied by the automatic fire suppression system's failure.

2.1.2 Dominant Scenarios from AP1000 At-Power Fire PRA

The dominant AP1000 at-power fire scenarios are examined; their initiating event frequencies are adjusted for shutdown and their shutdown CCDPs are estimated to assess the scenario CDFs. Refer to Table 2 for details.

Scenario 8: Area 0000 AF 00: The yard

The AP1000 Shutdown PRA CCDP for LOSP during non-drained conditions is 2.8E-08. This probability, multiplied by the initiating event frequency should result in a CDF at the order of 1E-10.

Scenario 9: Fire Area 1200 AF 03: Corridors 100' & 117'6"

This scenario is assumed to lead to loss of DAS. The scenario and its subscenarios are given in Table 2. The scenario CDF is very low.

Scenario 10: Fire Areas 4031 AF 01 and 4031 AF 02 – Battery Rooms and Charger Rooms

The AP1000 At-Power Fire Areas 4031 AF 01 and 4031 AF 02 have CDFs of 3.96E-09 and 4.33E-09 respectively. The fire-initiating event is divided by a factor greater than 10 because of the duration of non-drained shutdown. Therefore, the AP1000 CDF at non-drained shutdown is less than E-10.

Scenario 11: AP1000 Fire Areas Containing RNS V024 Electrical Cables

The AP1000 At-Power Fire Event Trees take into consideration the risk of spurious actuation of ADS that would lead to a LOCA. Modeling the RNS-V024 valve spurious actuation caused by a hot short having a probability of 0.06 and with spurious actuation of ADS valves with lower probabilities (from 8.64E-04 to 1.08E-2) leads to increase of the CDF by a factor of 3. The fire ignition would be ten times smaller and the scenario CDF would be lower than E-10.

2.2 Evaluation of Inside-Containment Scenarios

The AP600 Shutdown Fire PRA has no critical zone located inside of the containment. There are only two AP1000 At-Power Fire PRA containment zones that have a significant risk. These two zones are the only zones that appeared significantly different when compared to the AP600 Shutdown Fire PRA. The Containment Zones are 1100 AF 11300B and 1100 AF 11500. The fire scenarios associated with these zones are discussed below.

The AP1000 At-Power fire ignition frequencies for Fire Zones 1100 AF 11300B and 1100 AF 11500 are 3.71E-04 and 4.92E-04 respectively. The additional fire risk induced by welding activities, that were not considered during power operations, is evaluated to be 3.82E-04 for the AP600 containment. The fire ignition frequencies associated to the two zones, proportional to their surfaces are 6.0E-05 and 1.79E-04, respectively. The fire frequency for Hot/Cold shutdown is evaluated to be 9.15E-05 and 2.21E-04 respectively.

The fire scenarios and event trees are the same for the non-drained shutdown states as for the at-power study. According to the arguments for fire areas outside of the containment, the CCDP associated to these fire scenarios would be lower because of less severe success criteria (actually they are the same as in AP600) and more time for human actions by a factor of 10. At shutdown, the fire suppression system is fully automatic because the isolation valve,

normally closed and manually opened during at-power conditions, is open during shutdown operations.

Spurious Actuation of the RNS-V024 Valve (Scenarios 12 and 13)

The at-power fire event trees already take into consideration the risk of ADS spurious actuation that would lead to a LOCA. Modeling the motor operated RNS-V024 valve spurious actuation caused by a short having a conservative probability of 0.06 and the ADS spurious actuation having lower probabilities increases the CDF by a maximum factor of 6.

Scenario	AP1000 Zone	Frequency	CDF
SC-12	1100AF11300B	9.15E-05	Max in the order of 10-9
SC-13	1100AF11500	2.21E-04	Max in the order of 10-9

3.0 EVALUATION FOR DRAINED SHUTDOWN OPERATIONS

The risk for AP600 drained shutdown operations is higher than for non-drained shutdown states. The risk evaluation is conservative for non-drained shutdown because the CCDP calculations are mainly based on lost of offsite power (LOSP) event tree for each situation without loss of coolant and the RNS is not credited (focused PRA). The conservatism has heavier consequences because the mitigation's possibilities are not numerous.

This shows that a best estimate risk is much lower and the margins are very high.

It is possible to distinguish between the following three fire scenarios

1. A loss of non-safety related systems as an initiating event for the mid-loop PRA; the initiating event is either:

   - Loss of off-site power
   - Loss of RNS
   - Loss of CCWS or SWS

2. A loss of one or two divisions of safety related power systems. The plant state is degraded but there is no initiating event. It is necessary to combine this loss with an initiating event that would occur independently after the fire.

3. A loss of non-safety and safety systems. The CCDP would be higher but the scenario's frequency is generally low because this scenario involves a propagation of the fire from one fire area to another.

On the basis of the AP1000 at power fire event trees, it is possible to classify the areas and zones in each categories defined above and to evaluate the global fire scenario frequency for each case.

The fire scenario calculation is based on the fire ignitions of each fire area at-power multiplied, if necessary, by the probability of propagation and/or by the probability of the automatic fire suppression failure. This total is then multiplied by the duration ratio of the shutdown state (0.0204).

Inside the containment, the probability of fire due to the welding activities (the total value calculated for the AP600 containment multiplied by the rate of duration is 9.46E-05 * 0.0204/0.0177 = 1.1E-04) is also added.

3.1 Evaluation of Outside-Containment Scenarios

Scenario 14:

	Fire Areas	Consequence	Fire Scenario Frequency
Sc-14-1	0000 AF 00	LOSP	4.08E-04
Sc-14-2	1200AF01(fs), 1200 AF 02(p), 1204AF01, 1204AF03(p), 205AF02(p), 1230AF02, 1240AF01, 2000AF01(fs), 2003AF01(p), 2009AF02(p), 2033AF02(p), 2040AF01(p), 2043AF01(p), 2050AF01(p), 2052AF01, 2053AF01, 2053AF02, 4003AF01(p), 4031AF01(p), 4031AF02(p), 4031AF06(p), 4032AF01, 4032AF02(p), 4033AF01(p), 4034AF01(p), 4041AF01, 4041AF02, 4042AF01(p), 4042AF02(p), 4052AF01(p), 5031AF01(p)	a loss of either RNS, CCWS or SWS	4.2E-04

(p) The loss is consecutive to the propagation of the fire.
(fs) The loss is consecutive to the automatic fire suppression system failure

From Table 4,

CCDP for LOSP = 3.3E-06
CCDP for loss of RNS = 1.18E-04

The CDF is approximately 1.4E-09 for LOSP and 5.0E-08 for the loss of RNS.

Scenario 15:

	Fire Areas	Consequence	Fire Scenario Frequency
Sc-15-1	Loss of One Division of Safety Related Power	1201 AF 02, 1201 AF 03, 1201 AF 04, 1201 AF 05(p), 1201 AF 06(p), 1202 AF 02(p), 1202 AF 03, 1202 AF 04, 1210 AF 01(p), 1220 AF 01(p), 1230 AF 01(p), 1232 AF 01(p),1242 AF 02	1.5E-02 *0.0204= 3.06E-04
Sc-15-2	Loss of Two Divisions of Safety Related Power	1200AF03, 1201 AF 02(p), 1201 AF 03(p), 1202 AF 03(p), 1202 AF 04(p), 1242 AF 02(p)	1.78E-03* 0.0204=3.6 3E-05

All initiating events with a frequency higher than E-03 are combined together to calculate CDF. The AP600 CCDP for the loss 1 safety-related division of power is in the range of E-04 and, E-03 for the loss of two safety-related divisions. The fire risk is in the order of E-11.

Scenario 16:

	Fire Areas	Consequence	Fire Scenario Frequency
Sc-16	1201 AF 04(p), 1230 AF 02(p), 1240 AF 01(p), 2000 AF 01(fs-p), 4031 AF 05(p)	Loss of RNS and One Division of Safety Related Power	1.66E-06

CCDP is at the order of E-04; the CDF is at the order of E-10.

3.2 Evaluation of Inside-Containment Scenarios

Scenario 17:

	Fire Areas	Consequence	Fire Scenario Frequency
Sc-17-1	1200AF12341	Loss of One Division of Safety	4.05E-07

		Related Power	
Sc-17-2	1100 AF 11206, 1100 AF 11207, 1100 AF 11500, 1100 AF 11300A(p), 1100 AF 11300B	Loss of Two Divisions of Safety Related Power	9.01E-04 * 0.0204 + 1.1E-04 * 0.6(1) = 8.44E-05

(1) This value is the ratio between the sum of the surfaces 11206, 11207, 11500, 11300A (multiplied by propagation), 11300B and the total surface of the containment. It is applied to the total fire risk due to welding operations calculated for the containment.

To calculate CDF for fire areas located outside of the containment, it is necessary to combine fire events with initiating events. The CDF is in the order of E-14 for the loss of one division of safety related power and E-11 in scenarios where there is a loss of two divisions of safety related power.

Scenario 18:

RNS Valve V024 Spurious Actuation:

The RNS V024 spurious actuation, caused by a hot short having a probability of 0.06, may occur in containment Zones 1100 AF 11206, 1100 AF 11300A, 1100 AF 11500 and 1100 AF 11300B or in Fire Area 1230 AF 02 Non 1E-Equipment Penetration Room.

The fire ignition frequency calculated for the containment zones is 8.44E-05. The probability of a fire scenario, bypassing V024 valve, with a loss of two divisions of safety related power is 5.06E-06.

The AP600's CCDP for Containment Zone 1100 AF 11206 was calculated as 6.03E-03. As there is no differences between AP600 and AP1000 for this fire scenario, the CDF is then approximately 3.0E-08.

For the Fire Area 1230 AF 02:

The AP1000 at-power fire ignition frequency was calculated as 2.34E-04; therefore, during mid-loop operation it is 4.8E-06. The fire scenario frequency is calculated as 2.9E-07.

As the safety related systems are not damaged by the fire, the CCDP is taken from Table 1 as 1.18E-04 and the CDF is lower than E-10.

4.0 EVALUATION OF THE MAIN CONTROL ROOM

There is no difference between AP600 and AP1000 for the main control room. The AP600 evaluation is already very low and does not credit the non-safety-related systems. Based on AP600, a realistic evaluation for AP1000 should lead to a very low frequency.

An estimate for AP1000 MCR fire scenarios CDF is given as 7.8E-10 (from AP600 shutdown fire PRA), and is dominated by fire events at drained conditions.

5.0 CONCLUSIONS

This evaluation results in a total of 8.5E-08E-08/year estimation of the AP1000 shutdown fire risk from the 18 scenarios studied above, plus the control room fires at shutdown (See Table 4 for a summary)

The dominant contributors are:

CDF	Cumul. %	Sequence	SD State	Description
5.09E-08	59.7%	Sc-14	Drained	Fire Areas that would result in LOSP or Loss of RNS cooling
3 05E-08	95.5%	Sc-18	Drained	Fire Areas that would result in RNS valve Spurious Actuation
1E-09	96.7%	Sc-12	Non-Drained	Fire Areas that would result in RNS valve Spurious Actuation
1E-09	97.8%	Sc-13	Non-Drained	Fire Areas that would result in RNS valve Spurious Actuation
7.8E-10	98.7%		Drained	Control Room Fires - dominated by Midloop
2E-10	99.0%	Sc-8	Non-Drained	LOSP - the yard
1.66E-10	99 2%	Sc-16	Drained	Fire areas that would result in loss of RNS and 1 Division of Safety Actuation

	Table 2	AP1000 Dominant Fire Sequences				
Scenario	Fire Area (1)	Fire Frequency	Initiating Event	Scenario Frequency	CCDP	CDF
2.1.1 Dominant Scenarios selected from AP600 Shutdown Fire PRA:						
Sc-1-1	1201 AF 03	2.56E-04	Loss of one 1E-Division	2.56E-04	2.60E-08	6.66E-12
Sc-1-2	1201 AF 03	2.56E-04	LOCA and Loss of one 1E-Division	1.08E-07	4.00E-04	4.32E-11
Sc-1-3	1201 AF 03	2.56E-04	Loss of two 1E-Divisions	2.56E-06	1.00E-05	2.56E-11
Sc-1-4	1201 AF 03	2 56E-04	LOCA and Loss of two 1E-Divisions	1.08E-09	1.00E-03	1.08E-12
Sc-2-1	1202 AF 04	2 53E-04	Loss of one 1E-Division	2.53E-04	2.60E-08	6.58E-12
Sc-2-2	1202 AF 04	2.53E-04	LOCA + Loss of one 1E-Division	1.07E-07	4.00E-04	4.28E-11
Sc-2-3	1202 AF 04	2.53E-04	Loss of two 1E-Divisions	2.53E-06	1.00E-05	2.53E-11
Sc-2-4	1202 AF 04	2.53E-04	LOCA + Loss of two 1E-Divisions	1.07E-09	1.00E-03	1.07E-12
Sc-3-1	1202 AF 05	3.74E-04	Loss of one 1E-Division	3.74E-04	2.60E-08	9.72E-12
Sc-3-2	1202 AF 05	3.74E-04	LOCA + Loss of one 1E-Division	1.58E-07	4.00E-04	6.32E-11
Sc-3-3	1202 AF 05	3.74E-04	Loss of two 1E-Divisions	3.74E-06	1.00E-05	3.74E-11
Sc-3-4	1202 AF 05	3.74E-04	LOCA + Loss of two 1E-Divisions	1.58E-09	1.00E-03	1.58E-12
Sc-4-1	1222 AF 01	3.14E-04	Loss of one 1E-Division	3.14E-04	2.60E-08	8.16E-12
Sc-4-2	1222 AF 01	3.14E-04	LOCA + Loss of one 1E-Division	1.32E-07	4.00E-04	5.28E-11
Sc-4-3	1222 AF 01	3.14E-04	Loss of two 1E-Divisions	3.14E-06	1.00E-05	3.14E-11
Sc-4-4	1222 AF 01	3.14E-04	LOCA + Loss of two1E-Divisions	1.32E-09	1.00E-03	1.32E-12
Sc-5-1	1222 AF 02	3.87E-04	No risk	3 87E-04		
Sc-5-2	1222 AF 02					
Sc-5-3	1222 AF 02	3.87E-04	Loss of one 1E-Division	3.87E-06	1.00E-08	3.87E-14

Sc-5-4	1222 AF 02	3.87E-04	LOCA + Loss of one 1E-Division	4.20E-08	4 00E-04	1.68E-11
Sc-6-1	1230 AF 03	1.32E-04	Loss of all non- safety related AC and DC power (actually one Division)	1.32E-04	1.64E-08	2.16E-12
Sc-6-2	1230 AF 03	1.32E-04	Loss of all non- safety related AC and DC power + LOCA (DAS)	1.13E-07	4.72E-04	5.33E-11
Sc-6-3	1230 AF 03	1.32E-04	Loss of all non- safety related AC and DC power + Loss of Division C	1.32E-06	1.00E-05	1.32E-11
Sc-6-4	1230 AF 03	1.32E-04	LOCA + Loss of one 1E-Division + Loss of all non-safety related AC and DC power	1.43E-08	1.00E-04	1.43E-12
Sc-7-1	2000 AF 01	5.14E-03	Loss of all non-safety related AC and DC power (actually one Division)	5.14E-03	1.64E-08	8.43E-11
Sc-7-2						
Sc-7-3	2000 AF 01	5.14E-03	Loss of all non-safety related AC and DC power + Loss of Division C	2 57E-06	1.00E-05	2.57E-11
Sc-7-4						
2.1.2 Dominant Scenarios selected from AP1000 At-Power Fire PRA:						
Sc-8	0000 AF 00	2.00E-02	Loss of RNS (restart possible)	2.00E-02	1.00E-08	2.00E-10
Sc-9-1	1200 AF 03	1.92E-05	Loss of DAS	1.92E-05	1.64E-08	3.15E-13
Sc-9-2	1200 AF 03		LOCA + Loss of DAS	1 66E-08	4.72E-04	7.84E-12
Sc-9-3	1200 AF 03		Loss of DAS + Loss of Division C	1.94E-08	2.60E-08	5.04E-16
Sc-9-4	1200 AF 03		LOCA + Loss of DAS + Division C	1.67E-10	3.94E-04	6.58E-14
Sc-10	4031 AF 01 and 4031 AF 02					5.00E-11
Sc-11	Containing RNS V024					5.00E-11

	Electrical Cables					
2.2 In-Containment Scenarios						
Sc-12	1100AF11300B	9.15E-05				1.00E-09
Sc-13	1100AF11500	2 21E-04				1.00E-09

3.1 Drained Operations – Outside-Containment						
Sc-14-1	0000 AF 00		LOSP	4.08E-04	3 30E-06	1.35E-09
Sc-14-2	1200AF01(fs), 1200 AF 02(p), 1204AF01, 1204AF03(p), 205AF02(p), 1230AF02, 1240AF01, 2000AF01(fs), 2003AF01(p), 2009AF02(p), 2033AF02(p), 2040AF01(p), 2043AF01(p), 2050AF01(p), 2052AF01, 2053AF01, 2053AF02, 4003AF01(p), 4031AF01(p), 4031AF02(p), 4031AF06(p), 4032AF01, 4032AF02(p), 4033AF01(p), 4034AF01(p), 4041AF01, 4041AF02, 4042AF01(p), 4042AF02(p), 4052AF01(p), 5031AF01(p)		a loss of either RNS, CCWS or SWS	4.20E-04	1.18E-04	4.96E-08

Sc-15-1	1201 AF 02, 1201 AF 03, 1201 AF 04, 1201 AF 05(p), 1201 AF 06(p), 1202 AF 02(p), 1202 AF 03, 1202 AF 04, 1210 AF 01(p), 1220 AF 01(p), 1230 AF 01(p), 1232 AF 01(p),1242 AF 02		Loss of One Division of Safety Related Power	3.06E-04	3.00E-08	9.18E-12
Sc-15-2	1200AF03, 1201 AF 02(p), 1201 AF 03(p), 1202 AF 03(p), 1202 AF 04(p), 1242 AF 02(p)		Loss of Two Divisions of Safety Related Power	3.06E-05	3.00E-07	9.18E-12
Sc-16	1201 AF 04(p), 1230 AF 02(p), 1240 AF 01(p), 2000 AF 01(fs-p), 4031 AF 05(p)		Loss of RNS and One Division of Safety Related Power	1.66E-06	1.00E-04	1.66E-10
3.2 Drained Operations - In-Containment						
Sc-17-1	1200AF12341		Loss of One Division of Safety Related Power	4.05E-07	3.00E-08	1.00E-14
Sc-17-2	1100 AF 11206, 1100 AF 11207, 1100 AF 11500, 1100 AF 11300A(p), 1100 AF 11300B		Loss of Two Divisions of Safety Related Power	8.44E-05	3.00E-07	1.00E-11
Sc-17			Sum of subscenarios 1 and 2	8.48E-05		

Sc-18-1	1100 AF 11206, 1100 AF 11300A, 1100 AF 11500 and 1100 AF 11300B		RNS V024 spurious actuation	5.05E-06	6.03E-03	3 05E-08
Sc-18-2	1230 AF 02		RNS V024 spurious actuation	2.90E-07	1.18E-04	3.42E-11
4.0 Control Room Fires						7.80E-10
				Sum =		8.5E-08

Note (1) = For the first seven scenarios, the fire areas refer to AP600; however, the scenarios are adjusted for AP1000 whenever needed.

Table 4	Summary of AP1000 Shutdown Fire Evaluation			
CDF	Cumul. %	Sequence	SD State	Description
5.09E-08	59.7%	Sc-14	Drained	Fire Areas that would result in LOSP or Loss of RNS cooling
3.05E-08	95.5%	Sc-18	Drained	Fire Areas that would result in RNS valve Spurious Actuation
1E-09	96.7%	Sc-12	Non-Drained	Fire Areas that would result in RNS valve Spurious Actuation
1E-09	97.8%	Sc-13	Non-Drained	Fire Areas that would result in RNS valve Spurious Actuation
7.8E-10	98.7%		Drained	Control Room Fires - dominated by Midloop
2E-10	99.0%	Sc-8	Non-Drained	LOSP - the yard
1.66E-10	99.2%	Sc-16	Drained	Fire areas that would result in loss of RNS and 1 Division of Safety Actuation
1.12E-10	99.3%	Sc-3	Non-Drained	1202 AF 05
1.1E-10	99.4%	Sc-7	Non-Drained	2000 AF 01
9.37E-11	99.5%	Sc-4	Non-Drained	1222 AF 01
7.65E-11				
7.57E-11	99.6%	SC-1		
7.01E-11	99.7%	Sc-2		
5E-11	99.8%	Sc-6		
5E-11	99.8%	Sc-10		
1.84E-11	99.9%	Sc-11		
1.68E-11	99.9%	Sc-15		
1E-11	99.9%	Sc-5		
8.22E-12	99.9%	Sc-17		
8.22E-12	99.9%	Sc-9		
8.52E-08	**100.0%**	**= Total CDF**		

Attachment 3d

Shutdown Operations

The shutdown flooding analysis reviews the effects of flooding on maintaining a safe, stable state during the modes identified in the low-power and shutdown assessment. Only changes from the at-power assessment are documented in the following subsections.

Detailed Screening Assessment

Screening for the shutdown analysis is based on the flood screening assessment conducted for at-power operations. For shutdown, screening is based only on the systems modeled for maintaining a safe, stable state in the low-power and shutdown assessment.

Screening of Auxiliary Building

There are no changes from the at-power flooding assessment.

Screening of Containment

There are no changes from the at-power flooding assessment.

Screening of Turbine Building

Areas in the turbine building are retained for further analysis only for their effects on the component cooling water and service water systems. Flooding in the turbine building north or south switchgear rooms does not result in the failure of the component cooling water, service water, or normal residual heat removal systems and is not considered further in this analysis. The loss of main feedwater to both steam generators, loss of compressed air, and loss of condenser events are eliminated from further analysis because these systems are not modeled for maintaining a safe, stable state during shutdown.

Screening of Annex Building

There are no changes from the at-power flooding assessment.

Screening of Other Buildings

Diesel Generator Building

A flooding event in the diesel generator building is conservatively assumed to result in the loss of both diesel generators; however, it does not place a demand on the plant to recover from this effect. Therefore, the diesel generator building is screened from further analysis.

Circulating Water Pumphouse

The circulating water pumphouse has no components used to maintain a safe stable state during shutdown. Therefore, the circulating water pumphouse is eliminated from further analysis.

Identification of Flood-Induced Initiating Events

From the low-power and shutdown assessment, the following postulated initiating events could be caused by a flood-induced initiating event:

- Loss of decay heat removal due to failure within the normal residual heat removal system during reactor coolant system hot/cold shutdown condition
- Loss of decay heat removal due to failure within the normal residual heat removal system (RNS) during reactor coolant system drained condition
- Loss of decay heat removal due to failure of the component cooling water system or service water system during reactor coolant system hot/cold shutdown condition
- Loss of decay heat removal due to failure of the component cooling water system or service water system during reactor coolant system drained condition
- Postulated loss-of-coolant accident and normal residual heat removal pipe break scenarios are addressed in the low-power and shutdown assessment.

Turbine Building 100'-0", 117'-6", 135'-3" Areas

A rupture of the component cooling water, service water, or fire protection piping can result in a loss of the component cooling water and/or the service water systems. This scenario is retained for quantification under loss of decay heat removal due to failure of the component cooling water

system or service water system for both the reactor coolant system hot/cold shutdown and the reactor coolant system drained conditions.

Annex Building 117'-6" AC Switchgear Area

The rupture of the fire protection piping in the annex building ac switchgear area is retained for quantification under the loss of normal residual heat removal due to failure within the normal residual heat removal system during reactor coolant system hot/cold shutdown and the reactor coolant system drained conditions.

Annex Building 135'-3" North Air Handling Equipment Area

The rupture of the fire protection piping in the north air handling equipment area is retained for quantification under the loss of normal residual heat removal due to failure within the normal residual heat removal system during reactor coolant system hot/cold shutdown and reactor coolant system drained conditions.

Auxiliary Building 66'-6", 82'-6" RCA

A rupture of the chemical and volume control or fire protection systems can result in a failure of the RNS. This scenario is retained for quantification under the loss of normal residual heat removal due to failure within the normal residual heat removal system during reactor coolant system hot/cold shutdown and reactor coolant system drained conditions. Rupture of the RNS piping is considered separately in the low-power and shutdown assessment.

Calculation of Flood-Induced Initiating Event Frequencies

For the annex building 135'-3" north air handling equipment area, the loss of decay heat removal due to failure of the normal residual heat removal scenarios from the rupture of the 8-in. fire main extension uses the same event tree developed for the at-power annex building 135'-3" north air handling equipment area loss of main feedwater to both steam generators scenario except the pipe rupture probability. For all the other flood-induced scenarios, no credit is taken for corrective or mitigative actions and just an initiating event frequency is determined.

As documented in the low power and shutdown assessment, the frequency of the plant being at hot/cold shutdown condition is 2.87 events per year. The mission time used to calculate the initiating event frequencies during the hot/cold shutdown phase is 220 hours. The frequency of the plant being at reactor coolant system drained conditions is estimated to be 1.07 events per

year. The mission time used to calculate the initiating event frequencies during reactor coolant system drained conditions is 120 hours.

Turbine Building 100'-0", 117'-6", 135'-3" Areas

Rupture of the component cooling water, service water, or fire protection piping resulting in loss of decay heat removal due to failure of the component cooling or service water system

- During Hot/Cold Shutdown Condition
  - The initiating event frequency is calculated as follows:
  - Pipe rupture rate: 4.25E-10 per section per hour
  - Number of service water pipe sections in the vicinity of the pumps: 16
  - Number of component cooling water pipe sections in the vicinity of the pumps: 22
  - Number of fire protection pipe sections in the vicinity of the pumps: 10
  - Number of fire protection pipe sections in 117'-6" general area: 70
  - Number of fire protection pipe sections in 135'-3" general area: 86
  - Number of fire protection pipe sections in 160'-0" general area: 24
  - Mission time: 220 hours
  - Frequency of hot/cold shutdown: 2.87 per year
- The failure probability is:
  - 4.25E-10 x (16 + 22 + 10 + 70 + 86 + 24) x 220 = 2.13E-05
- Therefore, the initiating event frequency is:
  - 2.13E-05 x 2.87 = 6.11E-05 per year
- During Drained Condition

- The initiating event frequency is calculated using the same number of pipe sections and pipe failure rate as used in the hot/cold shutdown.

  -- Mission time: 120 hours

  -- Frequency of drained conditions: 1.07 per year

  -- The failure probability is:

  -- 4.25E-10 x (16 + 22 + 10 + 70 + 86 + 24) x 120 = 1.16E-05

- Therefore, the initiating event frequency is:

- 1.16E-05 x 1.07 = 1.24E-05 per year

Annex Building 117'-6" AC Switchgear Area

Rupture of the fire protection piping resulting in a loss of decay heat removal due to failure within RNS

- During Hot/Cold Shutdown Condition

- The initiating event frequency is calculated as follows:

  - Pipe rupture rate: 4.25E-10 per section per hour
  - Number of fire protection pipe sections: 4
  - Mission time: 220 hours
  - Frequency of hot/cold shutdown: 2.87 per year

- The failure probability is:

  - 4.25E-10 x 4 x 220 = 3.74E-07

- Therefore, the initiating event frequency is:

  - 3.74E-07 x 2.87 = 1.07E-06 per year

  - During Drained Condition

- The initiating event frequency is calculated using the same number of pipe sections and pipe failure rate as used in the hot/cold shutdown.

- Mission time: 120 hours
- Frequency of drained condition: 1.07 per year

- The failure probability is:
  - 4.25E-10 x 4 x 120 = 2.04E-07
- Therefore, the initiating event frequency is:
  - 2.04E-07 x 1.07 = 2.18E-07 per year

Annex Building 135'-3" North Air Handling Equipment Area

Rupture of the 8-in. fire main extension resulting in a loss of decay heat removal due to failure within the RNS

- The event tree for the rupture of the fire main extension during hot/cold shutdown or during drained conditions is the same as the at-power rupture of the 8-in. fire main extension with the exception of the rupture frequency. Figures 56-10 and 56-11 show the event trees for the fire main rupture during hot/cold shutdown and drained conditions.
- During Hot/Cold Shutdown Condition
- The rupture frequency (FMRHC) is calculated as follows:
  - Pipe rupture rate: 4.25E-10 per section per hour
  - Number of fire protection pipe sections: 10
  - Mission time: 220 hours
  - Frequency of hot/cold shutdown: 2.87 per year
- The failure probability is:
  - 4.25E-10 x 10 x 220 = 9.35E-07
- Therefore, the rupture frequency FMRHC is:
  - 9.35E-07 x 2.87 = 2.68E-06 per year
- Based on the event tree in Figure 56-10, there are three paths that lead to failure:

- FMRAP x SGDTM x (1-CRDET) x FLISM
  Conservatively assuming (1-CRDET) = 1
  2.68E-06 x 1.9E-02 x (1) x 3.8E-02 = 1.94E-09 per year

- FMRAP x SGDTM x CRDET x (1-SGCCR) x FLISM
  Conservatively assuming (1-SGCCR) = 1
  2.68E-06 x 1.9E-02 x 4.31E-02 x (1) x 3.8E-02 = 8.35E-11 per year

- FMRAP x SGDTM x CRDET x SGCCR
  2.68E-06 x 1.9E-02 x 4.31E-02 x 5.10E-01 = 1.12E-09 per year

- Therefore, the initiating event frequency is:

  - 1.94E-09 + 8.35E-11 + 1.12E-09 = 3.14E-09 per year

- During Drained Condition

- The rupture frequency (FMRML) is calculated using the same number of pipe sections and pipe failure rate as used in the hot/cold shutdown.

  - Mission time: 120 hours
  - Frequency of drained condition: 1.07 per year

- The failure probability is:

  - 4.25E-10 x 10 x 120 = 5.10E-07

- Therefore, the rupture frequency FMRML is:

  - 5.10E-07 x 1.07 = 5.46E-07 per year

- Based on the event tree in Figure 56-11, there are three paths that lead to failure:

  - FMRAP x SGDTM x (1-CRDET) x FLISM
    Conservatively assuming (1-CRDET) = 1
    5.46-07 x 1.9E-02 x (1) x 3.8E-02 = 3.94E-10 per year

  - FMRAP x SGDTM x CRDET x (1-SGCCR) x FLISM
    Conservatively assuming (1-SGCCR) = 1
    5.46E-07 x 1.9E-02 x 4.31E-02 x (1) x 3.8E-02 = 1.70E-11 per year

- FMRAP x SGDTM x CRDET x SGCCR
  5.46E-07 x 1.9E-02 x 4.31E-02 x 5.10E-01 = 2.28E-10 per year

- Therefore, the initiating event frequency is:
  - 3.94E-10 + 1.70E-11 + 2.28E-10 = 6.39E-10 per year

Auxiliary Building 66'-6", 82'-6" RCA

Rupture of the chemical and volume control or fire protection piping results in a loss of decay heat removal due to failure within the RNS

- During Hot/Cold Shutdown Condition
- The initiating event frequency is calculated as follows:
  - Pipe rupture rate: 4.25E-10 per section per hour
  - Number of normal residual heat removal pipe sections: 60
  - Number of chemical and volume control pipe sections: 90
  - Number of fire protection pipe sections: 74
  - Mission time: 220 hours
  - Frequency of hot/cold shutdown: 2.87 per year
- The failure probability is:
  - 4.25E-10 x (60 + 90 + 74) x 220 = 2.09E-05
- Therefore, the initiating event frequency is:
  - 2.09E-05 x 2.87 = 6.00E-05 per year
- During Reactor Coolant System Drained Conditions
- The initiating event frequency is calculated using the same number of pipe sections and pipe failure rate as used in the hot/cold shutdown.
  - Mission time: 120 hours
  - Frequency of reactor coolant system drained conditions: 1.07 per year
- The failure probability is:

- -- 4.25E-10 x (60 + 90 + 74) x 120 = 1.14E-05

- Therefore, the initiating event frequency is:
  - -- 1.14E-05 x 1.07 = 1.22E-05 per year

Shutdown Quantification

Scenario 1: Turbine Building General Area - Hot/Cold Shutdown - Rupture of Component Cooling Water System, Fire Protection System, Service Water System

The applicable initiating event from the shutdown PRA for this scenario is loss of decay heat removal due to component cooling water system/service water system failure (IEV-CCWND). Since the damaged non-safety-related accident mitigation systems are not used in this event tree, the event tree is quantified with no additional equipment failures and with a 6.11E-05 initiating event frequency. The resulting core damage frequency is 2.71E-11 per year.

Scenario 2: Turbine Building General Area - Reactor Coolant System Drained - Rupture of Component Cooling Water System, Fire Protection System, and Service Water System

The applicable initiating event from the shutdown PRA for this scenario is loss of decay heat removal due to component cooling water system/service water system failure (IEV-CCWD). Since the damaged non-safety-related accident mitigation systems are not used in this event tree, the event tree is quantified with no additional equipment failures and with a 1.24E-05 initiating event frequency. The resulting core damage frequency is 1.46E-09 per year.

Scenario 3: Annex Building 117'-6" AC Switchgear - Hot/Cold Shutdown - Rupture of Fire Protection System

The applicable initiating event from the shutdown PRA for this scenario is loss of decay heat removal due to RNS failure (IEV-RNSND). Since the damaged accident mitigation systems include both ac power buses, this scenario is essentially the corresponding shutdown focused PRA sensitivity study-initiating event. Therefore, the shutdown focused PRA event tree IEV-RNSND is quantified with no additional equipment failures and with a 1.07E-06 initiating event frequency. Additionally, prior to the quantification, the initiating event ID "IEV-RNSND" was changed to "IEV-RNSND-F" to be able to distinguish between the flooding case where the

shutdown base case event tree with the same name is used. The resulting core damage frequency is 4.74E-13 per year.

Scenario 4: Annex Building 117'-6" AC Switchgear - Reactor Coolant System Drained - Rupture of Fire Protection System

The applicable initiating event from the shutdown PRA for this scenario is loss of decay heat removal due RNS failure (IEV-RNSD). Since the damaged accident mitigation systems include both ac power buses, this scenario is essentially the corresponding shutdown focused PRA sensitivity study. Therefore, the shutdown focused PRA sensitivity study event tree IEV-RNSD is quantified with additional equipment failures and a 2.18E-07 initiating event frequency. Additionally, prior to the quantification, the initiating event ID "IEV-RNSD" was changed to "IEV-RNSD-F" to be able to distinguish between the flooding case where the shutdown base case event tree with the same name was used. To account for the additional equipment failure caused by the loss of both ac power buses, a factor of 10 penalty was assessed on the conditional core damage frequency. The resulting core damage frequency is:

1.18E-04 x 10 x 2.18E-07 = 2.57E-10 per year.

Scenario 5: Annex Building 135'-3" North Air Handling Equipment Area - Hot/Cold Shutdown - Rupture of 8-in. Fire Main Extension

The applicable initiating event from the shutdown PRA for this scenario is loss of decay heat removal due to RNS failure (IEV-RNSND). Due to the small initiating event frequency, 3.14E-09, and the plant systems that would remain available to respond to this event, this initiator was not explicitly quantified. Although the class 1E dc power batteries are failed, the ac feeds to the inverters and to the protection and safety monitoring system (PMS) cabinets remain intact and the safety-related systems should operate as expected. The non-class 1E dc failures would fail the diverse actuation system backup signals in the shutdown model. Conceding a reduced reliability of the signals to the safety-related systems, the flooding core damage frequency for this initiator is estimated by putting a factor of 100 penalty on the conditional core damage frequency for the loss of decay heat removal due to RNS failure (hot/cold shutdown):

4.43E-05 x 100 x 3.14E-09 = 1.39E-13 per year

Scenario 6: Annex Building 135'-3" North Air Handling Equipment Area - Reactor Coolant System Drained - Rupture of 8-in. Fire Main Extension

The applicable initiating event from the shutdown PRA for this scenario is loss of decay heat removal due to RNS failure (IEV-RNSD). Due to the small initiating event frequency, 6.39E-10,

and the plant systems that would remain available to respond to this event, this initiator is not explicitly quantified. Although the class 1E dc power batteries are failed, the ac feeds to the inverters and to the protection and safety monitoring system cabinets remain intact and the safety-related systems should operate as expected. The non-class 1E dc failures would fail the diverse actuation system backup signals in the shutdown model. Conceding a reduced reliability of the signals to the safety-related systems, the flooding core damage frequency for this initiator is estimated by putting a factor of 100 penalty on the conditional core damage frequency for the loss of decay heat removal due to RNS failure (reactor coolant system drained):

1.18E-02 x 100 x 6.39E-10 = 7.53E-12 per year

Scenario 7: Auxiliary Building RCA Portion - Hot/Cold Shutdown - Rupture of Chemical and Volume Control System, Fire Protection System

The applicable initiating event from the shutdown PRA for this scenario is loss of decay heat removal due to RNS failure (IEV-RNSND). Since the damaged non-safety-related accident mitigation system is the initiator and is not used for mitigation in this event tree, the event tree is quantified with no additional equipment failures and with a 6.00E-05 initiating event frequency. The resulting core damage frequency is 2.66E-11 per year.

Scenario 8: Auxiliary Building RCA Portion - Reactor Coolant System Drained - Rupture of Chemical and Volume Control System, Fire Protection System

The applicable initiating event from the shutdown PRA for this scenario is loss of decay heat removal due to RNS failure (IEV-RNSD). Since the damaged non-safety-related accident mitigation system is the initiator and is not used for mitigation in this event tree, the event tree is quantified with no additional equipment failures and with a 1.22E-05 initiating event frequency. The resulting core damage frequency is 1.44E-09 per year.

Total Shutdown Flooding Core Damage Frequency

Based on the conservative assumptions used to generate the flooding initiating event frequencies and the conservative estimates in the quantification process, the total shutdown flooding core damage frequency is 3.22E-09.

The results of the shutdown flood-induced core damage frequency quantification are summarized in Table 1. The eight dominant flooding accident sequences are also shown in the Table 1.

Seismically Induced Flooding

Seismic events could threaten the integrity of tanks and other flooding sources. The consequences of seismic events are modeled in the seismic margin study and in AP1000 SSAR.

Flooding Hazards during Refueling Outages

Flooding events during refueling outages are evaluated qualitatively. Flooding can occur during refueling outages when isolation procedures are not properly followed or when tanks are overfilled. With maintenance procedures that address potential flooding problems, flooding incidents are avoided. It is assumed that administrative controls during refueling outages would effectively mitigate flooding.

Summary of Findings

A PRA internal flooding analysis was performed based on AP1000 SSAR, available detailed design information, and conservative assumptions or engineering judgement.

The minimization of potential flooding sources in the safety-related areas in addition to the physical separation of redundant safety-related components and systems from each other and from non-safety-related components minimizes the consequences of internal flooding. The core damage frequencies arising from flooding events during at-power and shutdown operations are not appreciable contributors to overall AP1000 core damage frequencies.

The internal flooding analysis conservatively assumes that flooding of non-safety-related equipment results in system failure of the affected system. This resulted in a higher flooding-induced core damage frequency at shutdown than at-power, because of the use of the non-safety-related normal residual heat removal system as the primary means of decay heat removal at shutdown.

The top two shutdown flooding scenarios comprise 90 percent of the shutdown flooding-induced core damage frequency. The dominant shutdown flooding core damage initiators are as follows:

- Shutdown flooding scenario 2, loss of decay heat removal due to failure of the component cooling water system or service water system during reactor coolant system drained condition. This is due to a rupture of component cooling water, fire protection, or service water piping in the turbine building general area. This initiator contributes 45 percent of the shutdown flooding core damage frequency.

- Shutdown flooding scenario 8, loss of decay heat removal due to failure within the RNS during reactor coolant system drained condition. This is due to a rupture of chemical and volume control or fire protection piping in the auxiliary building RCA. This initiator contributes 45 percent of the shutdown flooding core damage.

Table 1

AP1000 Shutdown Flooding PRA

Scenario No	Initiating Event Frequency	Conditional Core Damage Frequency	Core Damage Frequency	% Contribution	Initiating Event	Initiating Event CDP Modified
1	6.11E-05	4 43E-07	2.71E-11	0.84	IEV-CCWND	
2	1 24E-05	1.18E-04	1.46E-09	45 41	IEV-CCWD	
3	1 07E-06	4.43E-07	4 74E-13	0 01	IEV-RNSND	
4	2 18E-07	1.18E-03	2 57E-10	7.98	IEV-RNSD	Factor of 10
5	3 14E-09	4 43E-05	1.39E-13	0.00	IEV-RNSND	Factor of 100
6	6 39E-10	1.18E-02	7.53E-12	0 23	IEV-RNSD	Factor of 100
7	6 00E-05	4 43E-07	2 66E-11	0 83	IEV-RNSND	
8	1.22E-05	1.18E-04	1.44E-09	44 68	IEV-RNSD	
Sum =	1.47E-04		3 22E-09	100.00		

The conditional core damage frequencies used in Table 1 were obtained from AP1000 PRA Shutdown Risk Evaluation – Level 1 Analysis (see Table 2 below).

Table 2

AP1000 Shutdown Initiating Events

Initiating Event	Initiating Event Frequency	Conditional Core Damage Frequency	Core Damage Frequency	% Contribution	System Condition	Initiating Event Description
IEV-CCWD	7.16E-04	1.178E-04	8.431E-08	68 5	DRAINED	Loss of CCS/SWS with RCS drained initiating event occurs
IEV-LOSPD	5 28E-03	3 293E-06	1.739E-08	14.13	DRAINED	Loss of offsite power initiating event occurs with RCS drained
IEV-RNSD	9.69E-05	1.178E-04	1.141E-08	9 27	DRAINED	Loss of RNS with RCS drained initiating event occurs

IEV-RCSOD	5.28E-06	7.102E-04	3.750E-09	3 05	DRAINED	Over draining of RCS during drain down to mid-loop initiating event
IEV-LOCA24ND	1 73E-05	1 173E-04	2.029E-09	1 65		LOCA/RNS-V024 opens initiating event occurs with RCS filled
IEV-CCWND	3 99E-03	4 434E-07	1.769E-09	1.44		Loss of CCS/SWS with RCS filled initiating event occurs
IEV-LOCA24D	1.15E-05	1.177E-04	1.354E-09	1.1	DRAINED	LOCA/RNS-V024 opens initiating event occurs with RCS drained
IEV-LOSPND	1.82E-02	2 804E-08	5 103E-10	0.41		Loss of offsite power initiating event occurs with RCS filled
IEV-RNSND	1.02E-03	4 432E-07	4 521E-10	0 37		Loss of RNS with RCS filled initiating event occurs
IEV-LOCAPRND	1.61E-05	7 236E-06	1.165E-10	0 09		LOCA/RNS pipe rupture with RCS filled initiating event occurs
Sum =	2 94E-02		1.231E-07	100		