ATTACHMENT 57B

MODELING OF OPERATOR ACTIONS IN FIRE SCENARIOS

In the AP1000 PRA internal fire analysis for events at power scenarios, operator actions are credited or affected for a few cases. This attachment discusses these operator actions and provides their failure probabilities.

OPA-01 = Operator deactivates the protection and safety monitoring system (PMS) division involved in the fire.

OPA-02 = Operator opens the manual valve to sprinklers in containment.

This attachment also discusses remote shutdown panel actions and credit for manual actuation of ADS by DAS.

57B.1 Calculation of Failure Probability of OPA-01

This section describes the operator action to diagnose a fire in a PMS division fire area and deactivate the PMS division involved in the fire, before two cabinets and their cable trays are involved in the fire. The operator deactivates the PMS division by removing power from all equipment in the affected division by switches in the affected IDS division. The main reason for this operator action is to prevent potential hot shorts in two cabinets/cable trays that may spuriously activate an ADS line. The action also renders the IDS division inoperable.

During normal plant operation at power, a fire event is postulated to occur in a fire area containing either division A, B, C, or D of PMS. These fire areas are labeled as 1202AF04, 1201AF02, 1201AF03, and 1202AF03. These fire areas contain multiple cabinets and their cable trays. Moreover, they contain multiple fire zones located at different floors. The bulk of the combustibles in such a fire area are due to the cabinets and the cable trays. There are no other main sources of combustibles. Thus, a most likely location of a fire is at one cabinet or a cable tray. A hot short in a single cabinet or cable tray is not capable of creating a spurious ADS actuation signal due to engineered design features; another coincidental hot short in a different (for example, adjacent) cabinet (or in its cable tray) must also happen by fire propagation to create the possibility of two hot shorts leading to spurious ADS actuation of any single or multiple stage ADS lines. The AP1000 DCD, in Section 9.5.1.8, states, "The Combined License applicant provides an analysis that demonstrates that operator actions which minimize the probability of the potential for spurious ADS actuation as a result of a fire can be accomplished within 30 minutes following detection of the fire." The fire areas in question are constantly monitored by smoke detectors, which are alarmed in the main control room. When the fire alarm is detected in the control room, the emergency procedures direct the control room staff to immediately go to the fire area in question (one floor down) to confirm the fire; then go down another floor to a different fire zone in the same fire area to deactivate the specific IDS division by opening a breaker. This breaker is clearly marked and is in a fire zone that does not contain the cabinets or the cable trays. The two zones (one containing the cabinets and the other containing the deactivation switch) are on different floors. It is not expected that the operator's entry into the deactivation zone is hampered by the fire in the cabinet zone.

The most likely scenario is that the fire is limited to a cabinet or a cable tray. It is assumed that it takes at least 30 minutes for fire to potentially propagate from one cabinet/cable tray to another adjacent one. This time window allows a realistic chance for the operators to both deactivate the IDS division and to suppress the fire. It is also assumed that the fire alarm sounds within seconds to minutes of the fire starting, due to placement of fire detectors close to cabinets/cable trays, so that the operator time window for diagnosis and action is not considerably shortened.

If the operator action is performed successfully in the time window of 30 minutes following the alarm in the main control room, a spurious ADS signal is unlikely.

Calculation of OPA-01 HEP

Diagnosis and action phases of a human action is considered to model this operator action. Due to the relative shortness of the available time window and uncertainty about the length of the time window, no credit is taken for recovery phase.

It is assumed that a control room operator goes down one floor to confirm that a fire is in progress; then go another floor down to deactivate the division. A time period of 10 minutes is more than sufficient to perform these actions. This allows a time period of up to 20 minutes for the "diagnosis" phase of the operator action. The diagnosis is based on responding to an alarm in the control room. No reactor trip, or multiple alarms are expected at this point.

The performance shaping factors (PSF) for this operator action are as follows:

1. There are emergency procedures for this action. The procedures are short (short list: <= 10 items). However, it is not expected that these procedures are routinely simulated.

2. The diagnosis is to be made in the MCR; the action to deactivate takes place in a fire zone two floors down.

3. Initially, there should be no unduly stress factor. However, after the operator confirms the fire, there may be some additional stress, which may influence the deactivation step.

4. The action is simple, and unambiguous, once the fire is confirmed.

5. The 30-minute time window is adequate for both diagnosis and action.

6. The deactivation switch is well identified and visible during the event (no excessive smoke in the fire zone containing the switch); the lights in the zone and in the corridors leading to the zone are operational (either primary or emergency lighting is available). There are no similar switches in the vicinity of the deactivation switch.

The human error probability (HEP) is given below. The HEP for the OPA-01 is calculated as follows.

Diagnosis Phase

HEP for diagnosis within 20 minutes by control room personnel of abnormal event annunciated in the MCR:

Median: 0.01 (input from NUREG/CR-1278, August 1983, Table 20-3, Item 3)
Error Factor (EF): 10 (input)
Mean: 2.66E-02 (calculated)

Stress: Optimum (normal)
PSF adjustment for HEP = 1.0 (multiplier)

HEP(diagnosis) = 0.0266

Action Phase

HEP for omission of a step in a short procedure:

Median: 0.001 (input from NUREG/CR-1278, August 1983, Table 20-7, Item 1)
EF: 3 (input)
Mean: 1.25E-03 (calculated)

Stress: Moderately high
Tagging Level: Normal
PSF adjustment for HEP = 2.0 (multiplier)

HEP(action) = 0.0025

HEP(OPA-01) = HEP(diagnosis) + HEP(action) = 0.03

EF of HEP = 10 (higher of the two EFs is assigned).

Result

The mean value of the HEP for OPA-01 is calculated to be 0.03 with an error factor of 10 (assuming a lognormal distribution). The 95% confidence level of this HEP is 0.11.

Major modeling assumptions that may affect the result:

1. Availability of a 30-minute time window.

2. The operator can reach the deactivation switch (fire zone is not affected by the fire in the cabinet fire zone).

57B.2 Calculation of Failure Probability of OPA-02

The operator action is to diagnose a fire in the containment fire area 1100AF 11300B, and to open the manual valve to supply water to the fire suppression system in the area. This should be accomplished before multiple sets of cabinets/cable trays involving multiple divisions and

non-1E power are involved in the fire. This operator action is defined as OPA-02. The operator supplies water to the fire suppression system by opening a manual valve in fire area 12306, which is outside the Containment. The main reason for this operator action is to prevent a fire starting in non-1E power to propagate to 1E divisions, or vice versa. If the operator action fails, both the 1E division and non-1E power in the area are conservatively assumed to be inoperable due to fire. Hot shorts may occur whether the operator action is successful or not.

A fire in the containment fire area 1100AF 11300B is alarmed both in the MCR and also in the central fire security station. There are fire procedures that directs the fire emergency personnel to go to the fire zone 1231AF12306 and open a manual valve to supply water to the fire suppression system in 1100AF 11300B. The valve is well tagged and easily located. The valve area is well lit (emergency lighting exists).

The time window to diagnose and perform this action is at least 30 minutes due to ample spacing between the 1E division cables and non-1E division cables. In fact, the distances between non-1E and 1E division cables involved make fire propagation from one set of cables to the other very unlikely. Currently, this fact is not credited probabilistically in the model.

Calculation of OPA-02 HEP

Diagnosis and action phases of a human action models this operator action. No credit is taken for recovery phase.

A time period of 10 minutes is more than sufficient to perform the action phase. This allows a time period of up to 20 minutes for the "diagnosis" phase of the operator action. The diagnosis is based on responding to an alarm in the central fire security station. No multiple alarms are expected at this point.

The performance shaping factors for these operator actions are as follows:

1. There are emergency procedures for this action. The procedures are short (short list: <= 10 items). However, it is not expected that these procedures are routinely simulated.

2. The diagnosis is to be made in the central fire security station; the action takes place in fire zone 1231AF12306, which is not affected by the fire. The fire (that is in the Containment) does not affect the route from the central fire security station to the fire suppression water supply manual valve.

3. Initially, there should be no unduly stress factor. However, after the operator confirms the fire, there may be some additional stress, which may influence the action step.

4. The action is simple, and unambiguous, once the fire is confirmed.

5. The 30-minute time window is adequate for both diagnosis and action.

6. The manual valve is well identified and visible during the event. The lights in the fire zone containing the actuation manual valve and in the corridors leading to the zone are operational (either primary or emergency lighting is available). There are no other valves within the near vicinity of the valve in question.

The human error probability (HEP) is given below. The HEP for the OPA-02 is calculated as follows.

Diagnosis Phase

HEP for diagnosis within 20 minutes (by control room personnel – assumed to apply also to the central fire security station emergency personnel) of abnormal event annunciated in the central fire security station:

Median: 0.01 (input from NUREG/CR-1278, August 1983, Table 20-3, Item 3)
EF: 10 (input)
Mean: 2.66E-02 (calculated)

Stress: Optimum (normal)
PSF adjustment for HEP = 1.0 (multiplier)

HEP (diagnosis) = 0.0266

Action Phase

HEP for omission of a step in a short procedure:

Median: 0.001 (input from NUREG/CR-1278, August 1983, Table 20-7, Item 1)
EF: 3 (input)
Mean: 1.25E-03 (calculated)

Stress: Moderately high
Tagging Level: Normal
PSF adjustment for HEP = 2.0 (multiplier)

HEP(action) = 0.0025

HEP (OPA-01) = HEP (diagnosis) + HEP (action) = 0.03

EF of HEP = 10 (higher of the two EFs is assigned).

Result

The mean value of the HEP for OPA-02 is calculated to be 0.03 with an error factor of 10 (assuming a lognormal distribution). The 95% confidence level of this HEP is 0.11.

Major modeling assumptions that may affect the result:

1. Availability of a 30-minute time window.

Failure Probability of Fire Suppression

The failure probability of fire suppression (Q8) is the sum of the failure probabilities of the operator action and the suppression equipment failure. Failure probability of suppression equipment is 0.05 (taken from Table 57-6).

Q8 = 0.03 + 0.05 = 0.08.

57B.3 Operator Actions at Remote Shutdown Panel

In the event of a MCR fire, the MCR crew trips the reactor, evacuates the MCR, and disables the MCR functions from a panel outside the MCR. Then, they proceed to the remote shutdown workstation for plant shutdown operations. The systems potentially needed for the shutdown, reactor trip, SFW, CMT, ADS, etc., have automatic actuation capabilities still available (no need for operator actuation), similar to the MCR. Operator intervention is required only in cases that would have needed operator actions if the operators had been in the MCR.

Thus, credit is taken for automatic actuation of shutdown functions at the remote shutdown workstation after evacuation and deactivation of MCR. In these scenarios, the operator action (for cases of automatic actuation failures, or for those systems that do not have automatic actuation) failure probabilities are increased to reflect the potentially negative performance shaping factors. This is done in a screening analysis fashion (e.g., conservatively) by increasing the HEPs to 0.1, whenever they are less than 0.1.

57B.4 More Reliable REC-MANDAS

In Attachment 57A, Section 57A.2, the failure probability of ADS actuation by DAS has been revised (lowered), as discussed in that section. This revision implies that the REC-MANDAS operator action HEP, which is calculated to be 1.16E-02 for the base PRA case, has been reduced for the specific cases in which it is used for the fire scenarios. The reduction is at the order of a factor of 10.

ATTACHMENT 57C

FIRE AREA EVENT TREES DEFINING SCENARIOS

This attachment contains the event tree models for each fire area, the data used in the event trees to quantify the scenario initiating event frequencies (Table 57C-1), and the scenario CDFs (Table 57C-2).

Table 57C-1 (Sheet 1 of 5)

DATA USED IN EVENT TREE SCENARIO FREQUENCY CALCULATIONS

TABLE 57-6 AUTOMATIC SUPPRESSION SYSTEM RELIABILITY

System Type	Unavailability of System	Source
Wet Pipe Sprinkler System	2.00E-02	Table 57-6
Preaction or Dry Pipe Sprinkler System	5.00E-02	Table 57-6
Deluge Sprinkler or Water Spray System	5.00E-02	Table 57-6
CO_2 System	4.00E-02	Table 57-6
Halon System	5.00E-02	Table 57-6
No Fire Suppression System	1	Total Failure = 1
Fire Suppression System in Zone 1100 AF 11300B	8.00E-02	See Atttachment 57B, Paragraph 57B.1
Probability of Fire Propagation to an Adjacent Area	0.01	Assumed Value (See Paragraph 57.4.2)
Probability of Hot-Shorts Leading to Spurious Actuation - Case of One Ordered Cable	0.06	NUREG/CR-2258 (See Reference 8)
No Spurious Actuation	0	If there is no spurious actuation, then Probability = 0

TABLE 57-7 FIRE IGNITION FREQUENCIES FOR AP1000 FIRE AREAS

Fire Area	Area Description	Ignition Frequency	Source
0000 AF 00	Yard Building (Including Transformer Yard)	2.00E-02	Table 57-3
1200 AF 01	RCA of Auxiliary Building (All Zones)	1.81E-02	Table 57-3
1200 AF 01 1220 AF 12251	RCA of Aux. Building Zone 1220 AF 12251 With Sprinklers	9.95E-03	
1200 AF 02	New Fuel and Used Fuel Storage, Waste Disposal Container (All Zones)	1.10E-03	Table 57-3
1200 AF 02 1230 AF 12371	New Fuel and Used Fuel Storage, Waste Disposal Container, Rail Car Bay Zone	1.84E-04	
1200 AF 03	Corridors 100' & 117'6"	1.63E-03	Table 57-3
1201 AF 02	Division B Batteries/DC Equipment Room/Instrumentation and Control	3.73E-03	Table 57-3
1201 AF 03	Division D DC Equipment/I&C	3.04E-03	Table 57-3

Table 57C-1 (Sheet 2 of 5)

DATA USED IN EVENT TREE SCENARIO FREQUENCY CALCULATIONS

Fire Area	Area Description	Ignition Frequency	Source
1201 AF 04	Division B/D VBS Equipment	3.60E-04	Table 57-3
1201 AF 05	MSIV Compartment A	6.60E-04	Table 57-3
1201 AF 06	MSIV Compartment B	3.31E-04	Table 57-3
1202 AF 02	Northeast Elevator Shaft	1.17E-03	Table 57-3
1202 AF 03	Division C Batteries/DC Equipment/I&C Room/RCP Trip Switchgear Room/I&C Penetration Room	4.45E-03	Table 57-3
1202 AF 04	Division A Electrical Equipment/Battery Room/I&C Room	3.00E-03	Table 57-3
1204 AF 01	RNS Pump Room B	4.97E-03	Table 57-3
1204 AF 03	South Shield Building Elevator Shaft	1.17E-03	Table 57-3
1205 AF 02	Southeast Elevator Shaft	1.17E-03	Table 57-3
1210 AF 01	Corridor/Spare Battery Room/Spare Room/Spare Battery Charger Room	1.47E-03	Table 57-3
1220 AF 01	Division B RCP Trip Switchgear/Spare Room/Corridor 82' 6"	4.43E-03	Table 57-3
1220 AF02	Lower Annulus Valve Area	1.71E-04	Table 57-3
1230 AF 01	Corridor Division A, B, C, D and Remote Shutdown Workstation	1.71E-04	Table 57-3
1230 AF 02	Non-Class 1E Electrical Compartment - 100'	1.56E-03	Table 57-3
1232 AF 01	Remote Shutdown Workstation	1.32E-04	Table 57-3
1240 AF 01	Non-Class 1E Electrical Compartment - 117'	1.55E-03	Table 57-3
1242 AF 02	Division A Penetration Area	3.33E-04	Table 57-3
1243 AF 01	Reactor Trip Switchgear I	2.84E-03	Table 57-3
1243 AF 02	Reactor Trip Switchgear II	2.84E-03	Table 57-3
1250 AF 01	Nonradioactive Ventilation System	2.68E-03	Table 57-3
2000 AF 01	Turbine Building Floor	6.47E-02	Table 57-3
2003 AF 01	Auxiliary Boiler Equipment Room	1.23E-03	Table 57-3
2009 AF 02	Elevator Machine Room	1.17E-03	Table 57-3
2033 AF 02	Motor-Driven Fire Pump Room	1.01E-03	Table 57-3

Table 57C-1 (Sheet 3 of 5)

DATA USED IN EVENT TREE SCENARIO FREQUENCY CALCULATIONS

Fire Area	Area Description	Ignition Frequency	Source
2040 AF 01	Clean and Dirty Lube Oil Storage	2.83E-04	Table 57-3
2043 AF 01	Chemical Laboratory	3.23E-04	Table 57-3
2050 AF 01	Lube Oil Conditioner Room	2.83E-04	Table 57-3
2052 AF 01	Southwest 6.9KV Switchgear Room	2.48E-03	Table 57-3
2053 AF 01	Electrical Equipment Room	6.70E-03	Table 57-3
2053 AF 02	Northwest 6.9KV Switchgear Room	2.48E-03	Table 57-3
4003 AF 01	Demineralized Water Deoxygenating Room/Air Handling Equipment Rooms	4.26E-03	Table 57-3
4031 AF 01	Battery Room and Battery Charger Room 1	2.87E-03	Table 57-3
4031 AF 02	Battery Room and Battery Charger Room 2/Computer Room B/Shift Turnover Room	3.14E-03	Table 57-3
4031 AF 05	Access Area, Access Corridor, Security Room 2, Corridor, Rest Room	1.42E-03	Table 57-3
4031 AF 06	Central Alarm Station/Security Room 1	1.93E-03	Table 57-3
4032 AF 01	Decontamination Room, Non-Radiological and Radiological Controlled Area Entries...	8.53E-04	Table 57-3
4032 AF 02	Containment Access Corridor Elevation 107' 2"	4.38E-04	Table 57-3
4033 AF 01	Hot Machine Shop	1.67E-03	Table 57-3
4034 AF 01	General Offices	1.42E-03	Table 57-3
4041 AF 01	Conference Rooms/Computer Room A/Corridor	4.66E-04	Table 57-3
4041 AF 02	Corridor/Restroom	4.50E-04	Table 57-3
4042 AF 01	Non-Class 1E Switchgear #1	8.34E-03	Table 57-3
4042 AF 02	Non-Class 1E Switchgear #2	2.66E-03	Table 57-3
4052 AF 01	Staging and Storage Area/Containment Air Filtration Exhaust Rooms A & B	1.94E-03	Table 57-3
5031 AF 01	Radwaste Building	2.42E-02	Table 57-3
6030 AF 01	Diesel Generator Room A	2.99E-02	Table 57-3

Table 57C-1 (Sheet 4 of 5)

DATA USED IN EVENT TREE SCENARIO FREQUENCY CALCULATIONS

Fire Area	Area Description	Ignition Frequency	Source
6030 AF 02	Diesel Generator Room B	3.03E-02	Table 57-3
6030 AF 03	Fuel Oil Day Tank Room A	2.10E-04	Table 57-3
6030 AF 04	Fuel Oil Day Tank Room B	2.10E-04	Table 57-3
Total		2.80E-01	Table 57-3

TABLE 57-4 FIRE IGNITION FREQUENCIES FOR AP1000 CONTAINMENT FIRE AREA

Fire Area	Description	Frequency	Source
1100 AF 11204	Reactor Coolant Drain Tank Room	3.50E-05	Table 57-4
1100 AF 11206	Accumulator Room A	1.81E-05	Table 57-4
1100 AF 11207	Accumulator Room B	1.81E-05	Table 57-4
1100 AF 11208	RNS Valve Room	1.81E-05	Table 57-4
1100 AF 11300A	Maintenance Floor (SE Quadrant Access)	1.54E-04	Table 57-4
1100 AF 11300B	Maintenance Floor (NNE Quadrant) and RCDT Access	3.71E-04	Table 57-4
1100 AF 11301	SG Compartment 1	1.70E-04	Table 57-4
1100 AF 11302	SG Compartment 2	9.51E-05	Table 57-4
1100 AF 11303	Pressurizer Compartment	1.81E-05	Table 57-4
1100 AF 11303A	ADS Lower Valve Area	1.81E-05	Table 57-4
1100 AF 11303B	ADS Upper Valve Area	1.81E-05	Table 57-4
1100 AF 11500	Operating Deck	4.92E-04	Calculated in Section 57.3.4 as 4.90E-04
1200 AF 12341	Middle Annulus	2.29E-05	Table 57-4
1200 AF12555	Main Control Room Emergency Habitability System Air Storage/Operating Deck Staging Area	1.50E-03	Table 57-4
	Total	2.95E-03	Table 57-4
	Main Control Room Fire Ignition Frequency	9.5E-03	Section 57.4.5.3
	MCR CDF	3.18E-12	Section 57.6

Table 57C-1 (Sheet 5 of 5)

DATA USED IN EVENT TREE SCENARIO FREQUENCY CALCULATIONS

Fire Area	Description	Frequency	Source
	Calculations		
	Failure of Suppression in a Zone Without Automatic Fire Suppression	1	Manual Fire Suppression Not Credited in AP1000
	Both NSS Trains Are Damaged By Fire In A Turbine Floor Fire Scenario When Suppression Works	0.5	Expresses the possibility of just losing one out of two NSS trains
	LOSP Following Yard Building Fire	1	LOSP Assumed Following A Yard Fire
	Logical Switch 1	1	Probability = 1
	HF-1 To Switch Off The Electrical Cabinets In Case of Fire In A Room	0.97	The probability to fail to switch off the electrical cabinets in one electrical division is 0.03; then the probability to switch off the cabinet before spurious actuation is 1-0.03=0.97
	Spurious Actuation Stage 4/Spurious Actuation Stage 1, 2 or 3 + Stage 4	0.5	= 2/(2+2)
	Logical Switch 0	0	Probability =0
	Qxx (fire propagation from I&C to DAS cables) within the same containment fire zone	1.00E-02	Section 57.4.5.2; fire area 1100AF 11300B

Table 57C-2 (Sheet 1 of 5)

CCDPs USED IN FIRE EVENT TREES

TABLE 57A-1 SUMMARY OF SCENARIO CCDPs

Initiating Event	Scenario Description (Additional Failures)	Fire Scenario CCDP	CCDP Scenario Number	AP1000 CCDP	Ratio f/a
		f		a	
IEV-LMFW	Loss of SFW, CCW, SWS, CAS	7.73E-08	SCEN1	2.45E-09	31.53
IEV-TRANS	Loss of SFW, CCW, SWS, CAS	7.51E-08	SCEN1A	2.10E-09	35.72
IEV-LMFW	Loss of SFW, CCW, SWS, CAS, Div D	1.93E-07	SCEN2	2.45E-09	78.51
IEV-LMFW	Loss of SFW, CCW, SWS, CAS, Div B	1.93E-07	SCEN2A	2.45E-09	78.51
IEV-SPADS	Loss of SFW, CCW, SWS, CAS, Div D	1.25E-03	SCEN3	5.48E-04	2.28
IEV-SPADS	Loss of SFW, CCW, SWS, CAS, Div D	1.25E-03	SCEN3A	5.48E-04	2.28
IEV-SPADS	Loss of Division B power	1.25E-03	SCEN3B	5.48E-04	2.28
IEV-SPADS	Loss of Division A power	1.25E-03	SCEN3C	5.48E-04	2.28
IEV-SPADS	Loss of Division D power	1.25E-03	SCEN3D	5.48E-04	2.28
IEV-LOSP	Loss of SFW, CCW, SWS, CAS, power on main AC buses OTH-R05 = 1	1.05E-07	SCEN4A	8.37E-09	12.54
IEV-LOSP	Loss of SFW, CCW, SWS, CAS, Div D, power on main AC buses	1.63E-07	SCEN5	8.37E-09	19.45
IEV-LOSP	Loss of SFW, CCW, SWS, CAS, Div D, power on main AC buses OTH-R05=1	2.33E-07	SCEN5A	8.37E-09	27.82
IEV-LMFW	Loss of one train of SFW, CCW, SWS, CAS	7.73E-08	SCEN6	2.45E-09	31.53
IEV-LMFW	Loss of one train of SFW, CCW, SWS, CAS, Div D	1.93E-07	SCEN7	2.45E-09	78.72
IEV-LOSP	AC power not recoverable after LOSP	1.02E-07	SCEN8	8.37E-09	12.18
IEV-MLOCA	Loss of Division B and D power	2.28E-03	SCEN9	3.69E-05	61.71
IEV-MLOCA	Loss of Division B and D power	2.28E-03	SCEN9A	3.69E-05	61.71
IEV-MLOCA	Loss of Division A and C power	2.28E-03	SCEN9B	3.69E-05	61.71
IEV-TRANS	Loss of A, B, C and D power	2.70E-06	SCEN10	2.10E-09	1.28E+03
IEV-TRANS	Loss of Division A and C power	2.70E-06	SCEN11	2.10E-09	1.28E+03
IEV-TRANS	Loss of Division B and D power	2.70E-06	SCEN11A	2.10E-09	1.28E+03

Table 57C-2 (Sheet 2 of 5)

CCDPs USED IN FIRE EVENT TREES

Initiating Event	Scenario Description (Additional Failures)	Fire Scenario CCDP	CCDP Scenario Number	AP1000 CCDP	Ratio f/a
IEV-SPADS	Loss of Division A and C power	1.60E-03	SCEN12	5.48E-04	2.92
IEV-SPADS	Loss of Division B and D power	1.60E-03	SCEN12A	5.48E-04	2.92
IEV-MLOCA	Loss of Division A and C power	2.28E-03	SCEN13	3.69E-05	61.71
IEV-TRANS	Loss of Division A power	2.70E-09	SCEN14	2.10E-09	1.28
IEV-TRANS	Loss of Division D power	7.47E-08	SCEN14A	2.10E-09	35.53
IEV-TRANS	Loss of Division B power	7.23E-08	SCEN14B	2.10E-09	34.39
IEV-TRANS	Loss of CVS	2.10E-09	SCEN15	2.10E-09	1.00
IEV-TRANS	Loss of RNS and CVS	2.55E-09	SCEN15A	2.10E-09	1.21
IEV-TRANS	Loss of Division C power and CVS	2.70E-09	SCEN16	2.10E-09	1.28
IEV-TRANS	Loss of Reactor Trip Switchgear I	2.10E-09	SCEN17	2.10E-09	1.00
IEV-MLOCA	Loss of DAS, RNS, and CVS	1.31E-03	SCEN18	3.69E-05	35.46
IEV-SPADS	Loss of RNS, CVS and DAS	1.02E-03	SCEN19	5.48E-04	1.86
IEV-MLOCA	Loss of Division B power	8.07E-04	SCEN20	3.69E-05	21.84
IEV-MLOCA	Loss of Division D power	8.07E-04	SCEN20A	3.69E-05	21.84
IEV-MLOCA	Loss of Division C power	8.07E-04	SCEN20B	3.69E-05	21.84
IEV-MLOCA	Loss of Division A power	8.07E-04	SCEN20C	3.69E-05	21.84
IEV-TRANS	Loss of DAS & non-1E electrical division	1.38E-06	SCEN21	2.10E-09	657.14
IEV-TRANS	Loss of Division C, DAS & non-1E electrical division	1.38E-06	SCEN22	2.10E-09	657.14
IEV-MLOCA	Loss of Division C, DAS & non-1E electrical division	2.05E-03	SCEN23	5.48E-04	3.74
IEV-MLOCA	Loss of Division C, DAS & non-1E electrical division	2.05E-03	SCEN24	3.69E-05	55.49
IEV-SPADS	Loss of Division C power	1.25E-03	SCEN25	5.48E-04	2.28
IEV-LMFW	Loss of MFW and SFW	7.73E-08	SCEN26	2.45E-09	31.53
IEV-LOSP	Loss of SFW, CCW, SWS, CAS, Div D	1.08E-07	SCEN27	8.37E-09	12.90
IEV-LOSP	Loss of SFW, CCW, SWS, CAS	1.87E-08	SCEN28	8.37E-09	2.23

Table 57C-2 (Sheet 3 of 5)

CCDPs USED IN FIRE EVENT TREES

Initiating Event	Scenario Description (Additional Failures)	Fire Scenario CCDP	CCDP Scenario Number	AP1000 CCDP	Ratio f/a
IEV-TRANS	Loss of IRWST valves 117A, 118A, 120A, 123A and 125A	2.10E-09	SCEN29	2.10E-09	1.00
IEV-TRANS	Loss of RNS MOV-023	2.55E-09	SCEN30	2.10E-09	1.21
IEV-LMFW	Loss of 1 CMT, MFW & SFW	7.34E-08	SCEN31	2.45E-09	29.94
IEV-LMFW	Loss of A & C Div, 2 CMT, MFW, SFW, DAS, 1 train of CCW, non-1E electrical division & hydrogen igniters	4.81E-04	SCEN32	2.45E-09	1.96E+05
IEV-TRANS	Loss of A & C Div, 2 CMT, DAS, 1 train of CCW, non-1E electrical division & hydrogen igniters	2.46E-06	SCEN33	2.10E-09	1.17E+03
IEV-SPADS	Loss of A & C Div, 2 CMT, MFW, SFW, DAS, 1 train of CCW, non-1E electrical division & hydrogen igniters	1.00E-00	SCEN34	5.48E-04	1.82E+03
IEV-SPADS	Loss of MFW and SFW	5.48E-04	N/A	5.48E-04	1.00
IEV-TRANS	Loss of 1 stage 1, 2 & 3 of ADS	2.99E-09	SCEN35	2.10E-09	1.42
IEV-MLOCA	Loss of 1 stage 1, 2 & 3 of ADS	4.03E-05	SCEN36	3.69E-05	1.09
IEV-LMFW	Loss of Div B & D, MFW and SFW	1.08E-06	SCEN37	2.45E-09	440.50
IEV-TRANS	Loss of Division A & DAS	1.38E-06	SCEN38	2.10E-09	657.14
IEV-MLOCA	Loss of Div A, DAS, non-1E electrical division & hydrogen igniters	1.94E-03	SCEN39	3.69E-05	52.51
IEV-TRANS	Loss of Division A & C, one CMT, one PRHR isolation valve and one path of CCW	1.02E-06	SCEN40	2.10E-09	485.71
IEV-TRANS	Loss of two diesel generators	2.10E-09	SCEN41	2.10E-09	1.00
IEV-SPADS	Loss of Division A & C, one CMT, one PRHR isolation valve and one path of CCW	2.50E-03	SCEN42	5.48E-04	4.56
IEV-TRANS	ALL HEP set to 1	2.91E-08	SCEN43	2.10E-09	13.86
IEV-TRANS	ALL HEP set to 0.1	4.35E-09	SCEN44	2.10E-09	2.07
IEV-MLOCA	Loss of A & C divisions (or B &D divisions) and loss of DAS	1.0	SCEN45	3.69E-05	27100

Table 57C-2 (Sheet 4 of 5)

CCDPs USED IN FIRE EVENT TREES

TABLE 57A-2 AP1000 BASE CASE CCDPs FOR INITIATING EVENTS

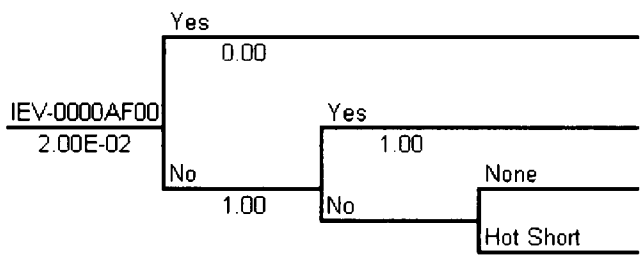
	Initiating Event	% Contribution to Plant CDF	# of Cutsets	Initiating Event CDF	Initiating Event Frequency	Initiating Event CCDP
1	IEV-SI-LB	39.5	1120	9.50E-08	2.12E-04	4.48E-04
2	IEV-LLOCA	18.7	286	4.50E-08	5.00E-06	8.99E-03
3	IEV-SPADS	12.3	1078	2.96E-08	5.40E-05	5.48E-04
4	IEV-SLOCA	7.52	1639	1.81E-08	5.00E-04	3.61E-05
5	IEV-MLOCA	6.7	1682	1.61E-08	4.36E-04	3.69E-05
6	IEV-RV-RP	4.16	1	1.00E-08	1.00E-08	1.00E-00
7	IEV-SGTR	2.77	2730	6.66E-09	3.88E-03	1.72E-06
8	IEV-CMTLB	1.53	989	3.68E-09	9.31E-05	3.95E-05
9	IEV-ATWS	1.51	145	3.62E-09	4.81E-01	7.53E-09
10	IEV-TRANS	1.22	1254	2.94E-09	1.40E-00	2.10E-09
11	IEV-POWEX	0.69	692	1.66E-09	4.50E-03	3.69E-07
12	IEV-RCSLK	0.69	1428	1.65E-09	6.20E-03	2.66E-07
13	IEV-LCOND	0.51	838	1.24E-09	1.12E-01	1.11E-08
14	IEV-LOSP	0.42	2224	1.00E-09	1.20E-01	8.37E-09
15	IEV-LMFW	0.34	1285	8.21E-10	3.35E-01	2.45E-09
16	IEV-ATW-T	0.3	15	7.13E-10	1.17E-00	6.09E-10
17	IEV-LCAS	0.28	416	6.72E-10	3.48E-02	1.93E-08
18	IEV-SLB-V	0.25	305	6.06E-10	1.21E-03	5.01E-07
19	IEV-PRSTR	0.18	320	4.29E-10	1.34E-04	3.20E-06
20	IEV-LMFW1	0.18	740	4.26E-10	1.92E-01	2.22E-09
21	IEV-LCCW	0.13	692	3.16E-10	1.44E-01	2.20E-09
22	IEV-SLB-U	0.05	160	1.31E-10	3.72E-04	3.51E-07
23	IEV-ATW-S	0.05	55	1.11E-10	1.48E-02	7.49E-09

Table 57C-2 (Sheet 5 of 5)

CCDPs USED IN FIRE EVENT TREES

	Initiating Event	% Contribution to Plant CDF	# of Cutsets	Initiating Event CDF	Initiating Event Frequency	Initiating Event CCDP
24	IEV-ISLOC	0.02	1	5.00E-11	5.00E-11	1.00E-00
25	IEV-LRCS	0.01	131	3.33E-11	1.80E-02	1.85E-09
26	IEV-SLB-D	0	18	9.15E-12	5.96E-04	1.54E-08

0000 AF 00 Yard Building (Including Transformer Yard)



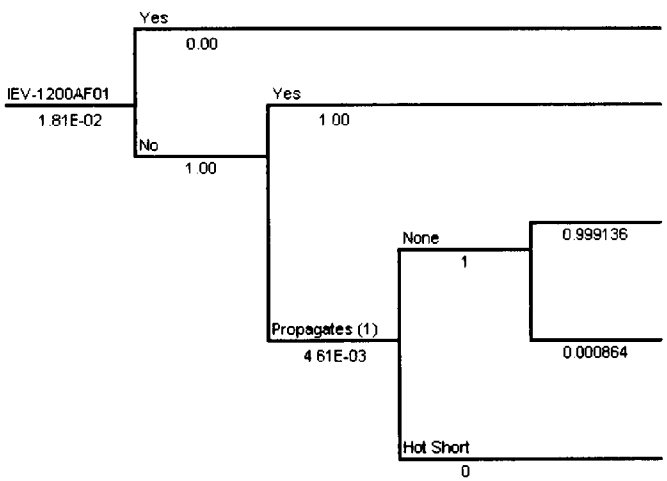
Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario number	Failed Components	Area Propagated Into
TB-1	0.00E+00					No Risk	
TB-2	2.00E-02	1.02E-07	2.04E-09	IEV-LOSP	SCEN8	See Note 1	None
TB-3							
TB-4							
Total =	2.00E-02		2.04E-09				

Note:
1. Loss of offsite power event is assumed to occur, and is assumed to be not recoverable in a short time period (R05 in LOSP event)

Figure 57C-1

0000 AF 00 Yard Building (Including Transformer Yard)

1200 AF 01 RCA of Auxiliary Building (All Zones)



Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenrio number	Failed Components	Area Propagated into
TB-1	0.00E+00	0.00E+00	0.00E+00				None
TB-2	1.80E-02	2.55E-09	4.59E-11	IEV-TRANS	SCEN15A	Loss of one RNS train and loss of CVS	None
TB-3	8.34E-05	1.38E-06	1.15E-10	IEV-TRANS	SCEN21	Loss of RNS, CVS, DAS (cables), and loss of B and D signals to the reactor switchgear	1230 AF 02
TB-5	7.21E-08	1.02E-03	7.36E-11	IEV-SPADS	SCEN19	Loss of RNS, CVS, DAS (cables), and loss of B and D signals to the reactor switchgear, spurious opening of one ADS stage 4 (DAS cables)	1230 AF 02
TB-6	0.00E+00	1.31E-03	0.00E+00	IEV-MLOCA	SCEN18	Loss of RNS, CVS, DAS (cables), and loss of B and D signals to the reactor switchgear, spurious opening of ADS stage 1,2,3 (DAS cables)	1230 AF 02
		Total =	2.35E-10				

Note:

1 The probability of propagation takes into account the automatic fire suppression system in the zone 1220 AF 12251

Thus, the fire propagates with a probability of 0.01 if it starts in the zone 1220 AF 12251 and the fire suppression fails or if the fire starts anywhere else:

Probability of propagation (Calc 1): 4.61E-03

2 The probability of actuation of stage 4 is: 4 times (because 4 valves) the spurious actuation due to hot shorts in manual cables

3 There is no possibility of spurious actuation of stage 1 or 2 or 3

Calc 1:

Probability = (RCA of Aux. Building Zone 1220 AF 12251 With Sprinklers x Wet Pipe Sprinkler System Unavailability + (RCA of Auxiliary Building All Zones - RCA of Aux. Building Zone 1220 AF 12251 With Sprinklers)) x (Probability of Fire Propagation to an Adjacent Area/ RCA of Auxiliary Building All Zones)

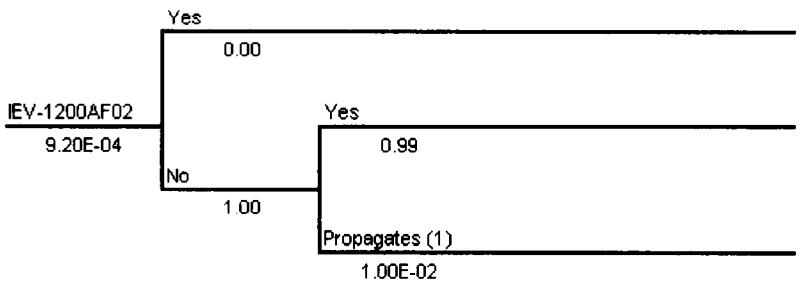
Probability = (9.95E-03 x 2.00E-02 + (1.81E-02 - 9.95E-03)) x (0.01/1.81E-02)

Probability = 4.61E-03

Figure 57C-2

1200 AF 01 RCA of Auxiliary Building (All Zones)

1200 AF 02 New Fuel and Used Fuel Storage, Waste Disposal Container (All Zones)



Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario number	Failed Components	Area Propagated Into
TB-1	0.00E+00	0.00E+00	0.00E+00			no	None
TB-2	9.10E-04	0.00E+00	0.00E+00			no	None
TB-3	9.20E-06	2.55E-09	2.34E-14	EV-TRANS	SCEN15A	Loss of RNS, CVS	1200 AF 01
		Total =	2.34E-14				

Note:

1. Ignition frequency is modified to take into account the fact there is a suppression system in one zone of the area that avoid propagation.

A risk appears only in case of propagation.

Ignition Frequency Calulation: 9.20E-04

Ignition Frequency = (New Fuel and Used Fuel Storage, Waste Disposal Container (All Zones) - New Fuel and Used Fuel Storage, Waste Disposal Container, Rail Car Bay Zone + (New Fuel and Used Fuel Storage, Waste Disposal Container, Rail Car Bay Zone x Unavailability of Wet Pipe Sprinkler System)

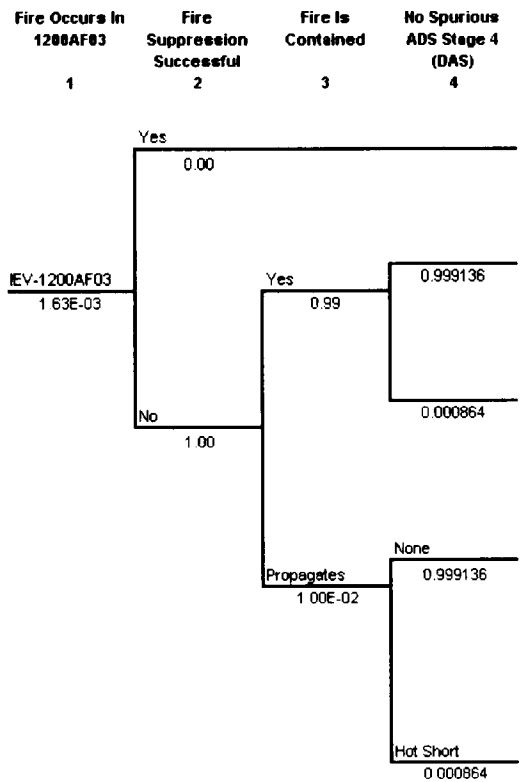
Ignition Frequency = 0.0011 - 0.000184 + (.000184 x .02)

Ignition Frequency = 9.20E-04

Figure 57C-3

1200 AF 02 New Fuel and Used Fuel Storage, Waste Disposal Container (All Zones)

1200 AF 03 Corridors 100'&117'6"



Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario number	Failed Components	Area Propagated into
TB-1	0.00E+00	2.70E-06	0.00E+00	IEV-TRANS	SCEN11A		None
TB-2	1.61E-03	2.70E-06	4.35E-09	IEV-TRANS	SCEN11A	Some Division B&D I&C cables (But ADS actuation is available), loss of DAS, loss of B and D signals to the reactor trip switchgear	None
TB-3	1.39E-06	1.60E-03	2.23E-09	IEV-SPADS	SCEN12A	Some Division B&D I&C cables (But ADS actuation is available), loss of DAS, loss of B and D signals to the reactor trip switchgear, opening of 1 ADS Stage 4 (due to DAS damage)	None
TB-4	1.63E-05	2.70E-06	4.40E-11	IEV-TRANS	SCEN11A	Some Division B&D I&C cables (But ADS actuation is available), loss of DAS, loss of B and D signals to the reactor trip switchgear, loss of Division C of power and control	1202 AF 03
TB-5	1.41E-08	1.60E-03	2.25E-11	IEV-SPADS	SCEN12	Some Division B&D I&C cables (But ADS actuation is available), loss of DAS, loss of B & D signals to the reactor trip switchgear, opening of 1 ADS Stage 4 (due to DAS damage), loss of Division C of power and control	1202 AF 03
		Total =	6.65E-09				

Notes:

1 Probability of spurious actuation of Stage 4 is multiplied by 4 to represent all four Stage 4 valves.

The spurious actuation due to hot shorts in manual cables = 4(.06)(.06)(.06)

The spurious actuation due to hot shorts in manual cables = 0.000864

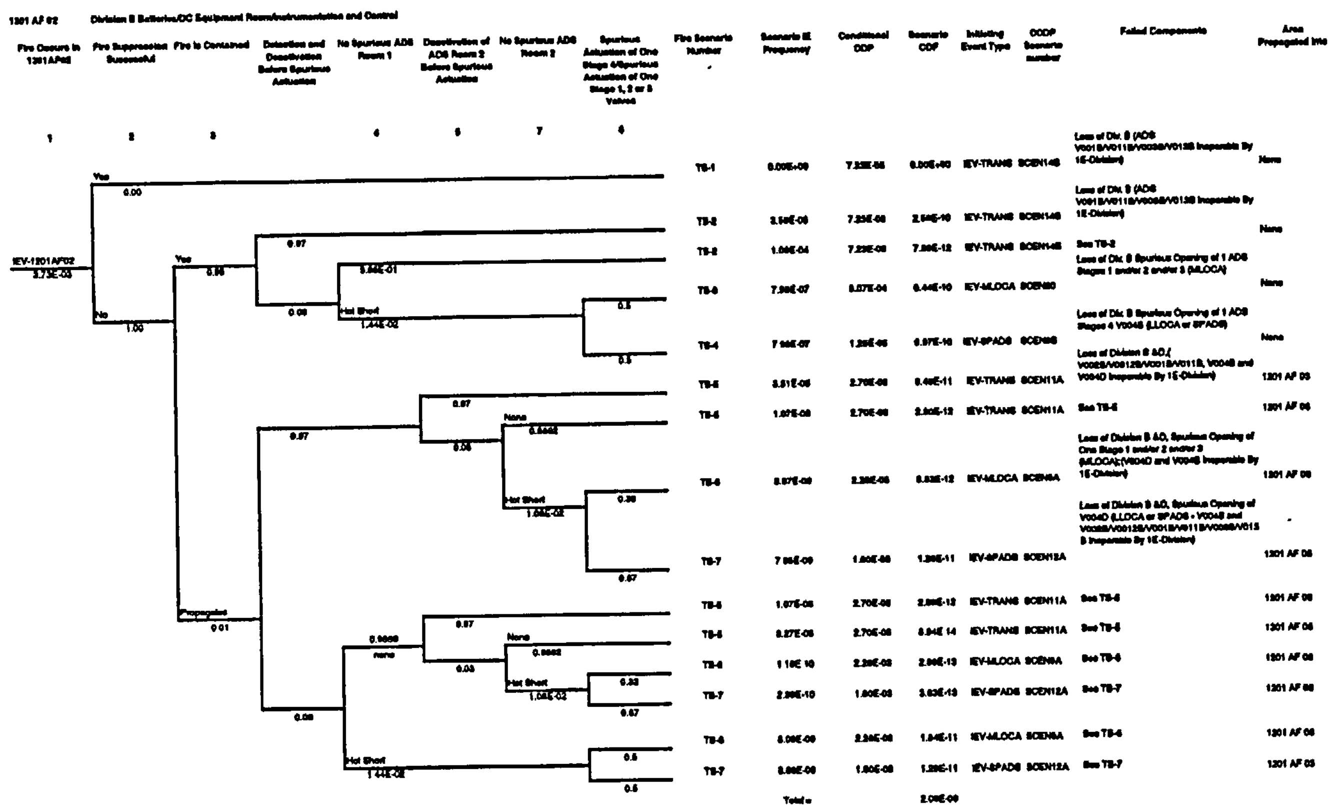
2 The loss of Division B & D cables in this area does not imply the loss of ADS, therefore, an assumption is made that there is only a spurious actuation of Stage 4 by DAS cables.

To be not too conservative, the CCDP models the loss of B & D divisions with the DAS still being available.

3 For Fire Scenario TB-4, a loss of 4 divisions is conservatively assumed.

Figure 57C-4

1200 AF 03 Corridors 100′ & 117′ 6″



Notes:

1 1 44E-02 is 4 valve failures of two cables calculated as 4(0.06)(0.06). There are 2 Stage 4 valves and 2 Stage 1, 2 or 3 valves included in this calculation therefore the value is split between the two group of stages or 0.5.

1 06E-02 is 3 valve failures of 2 cables calculated as 3(0.06)(0.06). There is one Stage 1, 2 or 3 valve and two Stage 4 valves therefore the split is 0.33 to 0.67 between the two group of stages.

The probability of spurious actuation in Room B is 0.06 x 0.06 (V001B/V011B)+ 0.06x0.06 (V003B/V013B)+ 0.06x0.06 (V004B)+ 0.06x0.06 (V004D)

The probability of spurious actuation in Room D is 0.06 x 0.06 (V002B/V012B)+ 0.06 x 0.06 (V004B)+ 0.06 x 0.06 (V004D)

2 For Fire Scenario TB-2, manual fire suppression is not credited in AP1000 Fire PRA

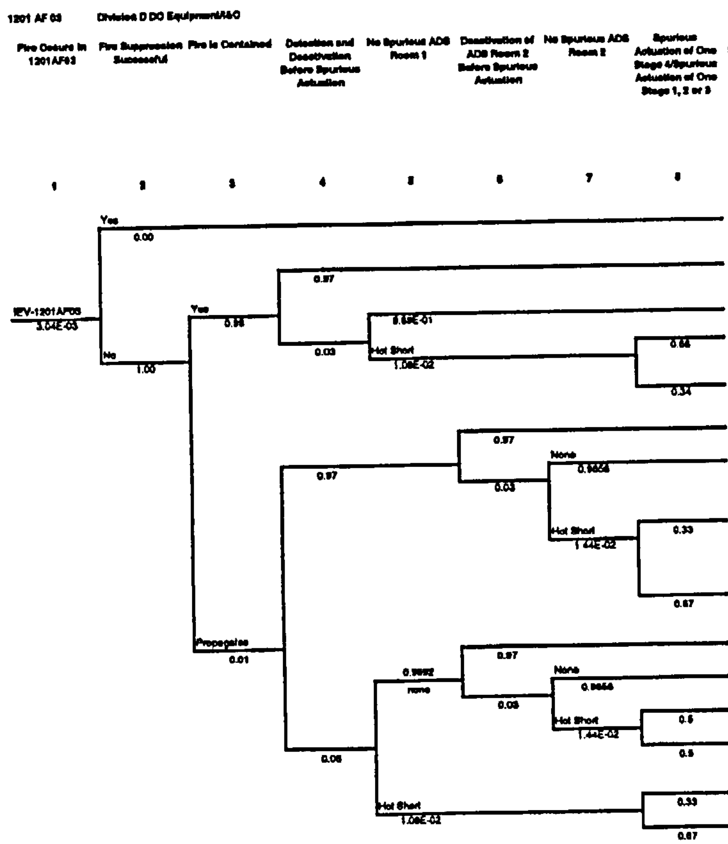
3 For Fire Scenario TB-5, despite manual fire suppression and a 3-hour rated fire barrier, the fire may propagate because of a failure of the fire barrier.

4 For Fire Scenario TB-4, 6 and 8, probability to deactivate the electrical cabinets before ADS spurious actuation

5 For Fire Scenario TB-7 and 9, spurious actuation of any ADS valve in Room 2 and ADS Stage 1, 2, 3 or 4 respectively.

Figure 57C-5

1201 AF 02 Division B Batteries/ DC Equipment Room/Instrumentation and Control



Fire Scenario Number	Scenario IE Frequency	Conditional CCP	Scenario CDF	Initiating Event Type	CCDP Scenario number	Failed Components	Area Propagated Into
TB-1	0.00E+00	7.47E-08	0.00E+00	IEV TRANS	SCEN14A		None
TB-2	2.92E-03	7.47E-08	2.18E-10	IEV-TRANS	SCEN14A	Loss of Div. D (ADS V002B/V012B Inoperable By 1E Division)	None
TB-3	8.93E-05	7.47E-08	6.67E-12	IEV-TRANS	SCEN14A	Loss of Div. D (ADS V002B/V012B Inoperable By 1E Division)	
TB-3	6.44E-07	8.07E-04	5.19E-10	IEV-MLOCA	SCEN80A	Loss of Div. D Spurious Opening of 1 ADS Stages 1 and/or 2 and/or 3 (MLOCA)	None
TB-4	3.32E-07	1.25E-03	4.14E-10	IEV-SPADS	SCEN3A	Loss of Div. D Spurious Opening of 1 ADS Stages 4 V004B (Large LOCA or SPADS)	None
TB-5	2.84E-05	2.70E-06	7.79E-11	IEV-TRANS	SCEN11A	Loss of Division B &D,(V002B/V012B/V001B/V011B/V003B/V013B, V004B and V004D Inoperable By 1E Division)	1201 AF 02
TB-5	8.72E-07	2.70E-06	2.36E-12	IEV-TRANS	SCEN11A	See TB-5	1201 AF 02
TB-6	4.20E-09	2.28E-03	9.59E-12	IEV-MLOCA	SCEN8A	Loss of Division B & D, Spurious Opening of One Stage 1 and/or 2 and/or 3 (MLOCA);(V004D and V004B Inoperable By 1E-Division)	1201 AF 02
TB-7	8.54E-09	1.80E-03	1.57E 11	IEV-SPADS	SCEN12A	Loss of division B &D, spurious opening of V004D (LLOCA or SPADS - V004B and V002B/V012B/V001B/V011B/V003B/V013B Inoperable by 1E-division)	1201 AF 02
TB-5	8.75E-07	2.70E-06	2.36E 12	IEV-TRANS	SCEN11A	see TB-5	1201 AF 02
TB-5	2.67E-08	2.70E-06	7.20E-14	IEV TRANS	SCEN11A	see TB-5	1201 AF 02
TB-6	1.95E-10	2.28E-03	4.44E-13	IEV-MLOCA	SCEN8A	see TB-6	1201 AF 02
TB-7	1.95E-10	1.60E-03	3.12E-13	IEV-SPADS	SCEN12A	see TB-7	1201 AF 02
TB-6	3.26E-09	2.28E-03	7.41E-12	IEV-MLOCA	SCEN8A	see TB-6	1201 AF 02
TB-7	6.60E-09	1.60E-03	1.06E-11	IEV-SPADS	SCEN12A	see TB-7	1201 AF 02
		Total =	1.28E-09				

Notes.

1 1.44E-02 is 4 valve failures of two cables calculated as 4(0.06)(0.06). There are 2 Stage 4 valves and 2 Stage 1, 2 or 3 valves included in this calculation therefore the value is split between the two group of stages or 0.5.
1.08E-02 is 3 valve failures of 2 cables calculated as 3(0.06)(0.06). There is one Stage 1, 2 or 3 valve and two Stage 4 valves therefore the split is 0.33 to 0.67 between the two group of stages.
The probability of spurious actuation in Room B is 0.06x0.06 (V001B/V011B)+ 0.06x0.06 (V003B/V013B)+ 0.06x0.06 (V004B)+ 0.06x0.06 (V004D)
The probability of spurious actuation in room D is 0.06x0.06 (V002B/V012B)+ 0.06x0.06 (V004B)+ 0.06x0.06 (V004D)

2 For Fire Scenario TB-2, manual fire suppression is not credited in AP1000 Fire PRA

3 For Fire Scenario TB-3, despite manual fire suppression and a 3-hour rated fire barrier, the fire may propagate because of a failure of the fire barrier

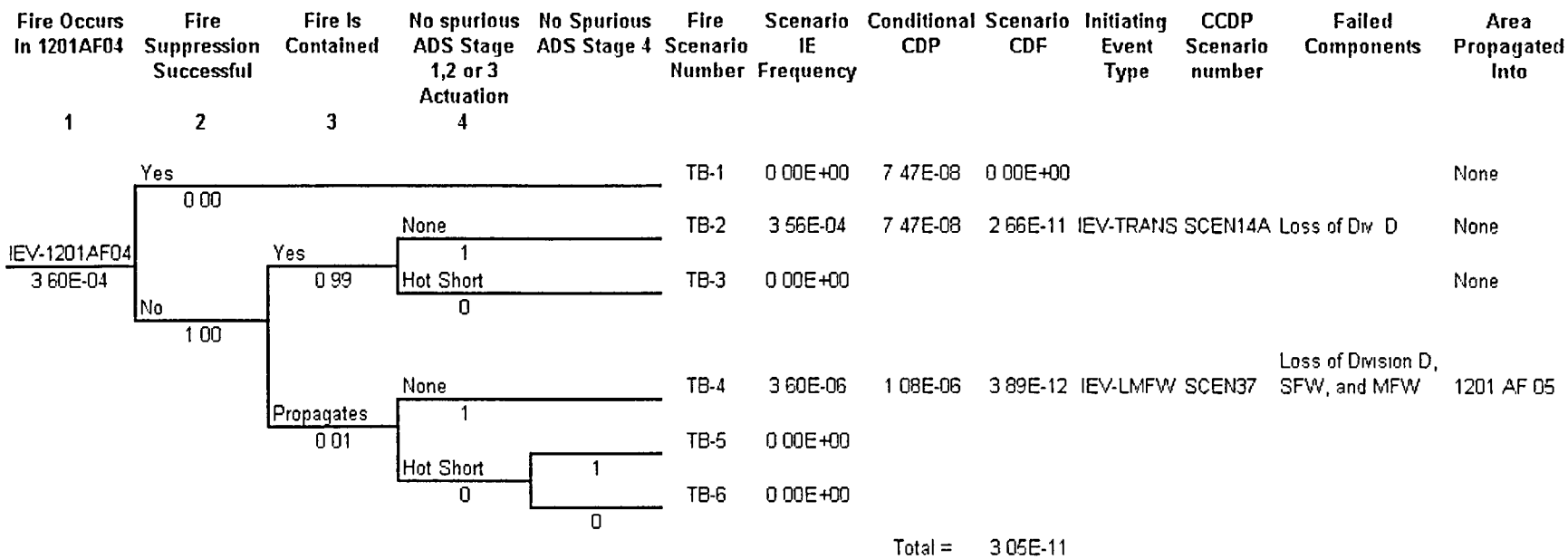
4 For Fire Scenario TB-4, 5 and 6, probability to deactivate the electrical cabinets before ADS spurious actuation

5 For Fire Scenario TB-7 and 8, spurious actuation of any ADS valve in Room 2 and ADS Stage 1, 2, 3 or 4 respectively.

Figure 57C-6

1201 AF 03 Division D DC Equipment/I&C

1201 AF 04 Division B/D VBS Equipment

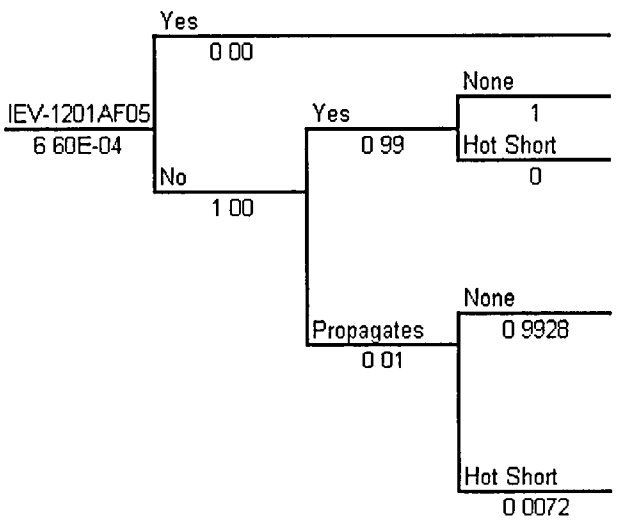


Note
1 Fire Scenario TB-4 is conservatively assumed to be a fire causing the loss of Divisions B & D, MFW and SFW

Figure 57C-7

1201 AF 04 Division B/D VBS Equipment

1201 AF 05 MSIV Compartment A



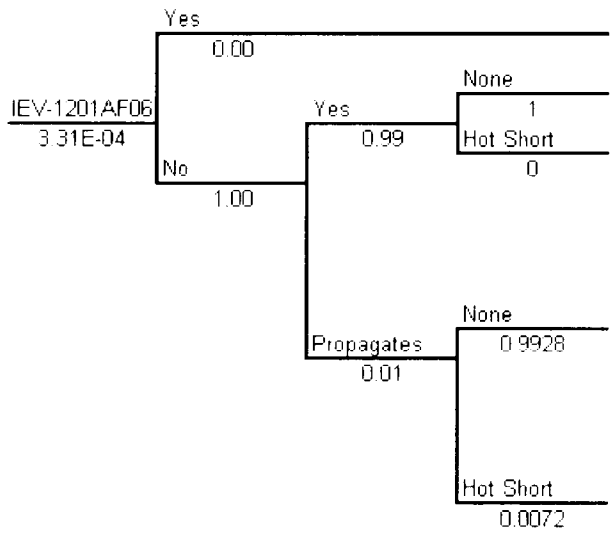
Fire Occurs In 1201AF05	Fire Suppression Successful	Fire Is Contained	No Spurious ADS	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
	Yes			TB-1	0 00E+00	7.73E-08	0 00E+00				
	No	Yes	None	TB-2	6 53E-04	7 73E-08	5 05E-11	IEV-LMFW	SCEN1	Loss of SWS and SFW	None
	No	Propagates	None	TB-4	6 55E-06	1 93E-07	1 26E-12	IEV-LMFW	SCEN2	Loss of Division D, SWS, SFW (ADS V002B/V012B Inoperable)	1201 AF 03
	No	Propagates	Hot Short	TB-5	4 75E-08	1 25E-03	5 94E-11	IEV-SPADS	SCEN3A	Loss of Division D, SWS, SFW, Spurious Opening of ADS Stage 4 V004B or V004D	1201 AF 03
						Total =	1 11E-10				

Note:
1 For these fire scenarios, the CCDP conservatively is assumed to contain the loss of CCW and CAS in addition to SWS, SFW ,and ADS valves

Figure 57C-8

1201 AF 05 MSIV Compartment A

1201 AF 06 MSIV Compartment B



Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario number	Failed Components	Area Propagated into
TB-1	0.00E+00	7.73E-08	0.00E+00				
TB-2	3.28E-04	7.73E-08	2.53E-11	IEV-LMFW	SCEN1	Loss of MSW, SFW	None
TB-4	3.29E-06	1.93E-07	6.33E-13	IEV-LMFW	SCEN2A	Loss of Division B, SWS and SFW (ADS V001B/V011B/V003B/V013 B Inoperable By 1E-Division)	1202 AF 03
TB-5	2.38E-08	1.25E-03	2.98E-11	IEV-SPADS	SCEN3B	Loss of Division B, SWS, SFW, and spurious opening of ADS Stage 4 V004B or V004D (LLOCA or SPADS)	1202 AF 03
		Total =	5.58E-11				

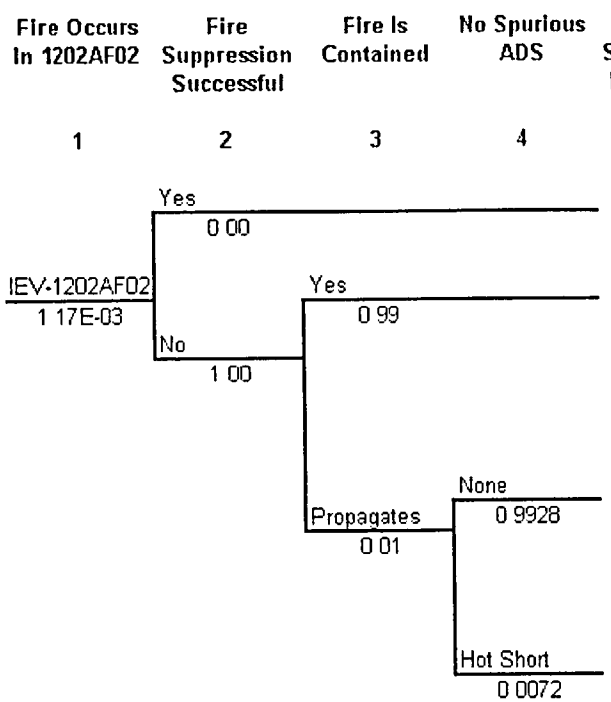
Note.

1. A loss of CCWS and CAS is included in Fire Scenarios TB-1, TB-2, TB-3 but not for Fire Scenario TB-4.
2. For spurious actuation of ADS Stage 4 a value of 0.0072 is derived from a loss of 2 failures of 2 cables (2(0.06)(0.06))

Figure 57C-9

1201 AF 06 MSIV Compartment B

1202 AF 02 Northeast Elevator Shaft



Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	Fire Scenario Number	Failed Components	Area Propagated Into
TB-1	0 00E+00	0 00E+00	0 00E+00			No Risk	
TB-2	1 16E-03	0	0 00E+00			No Risk	
TB-3	1 16E-05	2 70E-09	3 14E-14	IEV-TRANS	SCEN14	Loss of Division A of Power and Control (ADS V001A/V011A Inoperable By 1E-Division)	1202 AF 04
TB-4	8 42E-08	8 07E-04	6 80E-11	IEV-MLOCA	SCEN20C	Loss of division A of power and control, spurious opening of ADS (V001A/V011A) or (V003A/V013A)	1202 AF 04
		Total =	6 80E-11				

Note

1 The probability of spurious actuation (0 0072) in Room A is 0 06x0 06 (V001A/V011A)+ 0 06x0 06 (V003A/V013A)

Figure 57C-10

1202 AF 02 Northeast Elevator Shaft

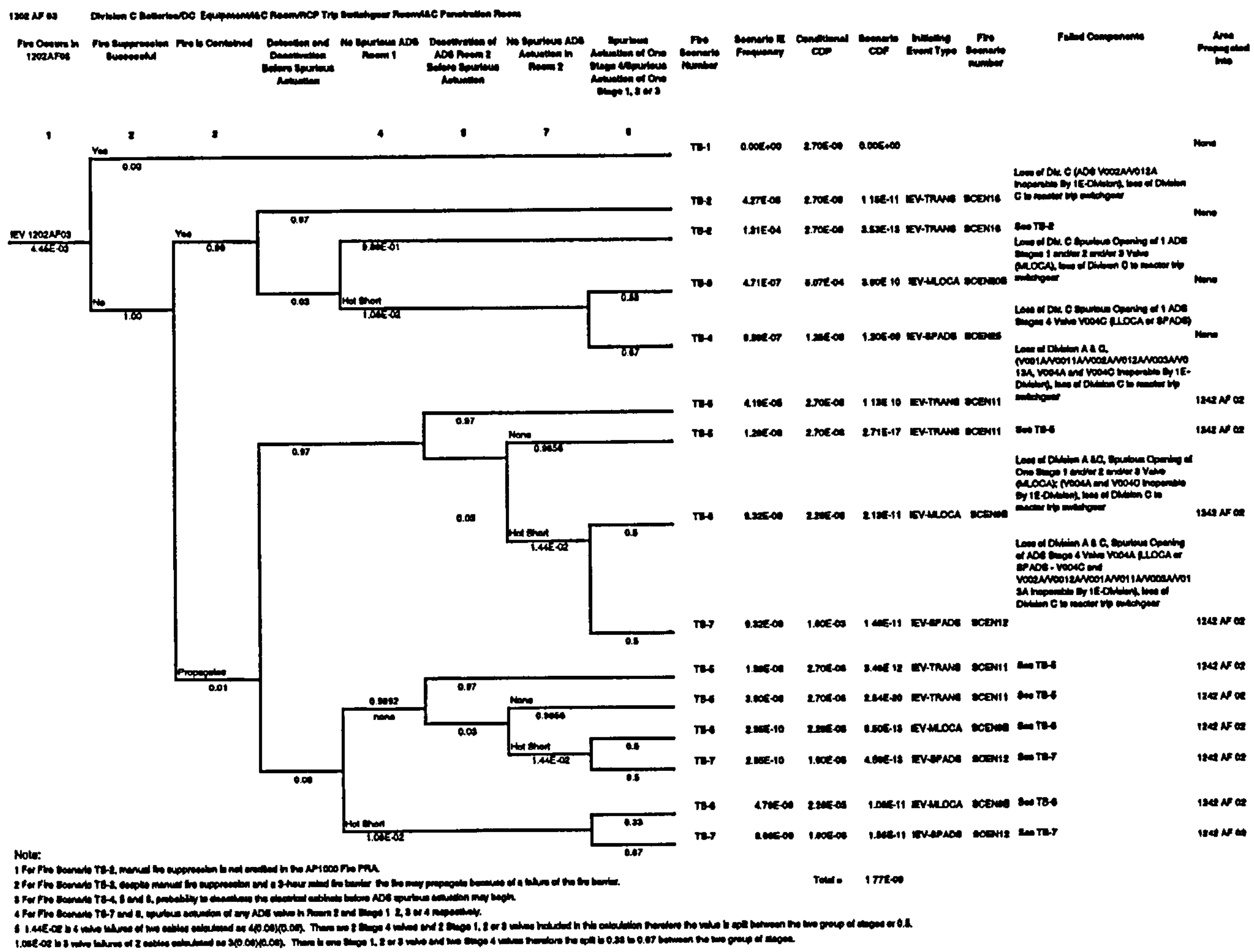
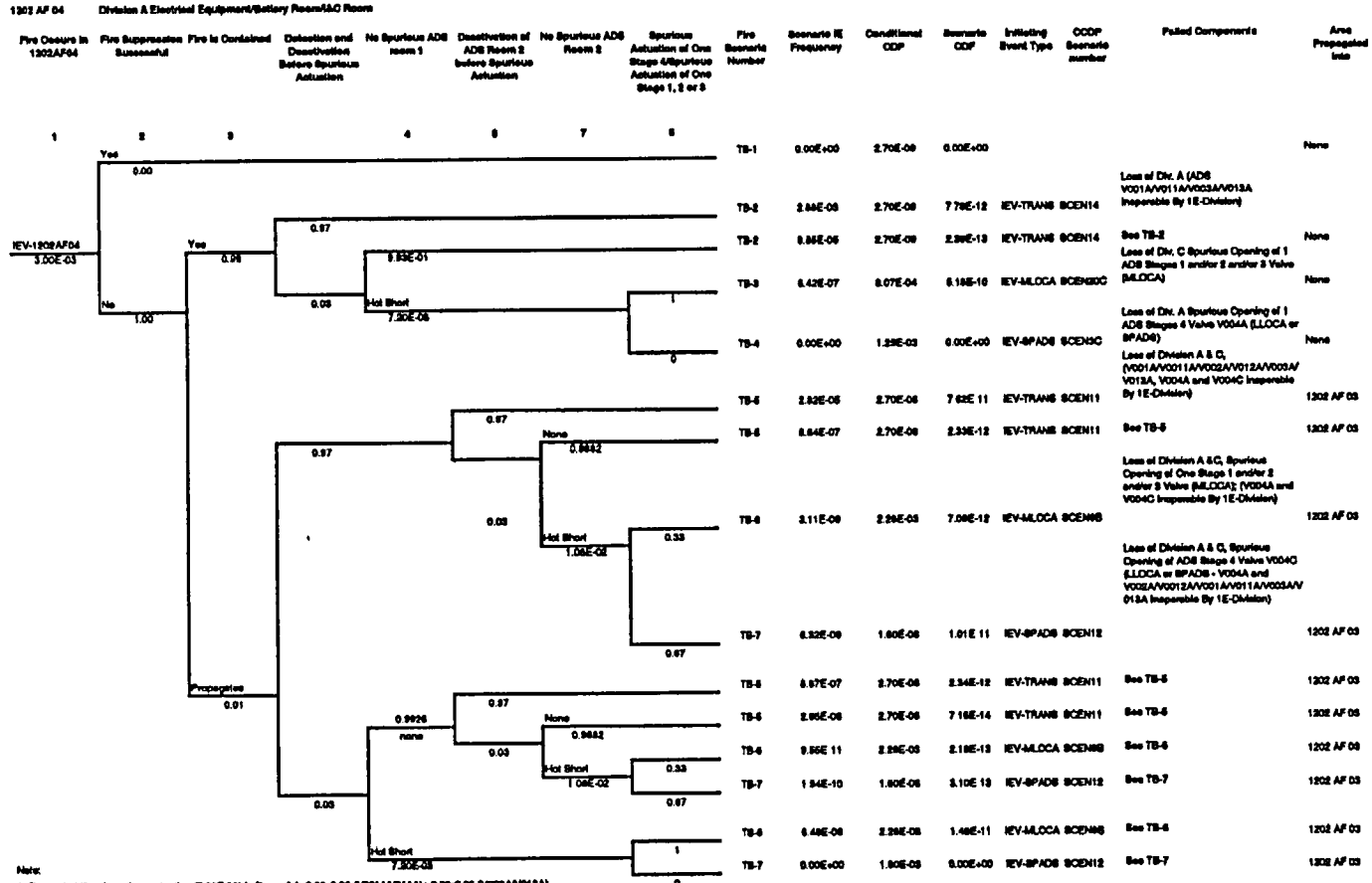


Figure 57C-11

1202 AF 03 Division C Batteries/DC Equipment/I&C Room/ RCP Trip Switchgear Room/I&C Penetration Room



Note:

1 The probability of spurious actuation (7.30E-05) in Room A is 0.08x0.08 (V001A/V011A)+ 0.08x0.08 (V003A/V013A), as all valves are valves from Stages 1 and 3 and none from Stage 4 then the failure is 1 and 0 respectively

The probability of spurious actuation (1.08E-02) in Room C is 0.08x0.08 (V002B/V012B)+ 0.08x0.08 (V004A)+ 0.08x0.08 (V004C) therefore a proportion of 0.33 and 0.67

2 For Fire Scenario TB-2, manual fire suppression is not credited in the AP1000 Fire PRA.

3 For Fire Scenario TB-3, despite manual fire suppression and a 3-hour rated fire barrier, the fire may propagate because of a failure of the fire barrier

4 For Fire Scenario TB-4, 5 and 6, probability to deactivate the electrical cabinets before ADS spurious actuation may begin.

5 For Fire Scenario TB-7 and 8, spurious actuation of any ADS valve in Room 2 and Stage 1, 2, 3 or 4 respectively

Figure 57C-12

1202 AF 04 Division A Electrical Equipment/ Battery Room/I&C Room

1204 AF 01 RNS Pump Room B

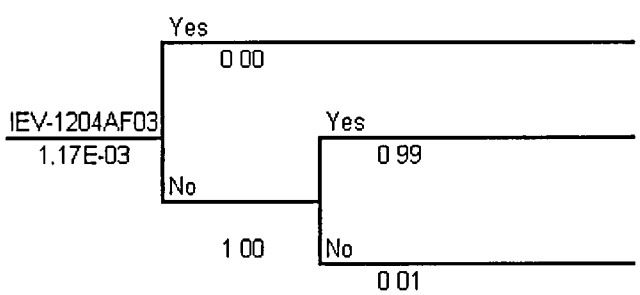
Fire Occurs In 1204 AF 01	Fire Suppression Successful	Fire Is Contained	No Spurious ADS Actuation	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario number	Failed Components	Area Propagated Into
1	2	3	4								
IEV-1204AF01 4 97E-03	Yes 0 00			TB-1	0 00E+00	2 55E-09	0 00E+00				None
	No 1 00	Yes 0 99		TB-2	4 92E-03	2 55E-09	1 25E-11	IEV-TRANS	SCEN15A	Loss of One RNS Pump	
		No 0 01		TB-3	4 97E-05	2 55E-09	1 27E-13	IEV-TRANS	SCEN15A	Loss of RNS and CVS Systems	1200 AF 01
						Total =	1 27E-11				

Note
1 For Fire Scenario TB-2, the fire damage is conservatively assumed as a loss of RNS and CVS

Figure 57C-13

1204 AF 01 RNS Pump Room B

1204 AF 03 South Shield Building Elevator Shaft

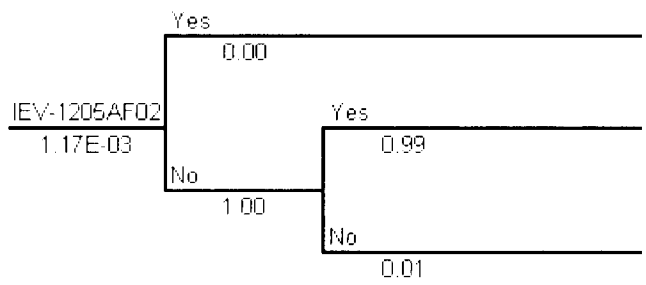


Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario number	Failed Components	Area Propagated Into
TB-1	0 00E+00	0	0 00E+00				None
TB-2	1.16E-03	0 00E+00	0.00E+00			No Risk	
TB-3	1 17E-05	2 55E-09	2 98E-14	IEV-TRANS	SCEN15A	Loss of RNS and CVS Systems	1200 AF 01
		Total =	2 98E-14				

Figure 57C-14

1204 AF 03 South Shield Building Elevator Shaft

1205 AF 02 Southeast Elevator Shaft

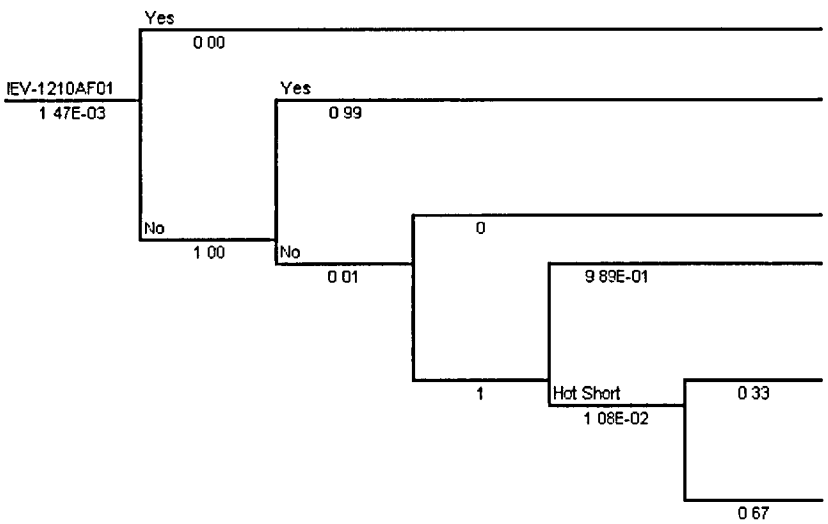


Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario number	Failed Components	Area Propagated Into
TB-1	0.00E+00	0	0.00E+00				None
TB-2	1.16E-03	0.00E+00	0.00E+00			No Risk	
TB-3	1.17E-05	2.55E-09	2.98E-14	IEV-TRANS	SCEN15A	Loss of RNS and CVS Systems	1200 AF 01
		Total =	2.98E-14				

Figure 57C-15

1205 AF 02 Southeast Elevator Shaft

1210 AF 01 Corridor/Spare battery Room/Spare Room /Spare Battery Charger Room



Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario number	Failed Components	Area Propagated Into
TB-1	0 00	0 00E+00	0 00E+00			No Risk	
TB-2	1 46E-03	0 00E+00	0 00E+00			No Risk	
TB-3	0 00E+00	2 70E-09	0 00E+00	IEV-TRANS	SCEN16	Loss of Div C (ADS V002A/V012A Inoperable By 1E-Division), loss of Division C of Reactor Trip Switchgear	1202 AF 03
TB-3	1 45E-05	2 70E-09	3 93E-14	IEV-TRANS	SCEN16		
TB-4	5 24E-08	8 07E-04	4 23E-11	IEV-MLOCA	SCEN20B	Loss of Div C Spurious Opening of 1 ADS Stages 1 and/or 2 and/or 3 Valve (MLOCA), loss of Division C of Reactor Trip Switchgear	1202 AF 03
TB-5	1 06E-07	1 25E-03	1 33E-10	IEV-SPADS	SCEN3C	Loss of Div C Spurious Opening of 1 ADS Stages 4 Valve V004C (LLOCA or SPADS)	1202 AF 03
		Total =	1 75E-10				

Note
1 for Fire Scenario TB-3, a loss is conservatively assumed as a loss of Division C and CVS
2 For Fire Scenario TB-5, the loss is assumed to be a loss of Division A and SPADS
3 The probability of spurious actuation (1 08E-02) in Room C is 0 06x0 06 (V002B/V012B)+ 0 06x0 06 (V004A)+ 0 06x0 06 (V004C), therefore, a split of 0 33 for Stage 2 and 0 67 for Stage 4

Figure 57C-16

1210 AF 01 Corridor/Spare Battery Room/ Spare Room/Spare Battery Charger Room

1220 AF 01 Division B RCP Trip Switchgear/Spare Room/Corridor 82' - 6"

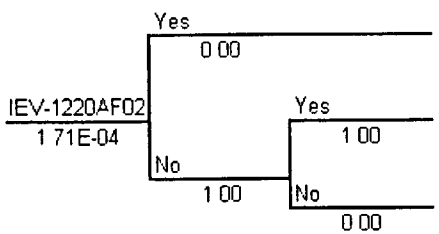
Fire Occurs In 1220AF01 1	Fire Suppression Successful 2	Fire Is Contained 3	No Spurious ADS Stage 4 4	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario number	Failed Components	Area Propagated Into
IEV-1220AF01 4.43E-03	Yes 0.00			TB-1	0.00E+00	2.10E-09	0.00E+00	IEV-TRANS	SCEN15		None
	No 1.00	Yes 0.99		TB-2	0.00E+00	2.10E-09	0.00E+00	IEV-TRANS	2.10E-09	Loss of Division B Input to RCP Trip Switchgear and Divisions B and D Reactor Trip Signals, and CVS	None
		Propagates 0.01	None 0.99	TB-3	4.38E-05	2.70E-09	1.18E-13	IEV-TRANS	SCEN16	Loss of Division C Power and Control, Division B & C Input to RCP Trip Switchgear and Division B and D Reactor Trip Signals, CVS	1202 AF 03
			Hot Short 1.08E-02	TB-4	4.78E-07	1.25E-03	5.98E-10	IEV-SPADS	SCEN3C	Loss of Division C Power and Control, Division B & C Input to RCP Trip Switchgear and Divisions B and D Reactor Trip Signals, CVS, and Spurious Opening of ADS Stage 4 Valve V004A or V004C (LLOCA or SPADS)	1202 AF 03
						Total =	5.98E-10				

Note:
The probability of spurious opening (1.08E-02) in one division: either stage 4 V004A (prob. of 0.06x0.06) or stage 4 V004C (prob. of 0.06x0.06) or stage 2 (V002A and V012A -prob. of 0.06x0.06)

Figure 57C-17

1220 AF 01 Division B RCP Trip Switchgear/ Spare Room/Corridor 82' 6"

1220 AF02 Lower Annulus Valve Area



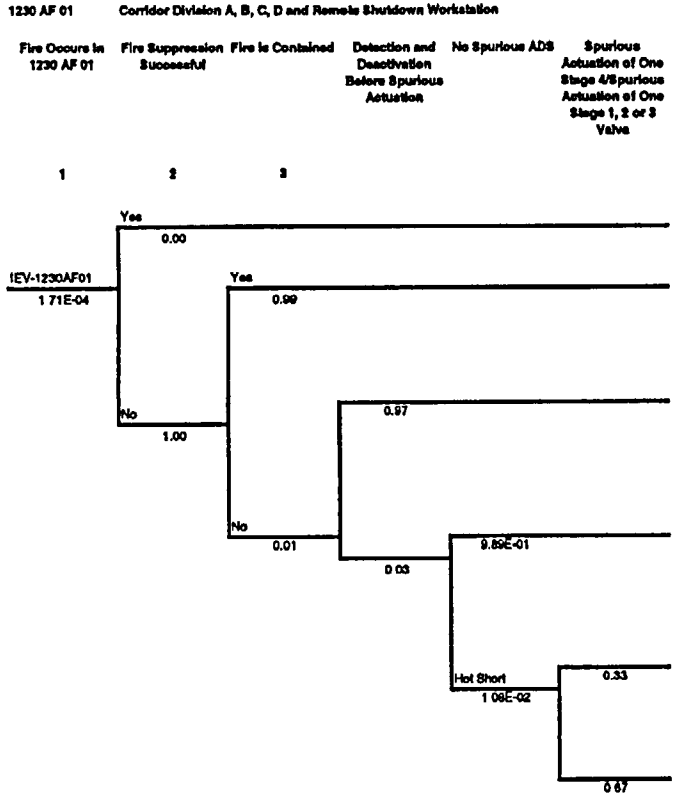
Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario number	Failed Components	Area Propagated Into
TB-1	0 00E+00	2 10E-09	0 00E+00	IEV-TRANS	SCEN15	Loss of CVS and WLS Systems	
TB-2	1 71E-04	2 10E-09	3 59E-13	IEV-TRANS	SCEN15	Loss of CVS and WLS Systems	None
		Total =	3 59E-13				

Note
1 For these fire scenarios, a loss due to fire damage of WLS has a neglible impact

Figure 57C-18

1220 AF 02 Lower Annulus Valve Area

1230 AF 01 Corridor Division A, B, C, D and Remote Shutdown Workstation

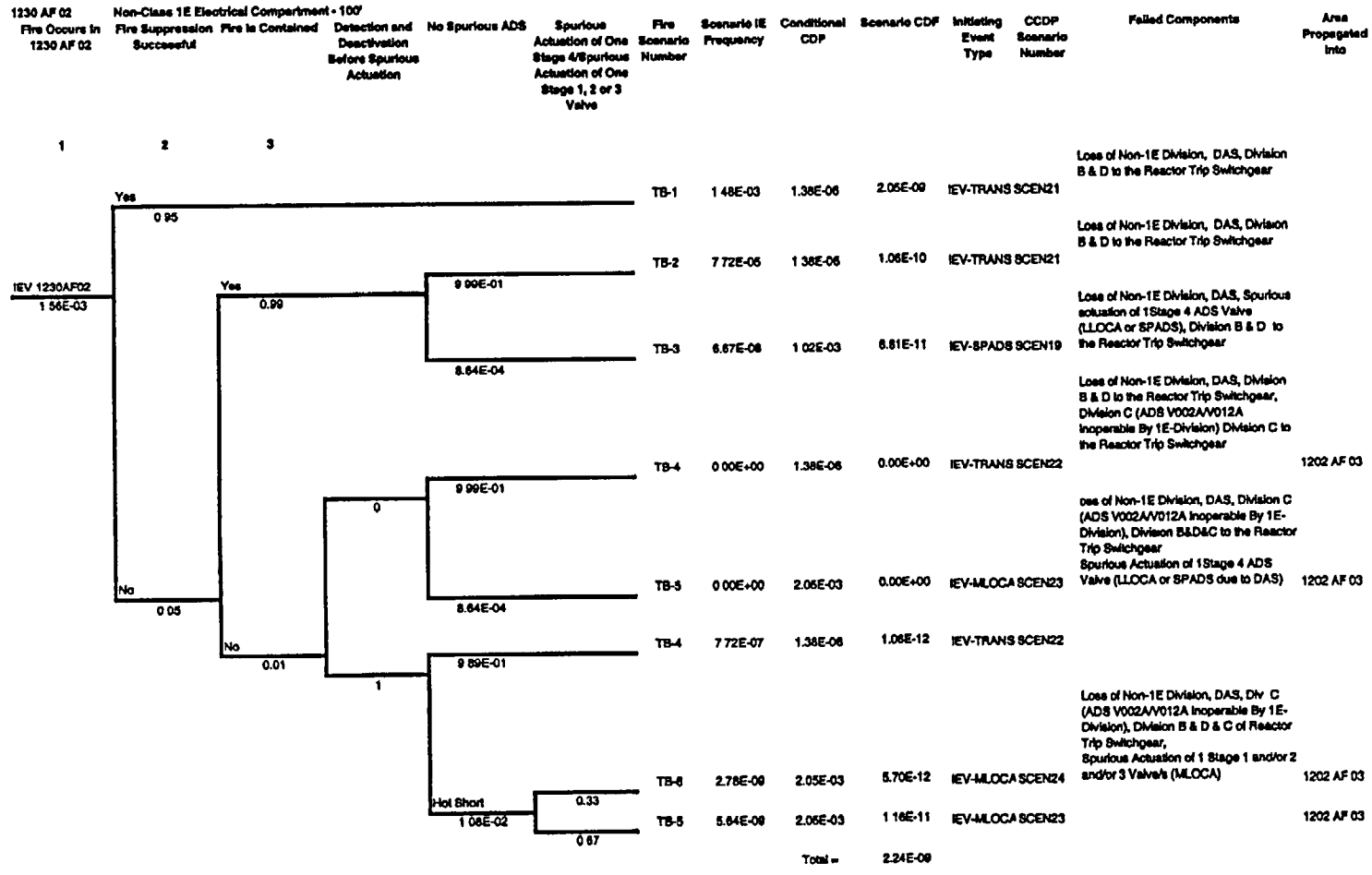


Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
TB-1	0 00	0 00E+00	0.00E+00			No Significant Risk	
TB-2	1 69E-04	0.00E+00	0.00E+00			No Significant Risk	
TB-3	1 66E-06	2.70E-09	4.48E-15	IEV-TRANS	SCEN16	Loss of Div. C (ADS V002A/V012A Inoperable By 1E-Division) Division C of Reactor Trip Switchgear	1202 AF 03
TB-3	5.07E-06	2.70E-09	1.37E-16	IEV-TRANS	SCEN16	Loss of Div. C (ADS V002A/V012A Inoperable By 1E-Division) Division C of Reactor Trip Switchgear	1202 AF 03
TB-4	1 83E-10	8.07E-04	1.48E-13	IEV-MLOCA	SCEN208	Loss of Div. C (ADS V002A/V012A Inoperable By 1E-Division) Division C of Reactor Trip Switchgear Spurious Actuation of 1Stage 1 and/or 2 and/or 3 Valve (MLOCA)	1202 AF 03
TB-5	3.71E 10	1.25E-03	4.64E-13	IEV-SPADS	SCEN25	Loss of Div. C (ADS V002A/V012A Inoperable By 1E-Division) Division C of Reactor Trip Switchgear Spurious Actuation of 1Stage 4 Valve (SPADS)	1202 AF 03
		Total =	6.12E-13				

Note
1 The probability of spurious actuation (1.06E-02) in Room C is 0 06x0 06 (V002B/V012B)+ 0 06x0 06 (V004A)+ 0 06x0 06 (V004C) and the proportion of failure is 0 33 for Stage 2 (1 valve) and 0 67 for Stage 4 (2 valves)
2 For Fire Scenario TB-3, it is conservatively assumed that there is a loss of Division C and CVS.

Figure 57C-19

1230 AF 01 Corridor Division A, B, C, D and Remote Shutdown Workstation



Notes.

1 The probability of spurious actuation (1.06E-02) in Room C is 0.06x0.06 (V002B/V012B)+ 0.06x0 06 (V004C)+ 0.06x0.06 (V004A) and the proportion of failure is 0.33 for Stage 2 (1 valve) and 0.67 for Stage 4 (2 valves).

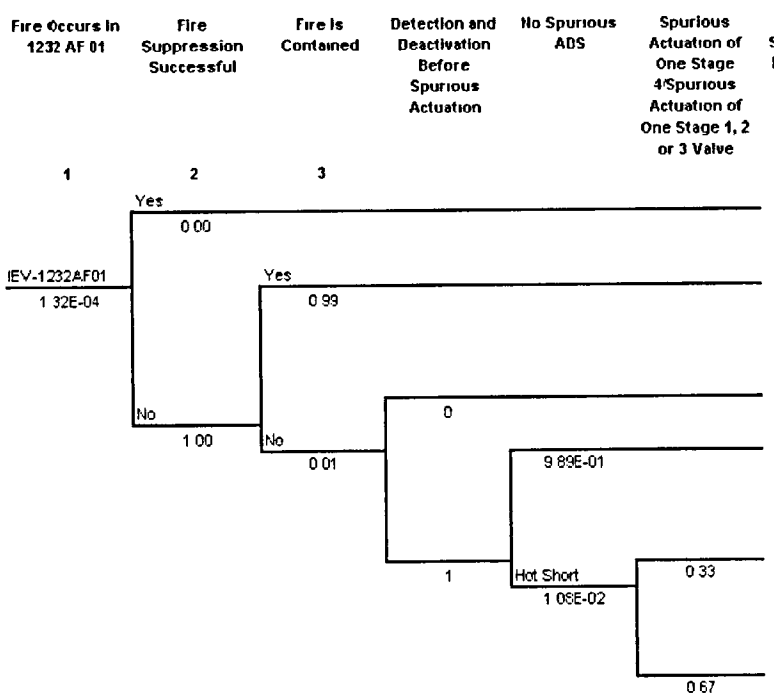
2 The probability of spurious actuation (8.64E-04) of Stage 4 is multiplied by 4 to account for the loss of all four Stage 4 valves due to hot shorts in the manual cables.

3 Spurious actuation of the ADS valves is not credited in the fire scenario when a fire suppression system is available.

Figure 57C-20

1230 AF 02 Non-Class 1E Electrical Compartment - 100'

1232 AF 01 Remote Shutdown Workstation



Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
TB-1	0 00	0	0			No Risk	
TB-2	1 31E-04	0	0 00E+00			No Risk	
TB-3	0 00E+00	2 70E-09	0 00E+00	IEV-TRANS	SCEN16	Loss of Division C (ADS V002A/V012A Inoperable By 1E-Division), Division C to the Reactor Trip Switchgear	1202 AF 03
TB-3	1 31E-06	2 70E-09	3 53E-15	IEV-TRANS	SCEN16		
TB-4	4 70E-09	8 07E-04	3 80E-12	IEV-MLOCA	SCEN20B	Loss of Division C Spurious Opening of 1 ADS Stages 1 and/or 2 and/or 3 Valve (MLOCA), Division C to the Reactor Trip Switchgear	1202 AF 03
TB-5	9 55E-09	1 25E-03	1 19E-11	IEV-SPADS	SCEN25	Loss of Division C, Spurious Opening of 1 ADS Stages 4 Valve V004C (LLOCA or SPADS)	1202 AF 03
		Total =	1 57E-11				

Note
1 The probability of spurious actuation (1 08E-02) in Room C is 0 06x0 06 (V002B/V012B)+ 0 06x0 06 (V004C)+ 0 06x0 06 (V004A) and the proportion of failure is 0 33 for Stage 2 (1 valve) and 0 67 for Stage 4 (2 valves)

Figure 57C-21

1232 AF 01 Remote Shutdown Workstation

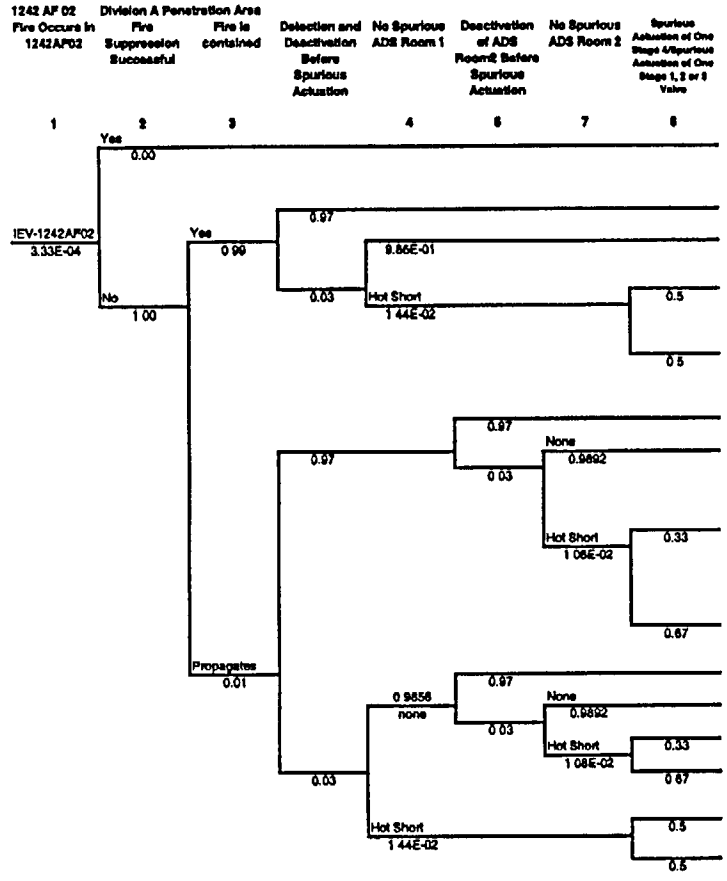
1240 AF 01 Non-Class 1E Electrical Compartment - 117'

Fire Occurs In 1240AF01	Fire Suppression Successful	Fire Is Contained	No Spurious ADS Stage 4	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
1	2	3	4								
IEV-1240AF01 1 55E-03	Yes 0 00			TB-1	0 00E+00	2 10E-09	0 00E+00	IEV-TRANS	None		None
	No 1 00	Yes 0 99		TB-2	0 00E+00	2 10E-09	0 00E+00	IEV-TRANS	None	Loss of Divisions A & C to the Reactor Trip Switchgear	None
		Propagates 0 01	None 0 99	TB-3	1 53E-05	2 70E-09	4 12E-14	IEV-TRANS	2 10E-09	Loss of Division A & C to the Reactor Trip Switchgear, Division A	1242 AF 02
			Hot Short 1 44E-02	TB-4	2 23E-07	1 25E-03	2 79E-10	IEV-SPADS	5 48E-04	Loss of Divisions A & C to the Reactor Trip Switchgear, Division A, Spurious Opening of One ADS Stage 4 Valve V004A	1242 AF 02
						Total =	2 79E-10				

Note
1 The probability of spurious actuation (1 44E-02) in Room A is 0 06x0 06 (V001A/V011A)+ 0 06x0 06 (V003A/V013A)+0 06x0 06 (V004A)+ 0 06x0 06 (V004C)

Figure 57C-22

1240 AF 01 Non-Class 1E Electrical Compartment - 117'

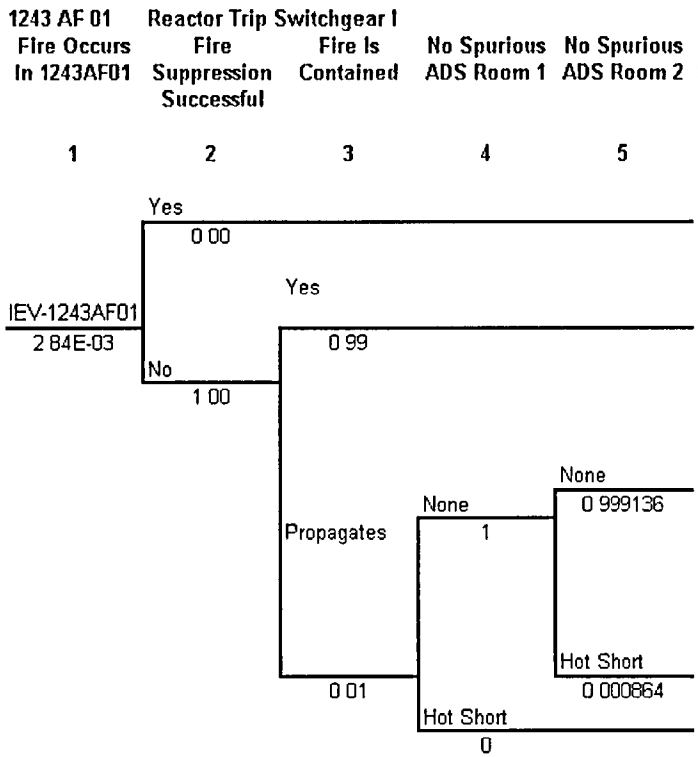


Fire Scenario Number	Scenario IE Frequency	Conditional CDF	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
TB-1	0 00E+00	2.70E-09	0.00E+00	IEV-TRANS	SCEN14		None
TB-2	3.20E-04	2.70E-09	8.63E-13	IEV-TRANS	SCEN14	Loss of Division A (ADS V001A/V011A/V003A/V013A Inoperable By 1E-Division)	None
TB-2	9 75E-06	2 70E-09	2 63E-14	IEV-TRANS	SCEN14	See TB-2	
TB-3	7 12E-06	8.07E-04	5.75E-11	IEV-MLOCA	SCEN20S	Loss of Division C, Spurious Opening of 1 ADS Stages 1 and/or 2 and/or 3 Valve (MLOCA)	None
TB-4	7 12E-06	1.25E-03	8.90E-11	IEV-SPADS	SCEN3C	Loss of Division A, Spurious Opening of 1 ADS Stages 4 Valve V004A (LLOCA or SPADS)	
TB-5	3 13E-06	2.70E-06	8.46E-12	IEV-TRANS	SCEN11	Loss of Division A &C,(V001A/V0011A/V002A/V012A/V003A/V013A, V004A and V004C Inoperable By 1E-Division)	1202 AF 03
TB-5	9 50E-08	2.70E-06	2.59E-13	IEV-TRANS	SCEN11	See TB-5	1202 AF 03
TB-6	3.45E-10	2.28E-03	7 87E-13	IEV-MLOCA	SCEN9B	Loss of division A &C, spurious opening of one stage 1 and/or 2 and/or 3 (MLOCA);(V004A and V004C inoperable by 1E-division)	1202 AF 03
TB-7	7 01E-10	1 60E-03	1 12E-12	IEV-SPADS	SCEN12	Loss of division A &C, spurious opening of V004C (LLOCA or SPADS - V004A and V002A/V0012A/V001A/V011A/V003A/V013A Inoperable by 1E-division)	1202 AF 03
TB-5	9.55E-06	2.70E-06	2.58E-13	IEV-TRANS	SCEN11	See TB-5	1202 AF 03
TB-5	2.92E-09	2.70E-06	7 89E-15	IEV-TRANS	SCEN11	See TB-5	1202 AF 03
TB-6	1 05E-11	2.28E-03	2.40E-14	IEV-MLOCA	SCEN9B	See TB-6	1202 AF 03
TB-7	2 14E-11	1.60E-03	3.42E-14	IEV-SPADS	SCEN12	See TB-7	1202 AF 03
TB-6	7 19E-10	2.28E-03	1 64E-12	IEV-MLOCA	SCEN9B	See TB-6	1202 AF 03
TB-7	7 19E-10	1 60E-03	1 15E-12	IEV-SPADS	SCEN12	See TB-7	1202 AF 03
		Total =	1 61E-10				

Notes
1 The probability of spurious actuation (1 44E-02) in Room A is 0.06x0.06 (V001A/V011A)+ 0.06x0.06 (V003A/V013A)+ 0.06x0.06 (V004C)+ 0.06x0.06 (V004A), there are four valves with two valves being from Stages 1 through 3 and two from Stage 4 then the failure probability is split between the two group of stages or = 0.5
The probability of spurious actuation (1 06E-02) in Room C is 0.06x0 06 (V002B/V012B)+ 0 06x0.06 (V004C)+ 0 06x0.06 (V004A) and the proportion of failure is 0.33 for Stage 2 (1 valve) and 0.67 for Stage 4 (2 valves).
2 For Fire Scenario TB-2, manual fire suppression is not credited in AP1000 Fire PRA
3 For Fire Scenario TB-3, despite manual fire suppression and a 3-hour rated fire barrier, the fire may propagate because of a failure of the fire barrier
4 For Fire Scenario TB-4, 5 and 6, probability to deactivate the electrical cabinets before ADS spurious actuation
5 For Fire Scenario TB-7 and 8, spurious actuation of any ADS valve in Room 2 and ADS Stage 1, 2, 3 or 4 respectively

Figure 57C-23

1242 AF 02 Division A Penetration Area

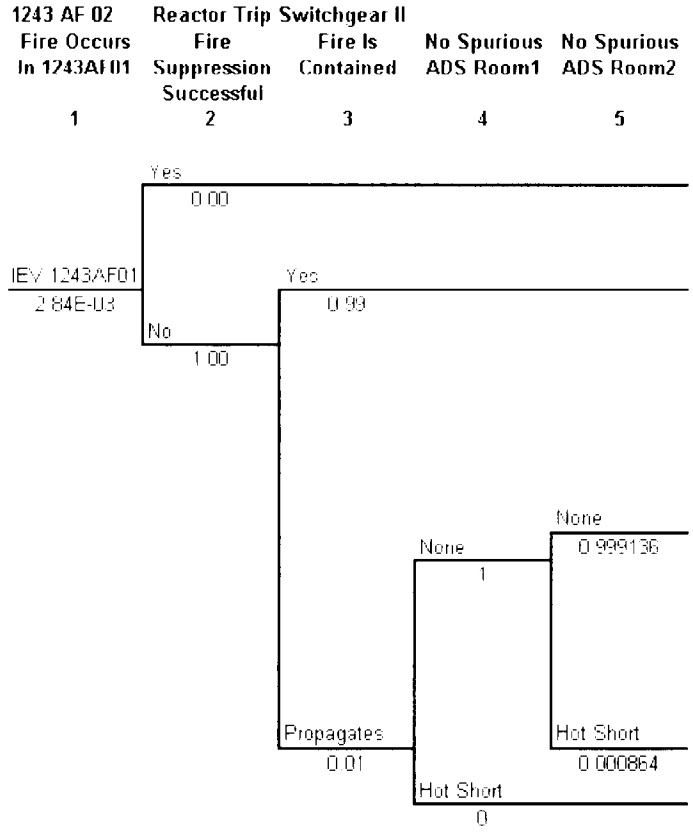


Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
TB-1	0 00E+00	2 10E-09	0 00E+00	IEV-TRANS	None		None
TB-2	2 81E-03	2 10E-09	5 91E-12	IEV-TRANS	None	Reactor Trip Switchgear I	None
TB-3	2 84E-05	1 38E-06	3 92E-11	IEV-TRANS	SCEN21	Loss of Reactor Trip Switchgear I, Division B & D to the Reactor Trip Switchgear, DAS	1230 AF 02
TB-5	2 45E-08	1 02E-03	2 50E-11	IEV-SPADS	SCEN19	Loss of Reactor Trip Switchgear I, Division B & D to the Reactor Trip Switchgear, DAS, Spurious Opening of 1 Stage 4 ADS Valve (LLOCA or SPADS)	1230 AF 02
		Total =	7 01E-11				

Note
1 The probability of spurious opening (8 64E-04) of ADS Stage 4 in Room 1230 AF 01 is four times 0 06x0 06x0 06,

Figure 57C-24

1243 AF 01 Reactor Trip Switchgear I



Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
TB-1	0 00E+00	2 10E-09	0 00E+00	IEV-TRANS	None		None
TB 2	2 81E 03	2 10E 09	5 91E 12	IEV-TRANS	None	Loss of Reactor Trip Switchgear II	None None
TB-3	2 84E-05	2 70E-06	7 66E-11	IEV-TRANS	SCEN11A	Loss of Reactor Trip Switchgear II, Division B & D to the Reactor Trip Switchgear, Division B & D of I&C (= probable loss of Division B & D power and control in the model), DAS	1200 AF 03
TB-5	2 45E-08	1 60E-03	3 93E-11	IEV-SPADS	SCEN12A	Loss of Reactor Trip Switchgear I, Division B & D to the Reactor Trip Switchgear, Division B & D of I&C, DAS, Spurious Opening of 1 Stage 4 ADS Valve (LLOCA or SPADS)	1200 AF 03
		Total =	1 22E-10				

Notes

1 Probability of spurious actuation of Stage 4 is multiplied by 4 to represent all four Stage 4 valves

The spurious actuation due to hot shorts in manual cables = 4(.06)(.06)(.06)

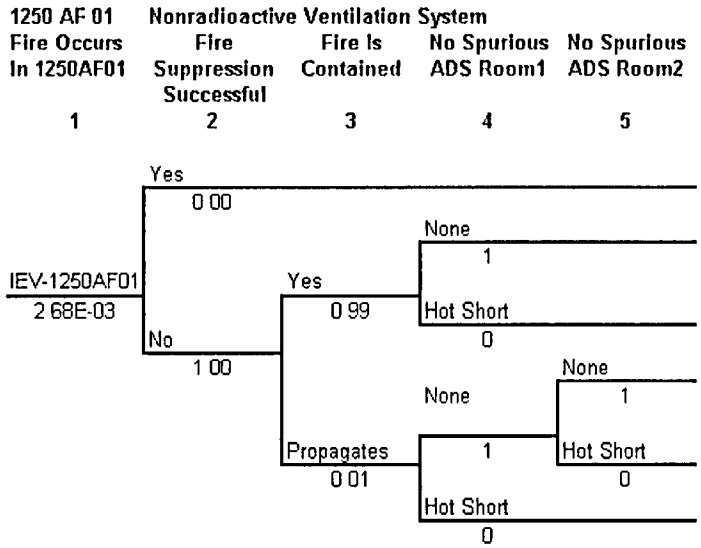
The spurious actuation due to hot shorts in manual cables = 0 000864

2 The loss of Division B & D cables in this area does not imply the loss of ADS, therefore, an assumption is made that there is only a spurious actuation of Stage 4 by DAS cables

To be not too conservative, the CCDP models the loss of B & D divisions with the DAS still being available

Figure 57C-25

1243 AF 02 Reactor Trip Switchgear II

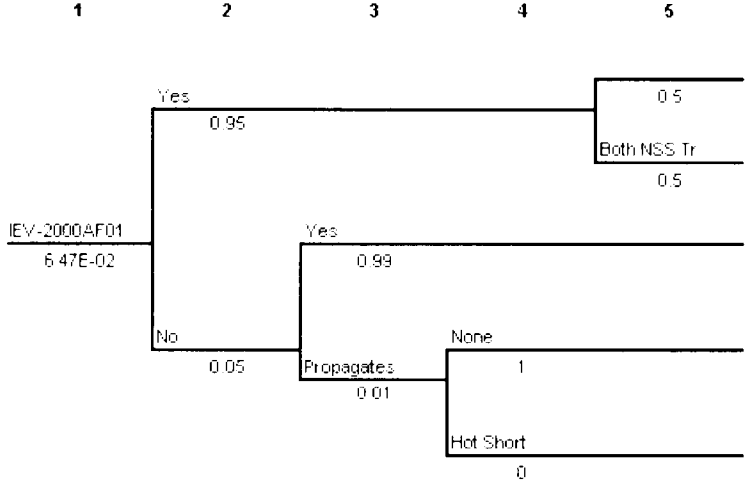


Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
TB-1	0 00E+00	0 00E+00	0 00E+00			No Risk	None
TB-2	2 65E-03	0 00E+00	0 00E+00			No Risk	None
TB-3	2 68E-05	7 73E-08	2 07E-12	IEV-LMFW	SCEN26	Loss of MFW and SFW Systems	1243AF01
		Total =	2 07E-12				

Figure 57C-26

1250 AF 01 Nonradioactive Ventilation System

2000 AF 01 Turbine Building Floor



Fire Occurs In 2000 AF 01 1	Fire Suppression Successful 2	Fire Is Contained 3	No Spurious ADS Actuation 4	Only 1 Train of NSS is Damaged 5	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
					TB-1	3.07E-02	7.73E-08	2.38E-09	IEV-LMFW	SCEN1	Loss of 1 Train of MFW, SFW, CCW, SWS, and CAS	None
					TB-2	3.07E-02	7.73E-08	2.38E-09	IEV-LMFW	SCEN1	Loss of MFW, SFW, CCW, SWS, and CAS	None
					TB-3	3.20E-03	1.05E-07	3.36E-10	IEV-LOSP	SCEN4A	Loss of LOSP, MFW, SFW, CCW, SWS, and CAS	None
					TB-4	3.24E-05	2.33E-07	7.54E-12	IEV-LOSP	SCENSA	Loss of LOSP, MFW, SFW, CCW, SWS, and CAS, and Division D	1201 AF 04
					TB-5	0.00E+00	2.33E-07	0.00E+00	IEV-LOSP	SCENSA	Loss of LOSP, MFW, SFW, CCW, SWS, CAS, and Division D	1201 AF 04
							Total =	5.10E-09				

Notes:

1. There are a total of five zones without fire suppression. However, if fire propagates from any one of these zones, it will propagate into the rest of the Turbine hall, but not into an adjacent fire area. Thus, these zones are treated as if the fire already propagated into the rest of the Turbine hall, for the purposes of question # 3 in the event tree.
2. There are AC power cables along the outer wall of the Turbine Building (in the east) that may be affected by a severe fire on the turbine floor. Thus, if suppression fails, LOSP is postulated to cover this possibility.
3. This Event Tree credits the introduction of fire suppression systems in zones with NSS pumps to reduce fire propagation from one NSS train to the other. Without these fire suppression systems, both NSS trains may be damaged by the fire.
4. There is no possibility of a hot short by propagation from this area to another (see text of the calcnote).
5. For Fire Scenario TB-1, the CCDP is conservatively configured as encompassing the loss.

Figure 57C-27

2000 AF 01 Turbine Building Floor

2003 AF 01 Auxiliary Boiler Equipment Room

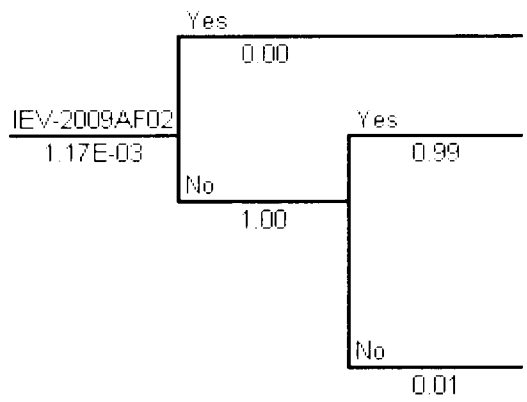
Fire Occurs In 2003 AF 01	Fire Suppression Successful	Fire Is Contained	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
1	2	3								
IEV-2003AF01 1.23E-03	Yes 0 98		TB-1	1.21E-03	0	0 00E+00			No Risk	
	No 0 02	Yes 0 00	TB-2	0 00E+00	0 00E+00	0 00E+00			No Risk	
		No 1 00	TB-3	2 46E-05	1 02E-07	2.51E-12	IEV-LOSP	SCEN8	Loss of off-site power not recoverable	2053 AF 01
					Total =	2 51E-12				

Note
1. In case of a failure of the automatic fire suppression system in the exposing area, credit is not given to the fire barrier rating because of the high combustible loading in this fire area

Figure 57C-28

2003 AF 01 Auxiliary Boiler Equipment Room

2009 AF 02 Elevator Machine Room

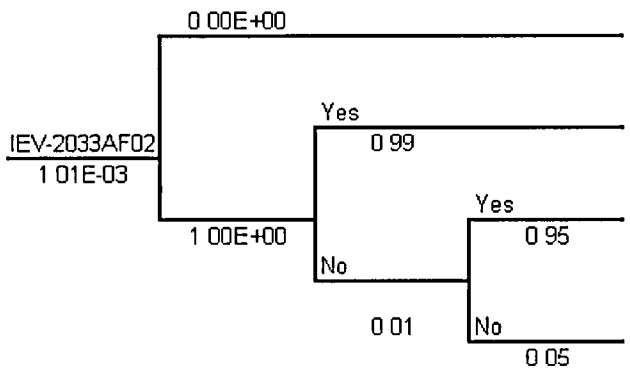


Fire Occurs In 2009 AF 02	Fire Suppression Successful	Fire Is Contained	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
	Yes 0.00		TB-1	0.00E+00	0	0.00E+00			No Risk	
IEV-2009AF02 1.17E-03	No 1.00	Yes 0.99	TB-2	1.16E-03	0.00E+00	0.00E+00			No Risk	
		No 0.01	TB-3	1.17E-05	1.02E-07	1.19E-12	IEV-LOSP	SCEN8	Loss of Off-Site Power	Outside of the Turbine Bldg to the East Due to the AC Cables
					Total =	1.19E-12				

Figure 57C-29

2009 AF 02 Elevator Machine Room

2033 AF 02 Motor-Driven Fire Pump Room



Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
TB-1	0 00E+00	0	0 00E+00			No Risk	
TB-1	1 00E-03	0	0 00E+00			No Risk	
TB-2	9 60E-06	0 00E+00	0 00E+00			No Risk	
TB-3	5 05E-07	7 73E-08	3 90E-14	IEV-LMFW	SCEN1	Loss of SFW, CCW, SWS, and CAS	2000 AF 01
		Total =	3 90E-14				

Figure 57C-30

2033 AF 02 Motor-Driven Fire Pump Room

2040 AF 01 Clean and Dirty Lube Oil Storage

Fire Occurs In 2040 AF 01 1	Fire Suppression Successful (In 2040 AF 01) 2	Fire Suppression Successful (In 2000 AF 01) 3	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
IEV-2040AF01 2.83E-04	Yes 0.98		TB-1	2.77E-04	0	0.00E+00				
	No 0.02	Yes 0.95	TB-2	5.38E-06	0.00E+00	0.00E+00			No Risk	
		No 0.05	TB-3	2.83E-07	7.73E-08	2.19E-14	IEV-LMFW	SCEN1	Loss of SFW, CCW, SWS, and CAS	2000 AF 01
					Total =	2.19E-14				

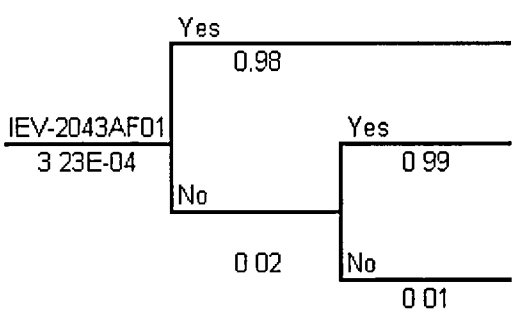
Note

1 In case of a failure of the automatic fire suppression system in the exposing area, credit is not given to the fire barrier rating because of the very high combustible loading in this fire area.

Figure 57C-31

2040 AF 01 Clean and Dirty Lube Oil Storage

2043 AF 01 Chemical Laboratory



Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
TB-1	3 17E-04	0 00E+00	0 00E+00			No Risk	
TB-2	6.40E-06	0 00E+00	0 00E+00			No Risk	
TB-3	6 46E-08	7 73E-08	4 99E-15	IEV-LMFW	SCEN1	Loss of SFW, CCW, SWS, and CAS	2053 AF 02
		Total =	4 99E-15				

Figure 57C-32

2043 AF 01 Chemical Laboratory

2050 AF 01 Lube Oil Conditioner Room

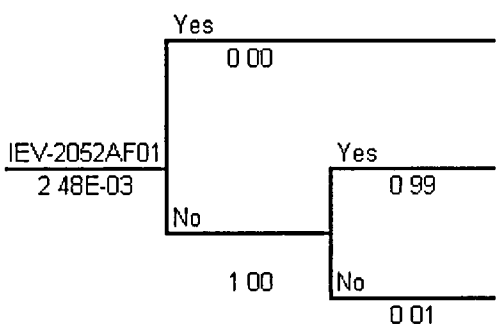
Fire Occurs In 2050 AF 01 1	Fire Suppression Successful (In 2050 AF 01) 2	Fire Suppression Successful (in 2000 AF 01) 3	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
IEV-2050AF01 2.83E-04	Yes 0.95		TB-1	2.69E-04	0.00E+00	0.00E+00				
	No	Yes 0.95	TB-2	1.34E-05	0.00E+00	0.00E+00			No Risk	
	0.05	No 0.05	TB-3	7.08E-07	7.73E-08	5.47E-14	IEV-LMFW	SCEN1	Loss of SFW, CCW, SWS, and CAS Systems	2000 AF 01
					Total =	5.47E-14				

Note:
1. In case of a failure of the automatic fire suppression system in the exposing area, credit is not given to the fire barrier rating because of the very high combustible loading in this fire area.

Figure 57C-33

2050 AF 01 Lube Oil Conditioner Room

2052 AF 01 Southwest 6.9KV Switchgear Room

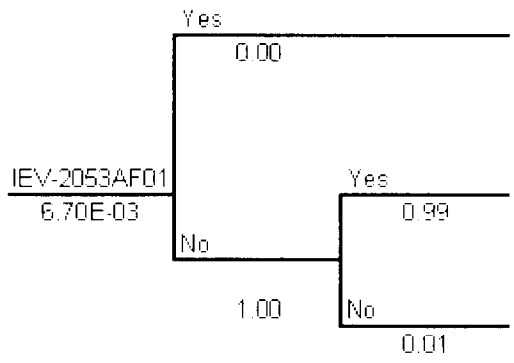


Fire Occurs in 2052 AF 01	Fire Suppression Successful	Fire Is Contained	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
	Yes 0 00		TB-1	0 00E+00	7 73E-08	0 00E+00	IEV-LMFW	SCEN1		
	No 1 00	Yes 0 99	TB-2	2 46E-03	7 73E-08	1 90E-10	IEV-LMFW	SCEN1	Loss of SFW, CCW, SWS, and CAS	None
		No 0 01	TB-3	2 48E-05	7 73E-08	1 92E-12	IEV-LMFW	SCEN1	Loss of SFW, CCW, SWS, and CAS	2053 AF 01
					Total =	1 92E-10				

Figure 57C-34

2052 AF 01 Southwest 6.9KV Switchgear Room

2053 AF 01 Electrical Equipment Room



Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
TB-1	0.00E+00	7.73E-08	0.00E+00	IEV-LMFW	SCEN1		
TB-2	6.63E-03	7.73E-08	5.13E-10	IEV-LMFW	SCEN1	Loss of SFW, CCW, SWS, and CAS	None
TB-3	6.70E-05	7.73E-08	5.18E-12	IEV-LMFW	SCEN1	Loss of SFW, CCW, SWS, and CAS	2053 AF 02 or 2052 AF
		Total =	5.18E-10				

Figure 57C-35

2053 AF 01 Electrical Equipment Room

2053 AF 02 Northwest 6.9KV Switchgear Room

Fire Occurs In 2053 AF 02 1	Fire Suppression Successful 2	Fire Is Contained 3	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
IEV-2053AF02 2 48E-03	Yes 0 00		TB-1	0 00E+00	7 73E-08	0 00E+00	IEV-LMFW	SCEN1		
	No 1 00	Yes 0 99	TB-2	2 46E-03	7 73E-08	1 90E-10	IEV-LMFW	SCEN1	Loss of SFW, CCW, SWS, and CAS	None
		No 0 01	TB-3	2.48E-05	7.73E-08	1 92E-12	IEV-LMFW	SCEN1	Loss of SFW, CCW, SWS, and CAS	2053 AF 01
					Total =	1 92E-10				

Figure 57C-36

2053 AF 02 Northwest 6.9KV Switchgear Room

4003 AF 01 Demineralized Water Deoxygenating Room/Air Handling Equipment Rooms

Fire Occurs in 4003 AF 01	Fire Suppression Successful	Fire Is Contained	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
1	2	3								
	Yes 0.00		TB-1	0.00E+00	0.00E+00	0.00E+00			No Risk	
IEV-4003AF01 4.26E-03		Yes 0.99	TB-2	4.22E-03	0.00E+00	0.00E+00			No Risk	
	No 1.00	No 0.01	TB-3	4.26E-05	2.55E-09	1.09E-13	IEV-TRANS	SCEN15A	Loss of 2 trains of RNS and CVS	1200 AF 01
					Total =	1.09E-13				

Note:
1 For Fire Scenario TB-3, the fire damage causes the loss of 2 trains of RNS and CVS

Figure 57C-37

4003 AF 01 Demineralized Water Deoxygenating Room/ Air Handling Equipment Rooms

4031 AF 01 Battery Room and Battery Charger Room 1

Fire Occurs In 4031 AF 01	Fire Suppression Successful	Fire Is Contained	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
1	2	3								
IEV-4031AF01 2 87E-03	Yes 0 00		TB-1	0 00E+00	1 38E-06	0 00E+00	IEV-TRANS	SCEN22		None
	No	Yes 0 99	TB-2	2 84E-03	1 38E-06	3 92E-09	IEV-TRANS	SCEN22	Loss of 1 Group of Non-1E AC/DC Power, DAS (Induced By the Loss of One Non-1E Division	None
	1 00	No 0 01	TB-3	2 87E-05	1 38E-06	3 96E-11	IEV-TRANS	SCEN22	Loss of Non-1E AC/DC Power, DAS	4031 AF 02
					Total =	3 96E-09				

Note:
1 For all three fire scenarios, the CCDPs are conservatively based on the loss of the entire non-1E power, the loss of DAS and the loss of Division C (no impact)

Figure 57C-38

4031 AF 01 Battery Room and Battery Charger Room 1

4031 AF 02 Battery Room and Battery Charger Room 2/Computer Room B/Shift Turnover Room

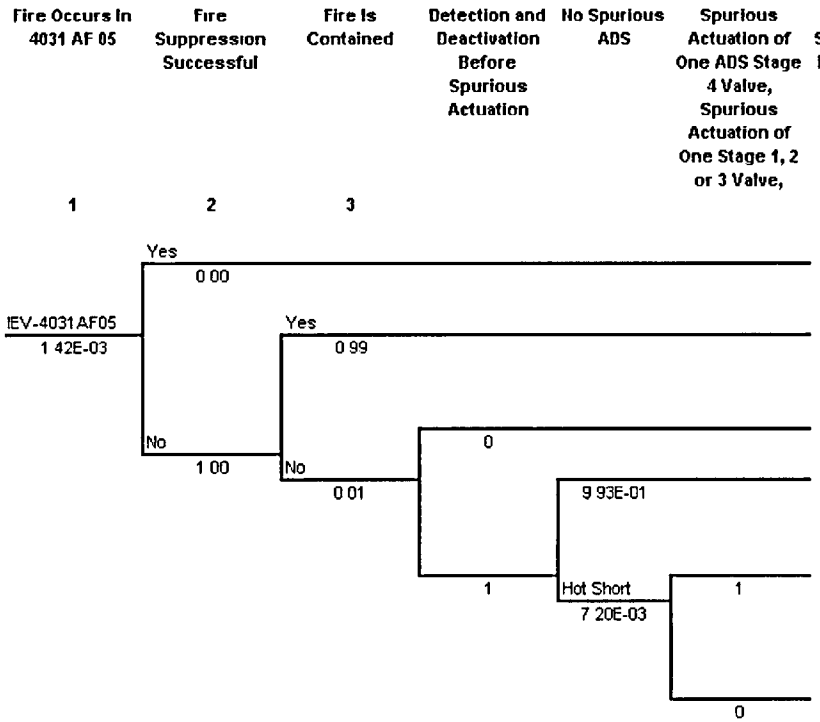
Fire Occurs In 4031 AF 02	Fire Suppression Successful	Fire Is Contained	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
1	2	3								
IEV-4031AF01 3.14E-03	Yes 0.00		TB-1	0.00E+00	1.38E-06	0.00E+00	IEV-TRANS	SCEN22		None
	No 1.00	Yes 0.99	TB-2	3.11E-03	1.38E-06	4.29E-09	IEV-TRANS	SCEN22	Loss of 1 Group of Non-1E AC/DC Power, DAS (Induced By the Loss of One Non-1E Division	None
		No 0.01	TB-3	3.14E-05	1.38E-06	4.33E-11	IEV-TRANS	SCEN22	Loss of Non-1E AC/DC Power, DAS	4031 AF 01
					Total =	4.33E-09				

Note:
1 For all three fire scenarios, the CCDPs are conservatively based on the loss of the entire non-1E power, the loss of DAS and the loss of Division C (no impact)

Figure 57C-39

4031 AF 02 Battery Room and Battery Charger Room 2/ Computer Room B/Shift Turnover Room

4031 AF 05 Corridor/Spare battery Room/Spare Room /Spare Battery Charger Room



Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
TB-1	0 00	0	0			No Risk	
TB-2	1 41E-03	0	0 00E+00			No Risk	
TB-3	0 00E+00	2 70E-09	0 00E+00	IEV-TRANS	SCEN14	Loss of Division A (ADS V001A/V011A/V003A/V013A Inoperable By 1E-Division)	1202 AF 04
TB-3	1 41E-05	2 70E-09	3 81E-14	IEV-TRANS	SCEN14		
TB-4	1 02E-07	8 07E-04	8 25E-11	IEV-MLOCA	SCEN20C	Loss of Division A, Spurious Opening of 1 ADS Stages 1 and/or 2 and/or 3 Valve (MLOCA)	1202 AF 04
TB-5	0 00E+00	1 25E-03	0 00E+00	IEV-SPADS	SCEN3C	Loss of Division A, Spurious Opening of 1 ADS Stages 4 Valve V004A (LLOCA or SPADS)	1202 AF 04
		Total =	8 25E-11				

Note

1 The probability of spurious actuation (7 20E-03) in Room A is 0 06x0 06 (V001A/V011A)+ 0 06x0 06 (V003A/V013A) and all is attributable to Stages 1 and 3, therefore, the entire failure is credited towards those stages

Figure 57C-40

4031 AF 05 Corridor/Spare Battery Room/ Spare Room/Spare Battery Charger Room

4031 AF 06 Central Alarm Station/Security Room 1

Fire Occurs In 4031 AF 06	Fire Suppression Successful	Fire Is Contained	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
1	2	3								
IEV-4031AF06 1.93E-03	Yes 0.00		TB-1	0.00E+00	0.00E+00	0.00E+00			No Risk	
	No 1.00	Yes 0.99	TB-2	1.91E-03	0.00E+00	0.00E+00			No Risk	
		No 0.01	TB-3	1.93E-05	1.38E-06	2.66E-11	IEV-TRANS	SCEN22	Loss of 1 Group of Non-1E AC/DC Power, DAS (Induced By the Loss of One Non-1E Division)	4031 AF 01
					Total =	2.66E-11				

Note:
1 For Fire Scenari TB-3, the CCDP is conservatively based on the loss of the entire non-1E power, the loss of DAS and the loss of Division C (no impact)

Figure 57C-41

4031 AF 06 Central Alarm Station/Security Room 1

4032 AF 01 Decontamination Room, Non-Radiological and Radiological Controlled Area Entries...

Fire Occurs In 4032 AF 01	Fire Suppression Successful	Fire Is Contained	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
1	2	3								
IEV-4032AF01 8 53E-04	Yes 0 00		TB-1	0 00E+00	2.10E-09	0 00E+00	IEV-TRANS	None		
	No 1 00	Yes 0 99	TB-2	8 44E-04	2 10E-09	1 78E-12	IEV-TRANS	None	Loss of 1 Group of Non-1E AC/DC Power	
		No 0 01	TB-3	8 53E-06	1 38E-06	1 18E-11	IEV-TRANS	SCEN22	Loss of Non-1E AC/DC (Manual DAS Available)	4042 AF 01
					Total =	1 35E-11				

Note
1 For all three fire scenarios, the CCDPs are conservatively based on the loss of the entire non-1E power, the loss of DAS and the loss of Division C (no impact)
2 For Fire Scenarios TB-1 and TB-2, the loss of 1 non-1E group is not risk significant as it is not the power supply itself (ie batteries)

Figure 57C-42

4032 AF 01 Decontamination Room, Non-Radiological and Radiological Controlled Area Entries...

4032 AF 02 Containment Access Corridor Elevation 107'-2"

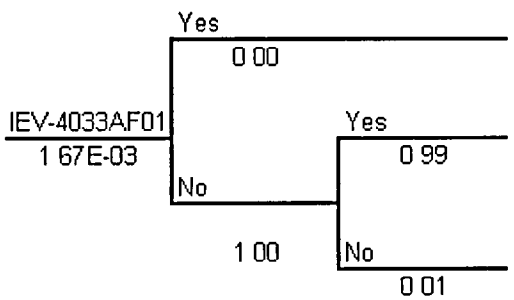
Fire Occurs In 4032 AF 02	Fire Suppression Successful	Fire Is Contained	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
1	2	3								
IEV-4032AF02 4.38E-04	Yes 0.98		TB-1	4.29E-04	0	0.00E+00				
	No 0.02	Yes 0.99	TB-2	8.67E-06	0.00E+00	0.00E+00			No Risk	
		No 0.01	TB-3	8.76E-08	1.38E-06	1.21E-13	IEV-TRANS	SCEN22	Loss of Group 2 of Non-1E AC/DC Power (Manual DAS Available)	4032 AF 01
					Total =	1.21E-13				

Note:
1 For Fire Scenario TB-3, the CCDP is conservatively based on the loss of the entire non-1E power, the loss of DAS and the loss of Division C (no impact).

Figure 57C-43

4032 AF 02 Containment Access Corridor Elevation 107' 2"

4033 AF 01 Hot Machine Shop



Fire Occurs In 4033 AF 01	Fire Suppression Successful	Fire Is Contained	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
	Yes		TB-1	0 00E+00	0	0 00E+00				
	0 00									
IEV-4033AF01 1 67E-03		Yes	TB-2	1 65E-03	0 00E+00	0 00E+00			No Risk	
		0 99								
	No									
	1 00	No	TB-3	1 67E-05	1 38E-06	2 30E-11	IEV-TRANS	SCEN22	Loss of one train of RNS and CVS	1200 AF 01
		0 01								
					Total =	2 30E-11				

Note:
1 For Fire Scenario TB-3, the CCDP is conservatively based on the loss of the entire non-1E power, the loss of DAS and the loss of Division C (no impact)

Figure 57C-44

4033 AF 01 Hot Machine Shop

4034 AF 01 General Offices

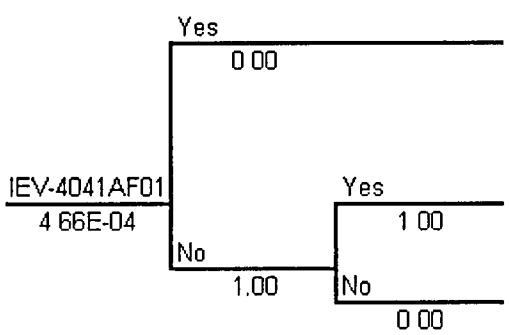
Fire Occurs In 4034 AF 01	Fire Suppression Successful	Fire Is Contained	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
1	2	3								
IEV-4034AF01 1.42E-03	Yes 0.00		TB-1	0.00E+00	0.00E+00	0.00E+00				
	No 1.00	Yes 0.99	TB-2	1.41E-03	0.00E+00	0.00E+00			No Risk	
		No 0.01	TB-3	1.42E-05	1.38E-06	1.96E-11	IEV-TRANS	SCEN22	Loss of 1 Group of Non-1E AC/DC Power, DAS (Induced By the Loss of One Non-1E Division	4031 AF 01
					Total =	1.96E-11				

Note
1 For Fire Scenario TB-3, the CCDP is conservatively based on the loss of the entire non-1E power, the loss of DAS and the loss of Division C (no impact).

Figure 57C-45

4034 AF 01 General Offices

4041 AF 01 Conference Rooms/Computer Room A/Corridor



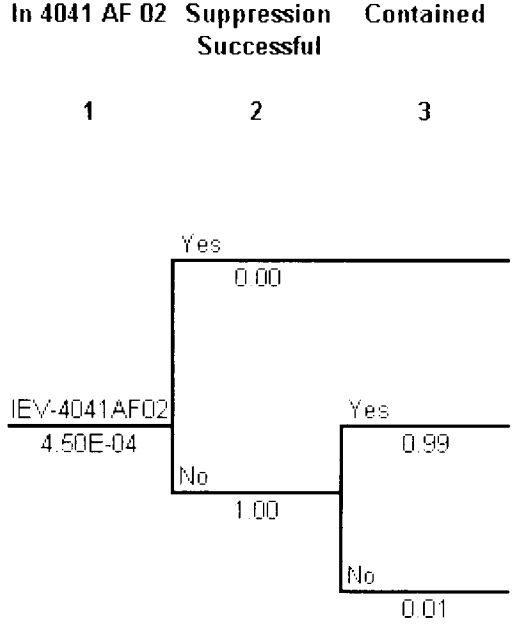
Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
TB-1	0 00E+00	2 10E-09	0	IEV-TRANS	None		
TB-2	4 66E-04	2.10E-09	9 80E-13	IEV-TRANS	None	Loss of 1 Group of Non-1E AC/DC Power, Automatic DAS	
		Total =	9 80E-13				

Note.
1 For Fire Scenarios TB-1 and TB-2, the loss of 1 non-1E group is not risk significant as it is not the power supply itself (ie batteries)

Figure 57C-46

4041 AF 01 Conference Rooms/Computer Room A/Corridor

4041 AF 02 Corridor/Restroom



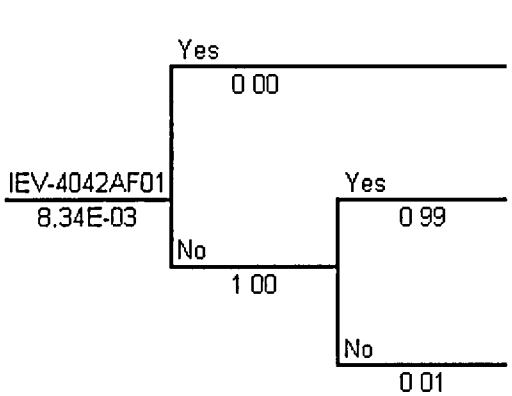
Fire Occurs In 4041 AF 02	Fire Suppression Successful	Fire Is Contained	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
1	2	3								
	Yes		TB-1	0.00E+00	2.10E-09	0.00E+00	IEV-TRANS	None	Loss of 1 Group of Non-1E AC/DC Power, Automatic DAS	
	No	Yes	TB-2	4.46E-04	2.10E-09	9.37E-13	IEV-TRANS	None	Loss of 1 Group of Non-1E AC/DC Power, Automatic DAS	
	No	No	TB-3	4.50E-06	1.38E-06	6.21E-12	IEV-TRANS	SCEN22	Loss of Non-1E AC/DC Power (Induces Loss of DAS)	4031 AF 02
					Total =	7.15E-12				

Note:
1 For Fire Scenario TB-3, the CCDP is conservatively based on the loss of the entire non-1E power, the loss of DAS and the loss of Division C (no impact).
2 For Fire Scenarios TB-1 and TB-2, the loss of 1 non-1E group is not risk significant as it is not the power supply itself (ie batteries).

Figure 57C-47

4041 AF 02 Corridor/Restroom

4042 AF 01 Non-Class 1E Switchgear #1



Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
TB-1	0 00E+00	2 10E-09	0 00E+00	IEV-TRANS	None	Loss of 1 Group of Non-1E AC/DC Power	
TB-2	8 26E-03	2 10E-09	1 74E-11	IEV-TRANS	None	Loss of 1 Group of Non-1E AC/DC Power	
TB-3	8 34E-05	1 38E-06	1 15E-10	IEV-TRANS	SCEN22	Loss of Non-1E AC/DC Power (Induces Loss of DAS)	4031 AF 02
		Total =	1 32E-10				

Note
1 For Fire Scenario TB-3, the CCDP is conservatively based on the loss of the entire non-1E power, the loss of DAS and the loss of Division C (no impact)
2 For Fire Scenarios TB-1 and TB-2, the loss of 1 non-1E group is not risk significant as it is not the power supply itself (ie batteries)

Figure 57C-48

4042 AF 01 Non-Class 1E Switchgear #1

4042 AF 02 Non-Class 1E Switchgear #2

Fire Occurs In 4042 AF 02	Fire Suppression Successful	Fire Is Contained	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
1	2	3								
IEV-4042AF02 2.66E-03	Yes 0.00		TB-1	0.00E+00	2.10E-09	0.00E+00	IEV-TRANS	None		
	No 1.00	Yes 0.99	TB-2	2.63E-03	2.10E-09	5.54E-12	IEV-TRANS	None	Loss of 1 Group of Non-1E AC/DC Power	
		No 0.01	TB-3	2.66E-05	1.38E-06	3.67E-11	IEV-TRANS	SCEN22	Loss of Non-1E AC/DC Power	4042 AF 01
					Total =	4.22E-11				

Note:
1 For Fire Scenario TB-3, the CCDP is conservatively based on the loss of the entire non-1E power, the loss of DAS and the loss of Division C (no impact).
2 For Fire Scenarios TB-1 and TB-2, the loss of 1 non-1E group is not risk significant as it is not the power supply itself (ie batteries).

Figure 57C-49

4042 AF 02 Non-Class 1E Switchgear #2

4052 AF 01 Staging and Storage Area/Containment Air Filtration Exhaust Rooms A & B

Fire Occurs In 4052 AF 01	Fire Suppression Successful	Fire Is Contained	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
1	2	3								
IEV-4052AF01 1 94E-03	Yes 0 00		TB-1	0 00E+00	0 00E+00	0.00E+00			No Risk	
	No 1 00	Yes 0.99	TB-2	1 92E-03	0 00E+00	0 00E+00			No Risk	
		No 0 01	TB-3	1 94E-05	2 10E-09	4 08E-14	IEV-TRANS	None	Loss of Group 1 of Non-1E AC/DC Power	4042 AF 01
					Total =	4 08E-14				

Note.
1 For Fire Scenario TB-3, the CCDP is conservatively based on the loss of the entire non-1E power, the loss of DAS and the loss of Division C (no impact)

Figure 57C-50

4052 AF 01 Staging and Storage Area/ Containment Air Filtration Exhaust Rooms A & B

5031 AF 01 Radwaste Building

Fire Occurs In 5031 AF 01 1	Fire Suppression Successful 2	Fire Is Contained 3	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
IEV-5031AF01 2.42E-02	Yes 0.95		TB-1	2.30E-02	0.00E+00	0.00E+00				
	No	Yes 0.99	TB-2	1.20E-03	0.00E+00	0.00E+00			No Risk	
	0.05	No 0.01	TB-3	1.21E-05	2.55E-09	3.08E-14	IEV-TRANS	SCEN15A	Loss of One RNS Train and Loss of CVS	1200 AF 01
					Total =	3.08E-14				

Figure 57C-51

5031 AF 01 Radwaste Building

6030 AF 01 Diesel Generator Room A

Fire Occurs In 6030 AF 01	Fire Suppression Successful	Fire Is Contained	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
1	2	3								
IEV-6030AF01 2 99E-02	Yes 0 83		TB-1	2 47E-02	0 00E+00	0 00E+00			No Risk (Loss of 1Diesel Generator)	
		Yes 0.99	TB-2	5 15E-03	0 00E+00	0.00E+00			No Risk (Loss of 1Diesel Generator)	
	No 0 17	No 0.01	TB-3	5 20E-05	2.10E-09	1.09E-13	IEV-TRANS	SCEN41	Loss of 2 Diesel Generators	6030 AF 02
					Total =	1 09E-13				

Note:

1 Propagation is assumed only in case where the fire starts from the diesel generator and the automatic fire suppression system fails (2 6E-02x0 05) or in case the fire starts anywhere else (3 9E-3) Then the equivalent probability of failure of automatic fire suppression system is

Pfailure = (Diesel Generator Fire Ignition Frequency x Fire Suppression System Unavailability) + Surrounding Area Fire Ignition Frequency/Diesel Generator Room A Fire Ignition Frequency

Pfailure = (0 026 x 0 05) + (3 9E-03)/2 99E-02

Pfailure = 1 74E-01

Figure 57C-52

6030 AF 01 Diesel Generator Room A

6030 AF 02 Diesel Generator Room B

Fire Occurs In 6030 AF 02 1	Fire Suppression Successful 2	Fire Is Contained 3	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
IEV-6030AF02 3.03E-02	Yes 0.81		TB-1	2.46E-02	0.00E+00	0.00E+00			No Risk (Loss of 1Diesel Generator)	
	No 0.19	Yes 0.99	TB-2	5.64E-03	0.00E+00	0.00E+00			No Risk (Loss of 1Diesel Generator)	
		No 0.01	TB-3	5.70E-05	2.10E-09	1.20E-13	IEV-TRANS	SCEN41	Loss of 2 Diesel Generators	6030 AF 01
					Total =	1.20E-13				

Note:

1. Propagation is assumed only in case where the fire starts from the diesel generator and the automatic fire suppression system fails (2.6E-02*0.05) or in case the fire starts anywhere else (4.4E-3) within DG Room B. Then the equivalent probability of failure of automatic fire suppression system is:

Pfailure = (Diesel Generator Fire Ignition Frequency * Fire Suppression System Unavailability) + Surrounding Area Fire Ignition Frequency/Diesel Generator Room B Fire Ignition Frequency

Pfailure = (0.026 x 0.05) + (4.4E-03)/3.03E-02

Pfailure = 1.88E-01

Figure 57C-53

6030 AF 02 Diesel Generator Room B

6030 AF 03 Fuel Oil Day Tank Room A

Fire Occurs In 6030 AF 03 1	Fire Suppression Successful 2	Fire Is Contained 3	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
IEV-6030AF03 2 10E-04	Yes 0 95		TB-1	2 00E-04	0 00E+00	0.00E+00			No Risk (Loss of 1 DG)	
	No 0 05	Yes 0 00	TB-2	0 00E+00	0 00E+00	0.00E+00			No Risk (Loss of 1 DG)	
		No 1 00	TB-3	1 05E-05	2 10E-09	2 21E-14	IEV-TRANS	SCEN41	Loss of 2 Diesel Generators	6030 AF 01 & 6030 AF 02
					Total =	2 21E-14				

Note:
1 In case of a failure of the automatic fire suppression system in the exposing area, credit is not given to fire barrier rating because of the very high combustible loading in this fire area

Figure 57C-54

6030 AF 03 Fuel Oil Day Tank Room A

6030 AF 04 Fuel Oil Day Tank Room B

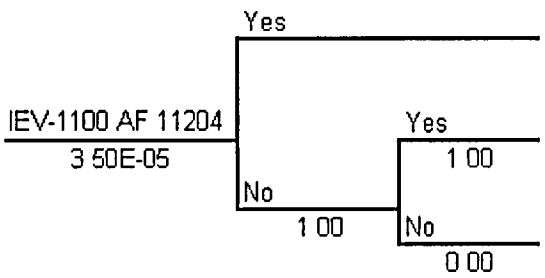
Fire Occurs In 6030 AF 04	Fire Suppression Successful	Fire Is Contained	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
1	2	3								
IEV-6030AF04 2.10E-04	Yes 0.95		TB-1	2.00E-04	0.00E+00	0.00E+00				
	No 0.05	Yes 0.00	TB-2	0.00E+00	0.00E+00	0.00E+00			No Risk (Loss of 1 DG)	
		No 1.00	TB-3	1.05E-05	2.10E-09	2.21E-14	IEV-TRANS	SCEN41	Loss of 2 Diesel Generators	6030 AF 01 & 6030 AF 02
					Total =	2.21E-14				

Note:
1. In case of a failure of the automatic fire suppression system in the exposing area, credit is not given to fire barrier rating because of a very high combustible loading in this fire area.

Figure 57C-55

6030 AF 04 Fuel Oil Day Take Room B

1100 AF 11204 Reactor Coolant Drain Tank Room



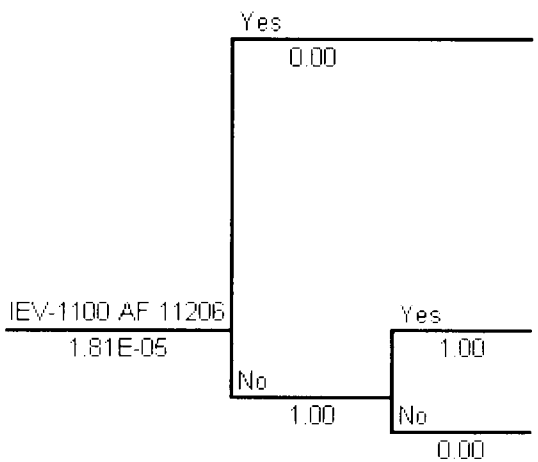
Fire Occurs In 1100 AF 11204	Fire Suppression Successful	Fire Is Contained	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
	Yes		TB-1							None
IEV-1100 AF 11204	No	Yes	TB-2	3 50E-05	2 10E-09	7 36E-14	IEV-TRANS	None	Loss of WLS	
		No	TB-3							
					Total =	7 36E-14				

Note
1 The loss of the WLS is not risk significant

Figure 57C-56

1100 AF 11204 Reactor Coolant Drain Tank Room

1100 AF 11206 Accumulator Room A

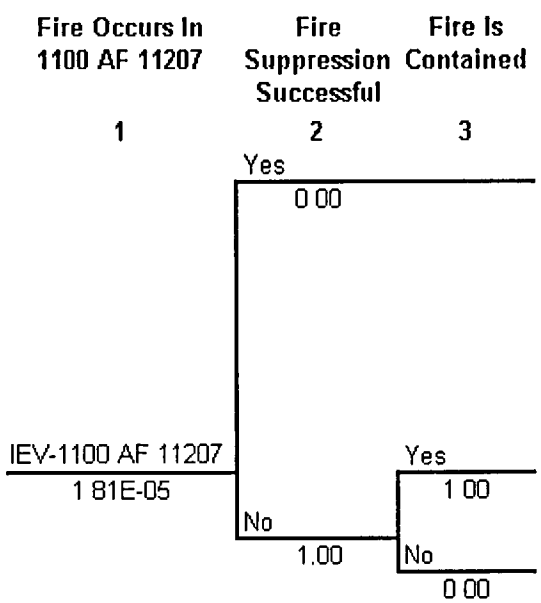


Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
TB-1	1.81E-05	2.10E-09	3.80E-14	IEV-TRANS	SCEN29	Loss of All Valves Supplied By Division B & D in the Zone (Loss of IRWST Valves V117A, V118A, V120A, V123A, V125A)	None
Total =	1.81E-05		3.80E-14				

Figure 57C-57

1100 AF 11206 Accumulator Room A

1100 AF 11207 Accumulator Room B

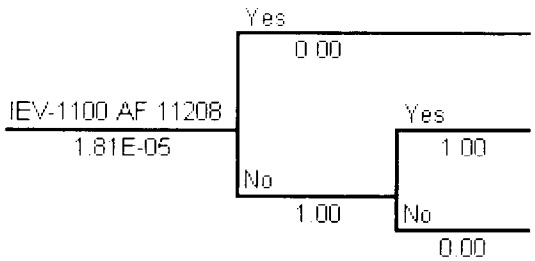


Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
TB-1	1 81E-05	2 10E-09	3 80E-14	IEV-TRANS	SCEN29	Loss of all the valves supplied by A&C divisions in the zone (loss of IRWST valves V117B, V118B, V120B, V123B, V125B)	None
Total =	1 81E-05		3 80E-14				

Figure 57C-58

1100 AF 11207 Accumulator Room B

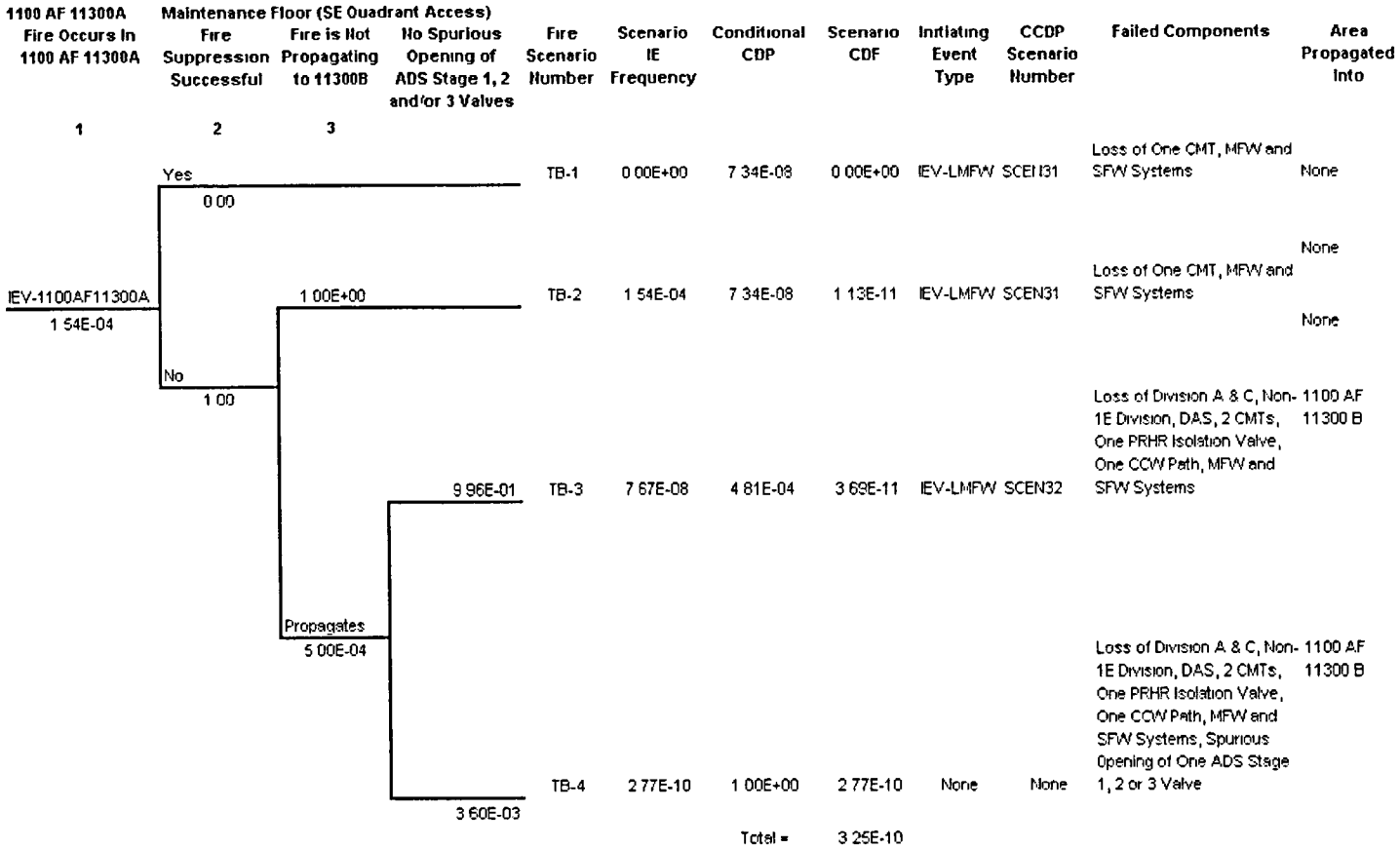
1100 AF 11208 RNS Valve Room



Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
TB-1	1.81E-05	2.55E-09	4.62E-14	IEV-TRANS	SCEN30	Loss of RNS-MOV-023	None
Total =	1.81E-05		4.62E-14				

Figure 57C-59

1100 AF 11208 RNS Valve Room



Notes

1 Propagation to Fire Zone 1100 AF 11300B is possible only if there is a fire suppression system failure

Pfailure = Probability of Fire Propagation to an Adjacent Area x Fire Suppression System Unavailability

Pfailure = (0 01 x 0 05)

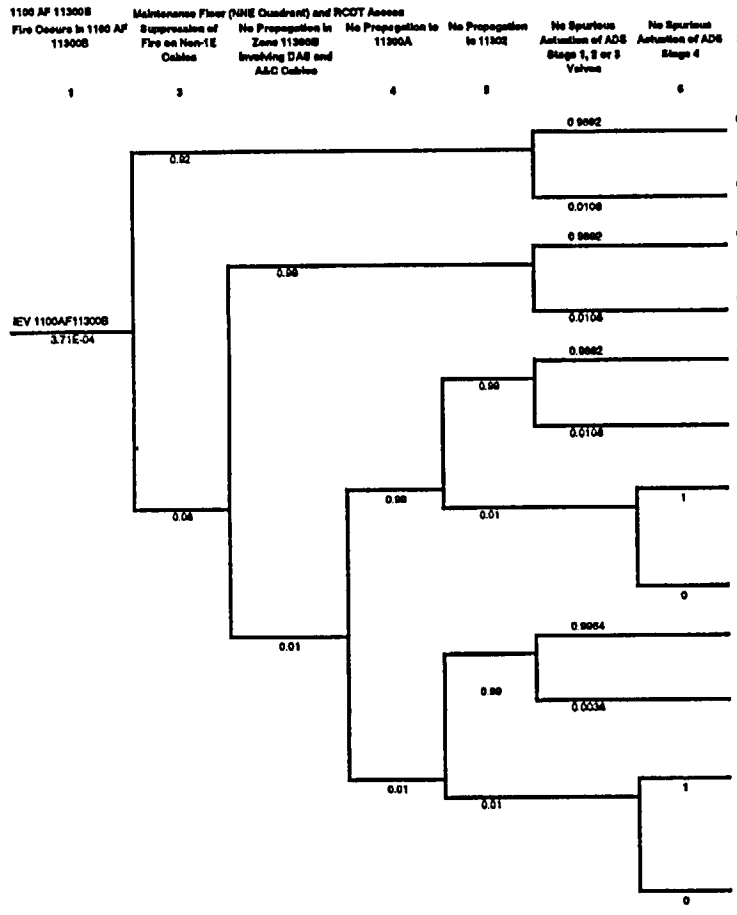
Pfailure = 5 00E-04

2 If the fire suppression system fails and the fire propagates to Fire Zone 1100 AF 11300B, a loss of all components within 1100 AF 11300B will result and the conditional core damage probability will be set to failure (1 00E+00)

3 Spurious actuation of one ADS Stage 1, 2 or 3 valve is equivalent to a hot short across two cables (0 06 x 0 06) = 3 60E-03

Figure 57C-60

1100 AF 11300A Maintenance Floor (SE Quadrant Access)



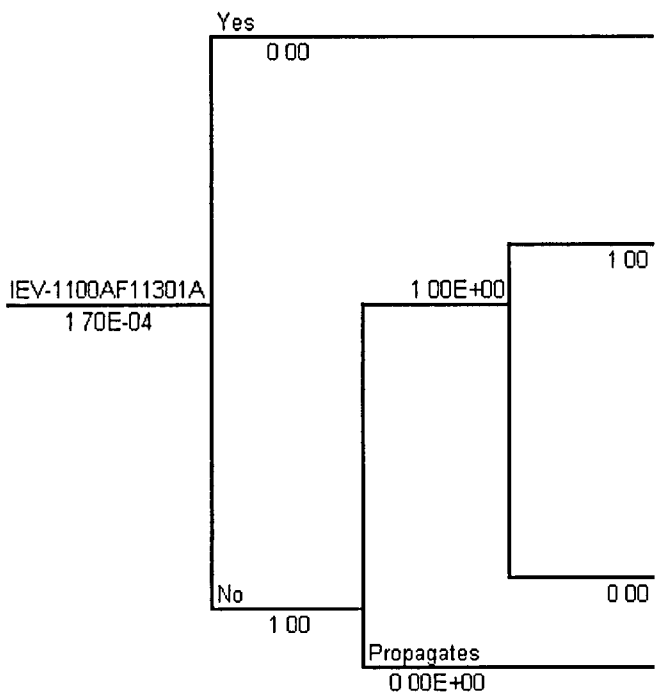
Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Zone Propagated Into
CT3008-1	3.36E-04	2.46E-06	8.31E-10	IEV-TRANS	SCEN33	Loss of Division A & C 1CMT, One PRHR Isolation Valve, and One CCS Path	None
CT3008-2	3.66E-06	2.26E-03	8.40E-09	IEV-MLOCA	SCEN13	Loss of Division A & C 1CMT, One PRHR Isolation Valve, One CCS Path, Spurious Opening of One ADS Stage 1, 2 or 3 Valve	None
CT3008-1	2.91E-06	2.46E-06	7.15E-11	IEV-TRANS	SCEN33	Loss of Division A & C 1CMT, One PRHR Isolation Valve, and One CCS Path	None
CT3008-2	3.17E-07	2.26E-03	7.24E-10	IEV-MLOCA	SCEN13	Loss of Division A & C 1CMT, One PRHR Isolation Valve, One CCS Path, Spurious Opening of One ADS Stage 1, 2 or 3 Valve	None
CT3008-3	2.86E-07	2.46E-06	7.06E-13	IEV-TRANS	SCEN33	Loss of Division A & C, Non-1E Cables, DAS Cables, 1CMT, one PRHR Isolation Valve, and One CCS Path	None
CT3008-4	3.14E-09	1.00E+00	3.14E-09	IEV-MLOCA	SCEN45	Loss of Division A & C, Non-1E Cables, DAS Cables, 1CMT, one PRHR Isolation Valve, and One CCS Path, Spurious Opening of One ADS Stage 1, 2 or 3 Valve	None
CT3008-5	2.94E-09	4.81E-04	1.41E-12	IEV-LMFW	SCEN32	Loss of Division A & C, Non-1E Cables, DAS Cables, 1CMT, Unavailability of 2 ADS Stage 4 Valves, loss of MFWS, SFWS, One PRHR Isolation Valve, and One CCS Path	11302
CT3008-6	0.00E+00	2.50E-03	0.00E+00	IEV-SPADS	SCEN42	Loss of Division A & C, Non-1E Cables, DAS Cables, 1CMT, Unavailability of 2 ADS Stage 4 Valves and Spurious Opening of 1 ADS Stage 4 Valve (V004A or V004C Supplied By Division A & C), Loss of MFWS, SFWS, One PRHR Isolation Valve, and One CCS Path	11302
CT3008-7	2.93E-09	2.46E-06	7.20E-15	IEV-TRANS	SCEN33	Loss of Division A & C, 2 CMTs, Non 1E cables, DAS Cables, One PRHR Isolation Valve, and One CCS Path	11300A
CT3008-8	1.06E-11	1.00E+00	1.06E-11	IEV-MLOCA	SCEN45	Loss of Division A & C, 2 CMTs, Non 1E cables, DAS Cables, One PRHR Isolation Valve, and One CCS Path, Spurious Opening of One ADS Stage 1, 2 or 3 Valve.	11300A
CT3008-9	2.97E-11	4.81E-04	1.43E-14	IEV-LMFW	SCEN32	Loss of Division A & C, 2 CMTs, Non 1E cables, DAS Cables, One PRHR Isolation Valve, and One CCS Path, Unavailability of 2 ADS Stage 4 Valves (V004A or V004C supplied by divisions A &C), and Loss of SFW, MFW Systems	11300A, 11302
CT3008-10	0.00E+00	1.00E+00	0.00E+00	IEV-SPADS	SCEN34	Loss of Division A & C, 2 CMTs, Non 1E cables, DAS Cables, One PRHR Isolation Valve, and One CCS Path, Spurious Opening of One ADS Stage 4 Valve (V004A or V004C supplied by divisions A &C), Unavailability of the other ADS Stage 4 Valve, and loss of SFW, MFW Systems	11300A, 11302
		Total =	1.32E-08				

Note
1. A manual fire water flow valve must be manually opened to allow fire water to reach the fire suppression system.
2. Spurious actuation of one ADS valve caused by a hot short across two cables = (0.06 x 0.06) = 3.60E-03.
2. Spurious actuation of three ADS valves caused by hot shorts across two cables = 3 x (0.06 x 0.06) = 1.08E-02.

Figure 57C-61

1100 AF 11300B Maintenance Floor (NNE Quadrant) and RCDT Access

1100 AF 11301 SG Compartment 1

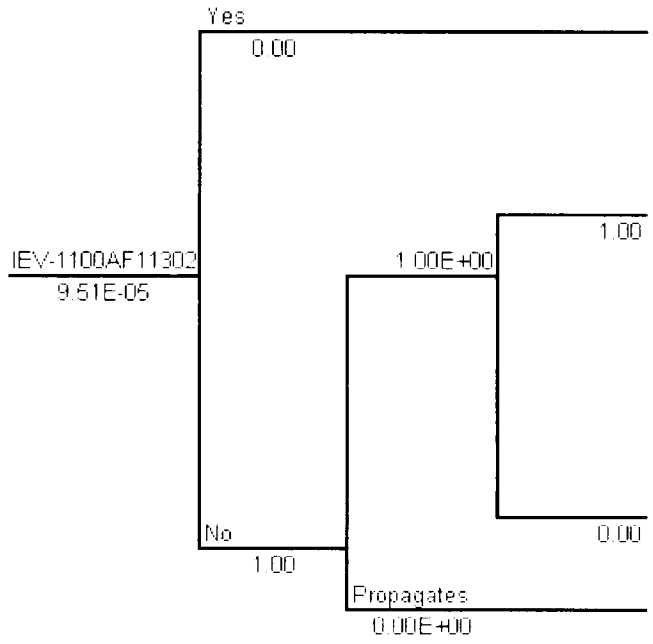


Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario Number	Failed Components	Area Propagated Into
TB-1	1 70E-04	7 73E-08	1 31E-11	IEV-LMFW	SCEN26	Loss of MFW and SFW Systems 2 ADS Stage 4 (V004B&V004D) Squib Valves Unavailable	
TB-2	0 00E+00	5 48E-04	0 00E+00	IEV-SPADS	None	Loss of MFW and SFW Systems 1 ADS Stage 4 (V004B & V004D) Squib Valve Unavailable and Spurious Opening of the Other ADS Stage 4 Squib Valve	
		Total =	1 31E-11				

Figure 57C-62

1100 AF 11301 SG Compartment 1

1100 AF 11302 SG Compartment 2

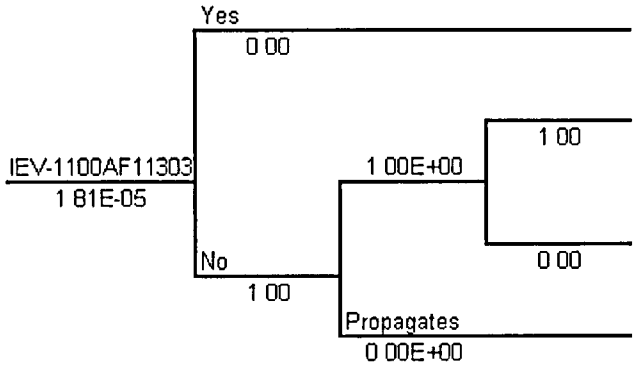


Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario number	Failed Components	Fire Propagated Into
TB-1	9.51E-05	7.73E-08	7.35E-12	IEV-LMFW	SCEN26	loss of MFW, SFW and 2 squib valves of ADS stage 4 (V004A&V004C) unavailable	
TB-2	0.00E+00	5.48E-04	0.00E+00	IEV-SPADS	None	loss of MFW, SFW, 1 squib valves of ADS stage 4 (V004A or V004C) unavailable, spurious opening of 1squib valve of ADS stage 4	
		Total =	7.35E-12				

Figure 57C-63

1100 AF 11302 SG Compartment 2

1100 AF 11303 Pressurizer Compartment

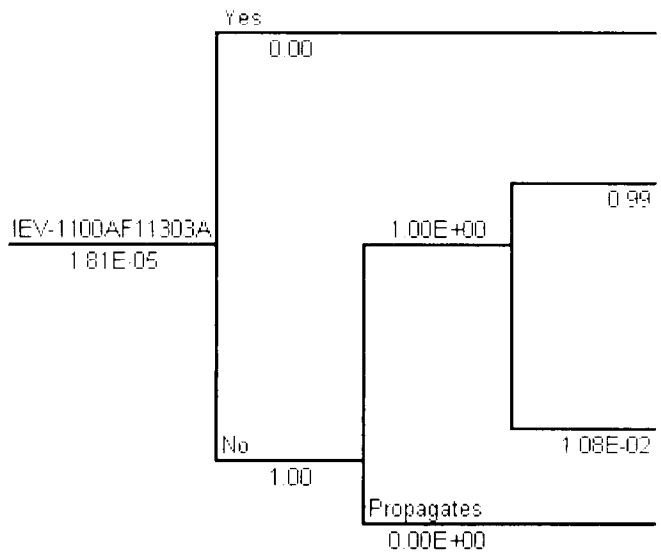


Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario number	Failed Components	Fire Propagated Into
TB-1	1 81E-05	2 10E-09	3 81E-14	IEV-TRANS	None	Loss of Auto Actuation of CMTs	
		Total =	3 81E-14				

Figure 57C-64

1100 AF 11303 Pressurizer Compartment

1100 AF 11303A ADS Lower Valve Area



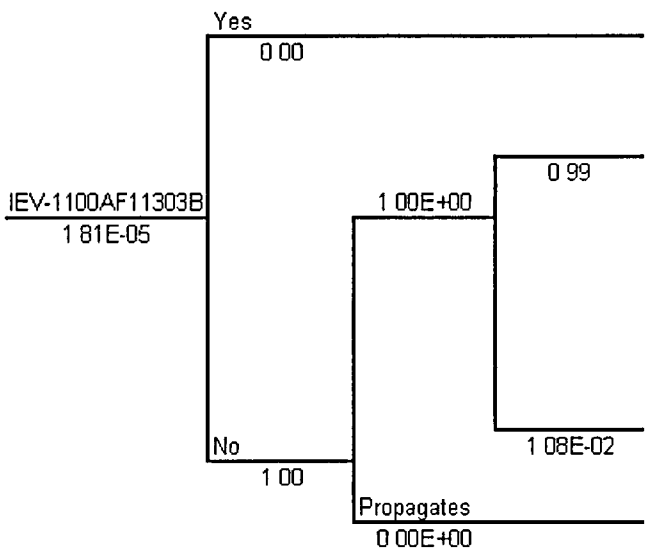
Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario number	Failed Components	Fire Propagated Into
TB-1	1.79E-05	2.99E-09	5.35E-14	IEV-TRANS	SCEN35	Loss of 1 ADS Stage 1, 2 and 3 Valves Cause by Cable Damage	
TB-2	1.95E-07	4.03E-05	7.88E-12	IEV-MLOCA	SCEN36	Unavailability of 1 ADS Stage 1, 2 and 3 Valve and Spurious Opening of At Least One of Them	
		Total =	7.93E-12				

Note:
1 Spurious actuation probability (1.08E-02) caused by fire induced hot shorts involves 3 valves and two cables or 3 x (0.06 x 0.06) = 1.08E-02

Figure 57C-65

1100 AF 11303A ADS Lower Valve Area

1100 AF 11303B ADS Upper Valve Area

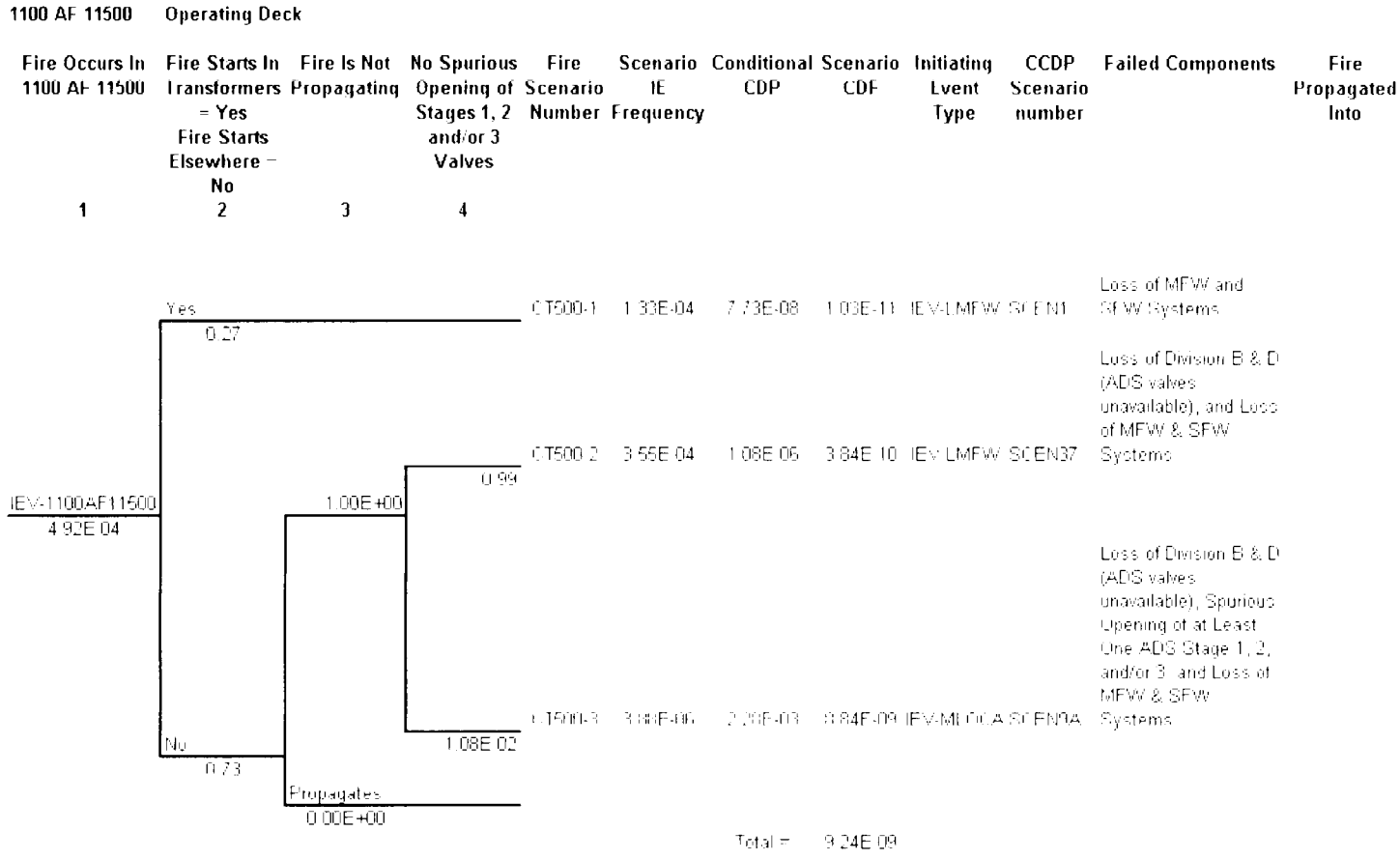


Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario number	Failed Components	Fire Propagated Into
TB-1	1 79E-05	2 99E-09	5 35E-14	IEV-TRANS	SCEN35	Unavailability of 1 ADS Stage 1, 2 and 3 Valves	
TB-2	1 95E-07	4 03E-05	7 88E-12	IEV-MLOCA	SCEN36	Unavailability of 1 ADS Stage 1, 2 and 3 Valves and Spurious Opening of at Least One of Them	
		Total =	7 93E-12				

Note
1 Spurious actuation probability (1 08E-02) caused by fire induced hot shorts involves 3 valves and two cables or 3 x (0 06 x 0 06) = 1 08E-02

Figure 57C-66

1100 AF 11303B ADS Upper Valve Area



notes

1 Spurious actuation probability (1.08E-02) caused by fire induced hot shorts that open the ADS Stage 1 &/or 2 &/or 3 Valves = 3 x (0.06x0.06)

2 Propagation to the Division B & D, from a transformer fire, is not possible because of the distance separating the transformers from the Division B & D cables

3 The 0.73 corresponds to fire ignition frequency of the transformers divided by the total fire ignition frequency in the fire zone

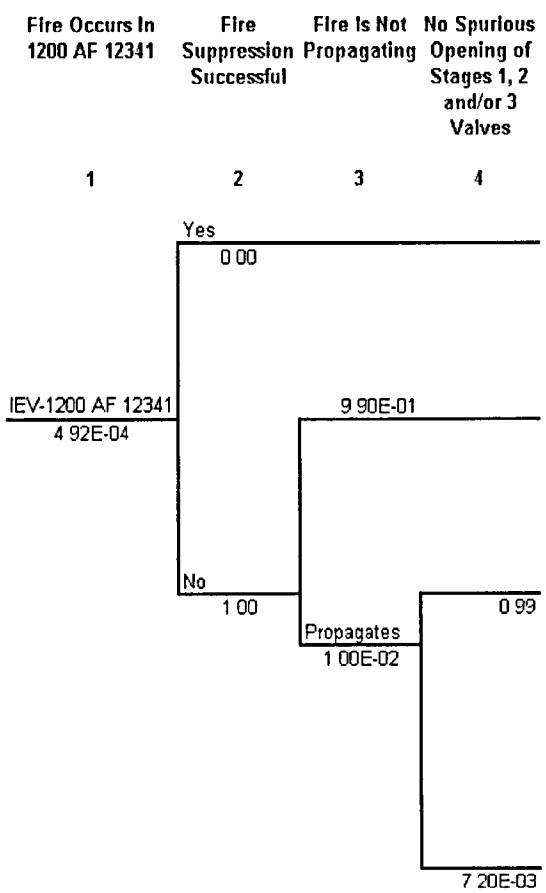
4 The Fire Scenario TB-1 is conservatively assumed as a loss of MFW, SFW, CCW, SWS, and the CAS Systems

5 If a fire starts in a transformers, it is assumed that it can not propagate to the Division B & D cables due to the distance separating the transformers from the Division B & D cables

Figure 57C-67

1100 AF 11500 Operating Deck

1200 AF 12341 Middle Annulus



Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario number	Failed Components	Fire Propagated Into
CT341-1	4 87E-04	1 38E-06	6 72E-10	IEV-TRANS	SCEN22	Loss of Non-1E Electrical Division to the Containment and DAS	
CT341-2	4 88E-06	1 38E-06	6 74E-12	IEV-TRANS	SCEN22	Loss of Division A, Non-1E Electrical Division to the Containment, and DAS	
CT-341-3	3 54E-08	1 94E-03	6 87E-11	IEV-MLOCA	SCEN39	Loss of Division A, Non-1E Electrical Division to the Containment, DAS, and Spurious Actuation of ADS Stage 1, 2 or 3 Valves	
		Total =	7 55E-11				

Note
1 The spurious actuation probability (7 20E-03) caused by fire induced hot shorts is 2 valves and 2 cables = 2 x (0 06 x 0 06)

Figure 57C-68

1200 AF 12341 Middle Annulus

1200 AF12555 Main Control Room Emergency Habitability System Air Storage/Operating Deck Staging Area

Fire Occurs In 1200 AF 12555	Fire Suppression Successful	Fire Is Not Propagating	No Spurious Opening of Stages 1, 2 and/or 3 Valves	Fire Scenario Number	Scenario IE Frequency	Conditional CDP	Scenario CDF	Initiating Event Type	CCDP Scenario number	Failed Components	Fire Propagated Into
1	2	3	4								
IEV-1200AF12555 1.50E-03	Yes 0.00			CT555-1	0.00E+00	0.00E+00	0.00E+00			No Risk	
	No 1.00	9.90E-01		CT555-2	1.49E-03	0	0.00E+00			No Risk	
		Propagates 1.00E-02	1.00	CT555-3	1.50E-05	2.55E-09	3.82E-14	IEV-TRANS	SCEN15A	Loss of CVS and RNS Systems	1200 AF 01
			0.00E+00	CT555-4	0.00E+00	0.00E+00	0.00E+00			No Risk	
						Total =	3.82E-14				

Figure 57C-69

1200 AF 12555 Main Control Room Emergency Habitability System Air Storage/Operating Deck Staging Area

ATTACHMENT 57D

AP1000 POTENTIAL FOR FIRE-INDUCED SPURIOUS ACTUATION OF FUNCTIONS THAT RESULT IN A BREACH OF HIGH/LOW PRESSURE BOUNDARY

The functions that could result in a breach of the high/low pressure boundary are ADS valve actuation, RV head vent valve actuation, and ADS system level actuation.

Control Room

Soft Controls

Most control room controls use soft-controls which communicate over multiplexed data channels. There are no fire-induced failures modes associated with soft controls that lead to spurious actuation.

Dedicated Safety Panel Switches

For the few hard control devices in the control room, there are cases where actuation of the manual controls results in a breach of the high/low pressure boundary. In these cases, 2 out of 2 logic is required; i.e., two switches must be actuated at the same time in order for the actuation to take place. There are two safety panels located in the control room. One is located adjacent to the reactor operator's desk and one adjacent to the SRO desk. For actuation that results in a breach of high/low pressure boundary, spurious actuation from the dedicated switches is required at each of the two safety panels. The separation provided by these locations (approximately 10 feet) is such that a fire initiating in one panel will not spread to the other panel before the operator can take action to extinguish the fire and to disable the panels at the transfer switches.

Each safety panel contains two switches for the following system-level actuations. Manual system-level actuation is achieved by simultaneous operator actuation of one of the corresponding switches at both panels.

- ADS Stages 1-3 actuation
- ADS Stage 4 actuation
- IRWST injection
- Containment recirculation/IRWST dump to containment
- RNS isolation

Each safety panel actuation circuit is two-pole, energize-to-actuate, ungrounded dc. PMS inputs only recognize an energize signal of proper polarity; therefore, spurious actuation of one circuit requires two hot shorts of proper polarity. Onerous actuation requires four hot shorts of proper polarity (two shorts for each safety panel).

Each safety panel also contains a switch for opening and closing each head vent valve (4 switches per panel). Each switch is a three-position, hold-in-position switch (open-neutral-close). If both switches associated with a valve are in the neutral position, soft control of that valve from the operator's console is allowed. If both switches are in the open position, the valve opens. Either switch in the close position closes the valve. If one switch is in neutral position and one in the open position, the valve holds its previous position but soft control is defeated. Onerous actuation requires eight hot shorts of proper polarity (two shorts for each safety panel per valve times two valves). Soft control from the remote shutdown workstation is enabled by the transfer switch action to defeat the safety panels.

The transfer switches on the route to the remote shutdown workstation disable all actuations from the safety panels following a control room evacuation. These transfer switches send signals to the four divisions of the protection and safety monitoring system in the four division I&C rooms. The protection and safety monitoring system ignores any further signals from the control room following receipt of the transfer signal.

DAS Panel

A normally-off master enable switch for the manual DAS panel is located on the reactor operator's desk. For manual DAS actuation, the operator must first turn on the actuation power at the operator's desk before using the DAS panel. The separation provided by these locations (approximately 15 feet) is such that a fire initiating in one location will not spread to the other location before the operator can extinguish the fire and disable the DAS panel. The master enable switch provides two normally-open contacts to interrupt both poles of the ungrounded dc actuation power to the DAS panel. The master enable switch is located on the center panel of the reactor operator's console between the two operator positions.

Each DAS manual actuation circuit is two-pole energize-to-actuate, ungrounded dc. After the DAS is energized, at least two manual actuation circuits are required to cause any DAS manual function.

- Two switches are provided for ADS Stage 1. One switch opens the gate valves. The other switch opens the globe valves. The two-out-of-two voting requirement for DAS is met by the fluid system configuration of two series valves.

- Two switches are provided for ADS Stage 2. One switch opens the gate valves. The other switch opens the globe valves. The two-out-of-two voting requirement for DAS is met by the fluid system configuration of two series valves.

- Two switches are provided for ADS Stage 3. One switch opens the gate valves. The other switch opens the globe valves. The two-out-of-two voting requirement for DAS is met by the fluid system configuration of two series valves.

- Two switches are provided for ADS Stage 4. For ADS Stage 4 actuation, the "arm" switch must be actuated, held for a few seconds, released, then the "actuate" switch actuated.

The master disable switch for the DAS panel, included with the transfer switches on the route to the remote shutdown workstation, removes power from the DAS panel following a control room evacuation. The master disable switch provides two normally-closed contacts to interrupt both poles of the ungrounded dc actuation power to the DAS panel.

Power to indicators on the DAS panel is limited to 4-20 mA loop power. The DAS actuation circuits require more power than is available from 4-20 mA loop power supplies so that a hot short from a DAS indicator circuit to an actuation circuit will not cause a spurious actuation.

Remote Shutdown Workstation

The remote shutdown workstation uses soft-controls that communicate over multiplexed data channels. There are no fire-induced failures modes associated with soft controls that lead to spurious actuation.

Division I&C Rooms

Sensor Cables used for Automatic Actuation

Fire-induced spurious actuation of the automatic actuation circuits due to fires in the division I&C rooms requires a fires in at least two division I&C rooms. If fires exist in two or more I&C rooms, then multiple shorts in two rooms could produce a spurious actuation. For example, hot shorts of proper impedance could produce false low-pressurizer pressure signals in both divisions resulting in an automatic CMT actuation (2-out-of-4 divisions). Following the CMT actuation, a spurious automatic ADS signal could be produced if hot shorts in both divisions generate low CMT level signals. This spurious actuation scenario requires fires in two I&C divisions, then two hot shorts of proper impedance for false, but valid, signals in the 4-20 mA loops. The short in the 4-20 mA circuit must have an impedance that gives a spurious signal that is in the valid range for that loop. The PMS system rejects the first out-of-range signal and simply place that channel in bypass. The second division with a spurious signal (either out of range or in range) results in a partial trip for that channel (1-out-of-4) but no actuation (2-out-of-4 not satisfied). A hot short of proper impedance is a low-probability event. Also, as the spurious signals are occurring, the DDS alarms, informing the operator that the redundant channels are not in agreement. The operator should respond to this alarm. Fire-induced spurious actuation that results in a breach of high/low pressure boundary is not credible for this scenario.

Manual Actuation Cables

Most control room controls use soft-controls which communicate over multiplexed data channels. There are no fire-induced failures modes associated with soft controls that lead to spurious actuation.

For actuation that results in a breach of high/low pressure boundary, actuation from the dedicated switches requires action at each of the two safety panels. Each safety panel actuation circuit is two-pole, energize-to-actuate, ungrounded dc. PMS inputs only recognize an energize signal of proper polarity; therefore, spurious actuation of one circuit requires two

hot shorts of proper polarity. Onerous actuation requires four hot shorts of proper polarity (two shorts for each circuit).

PMS Cabinets

A fire inside an I&C cabinet can produce a false output signal with a hot short on an output card. For spurious ADS, hot shorts would be required on output cards in two different PMS output cabinets.

For spurious head vent operation, hot shorts would be required on output cards in two different PMS divisions, one short in each of two divisions.

Cables from PMS Cabinets/DAS Panel to Motor Control Center (MOV Control)

MOV actuation circuits are two-pole, energize-to-actuate, ungrounded dc. Spurious actuation of one circuit requires two hot shorts of proper polarity. Onerous actuation of Stage 1, 2, or 3 ADS requires four hot shorts of proper polarity (two shorts for each MOV).

Cables from PMS Cabinets/DAS Panel to Squib Valve Controller Cabinet

Squib valve arm/actuate circuits use less than 50 V; therefore, squib valve cables are classified as instrumentation. For spurious actuation of squib valves to occur due to hot shorts in these cables, a sequence of hot shorts would be required – two hot shorts in the "arm" circuit, followed by removal of one of these shorts, followed (within a few minutes) by two hot shorts in the "fire" circuit. This is not considered credible.

Cables from PMS cabinets to Head Vent Valves

Head vent valve circuits are two-pole, energize-to-actuate, ungrounded dc. Spurious actuation of one valve requires two hot shorts. Onerous actuation of head vents requires four hot shorts (two shorts, one in each of two divisions, for two vent valves).

Squib Valve Controller Cabinets

A squib valve controller provides firing power for each squib valve. Each PMS division has a squib valve controller cabinet. Each cabinet contains multiple squib valve controller circuits. Power to each squib valve controller is normally removed and provided by PMS when needed for arming (charging) the circuit. The circuitry of the controller is designed so that the arming signal must be removed before the firing signal is provided. The PMS "actuate" signal is provided by an output cabinet different from the cabinet that provides the arming signal. The squib valve controllers are located in the Class 1E penetration rooms, separated from the PMS cabinets to allow sufficient time for fire detection and operator action to remove power from the I&C room before fire-induced spurious actuation occurs. Normally, there is no power in the squib valve controller cabinet; therefore, hot shorts, and thus spurious actuation, are not possible.

Motor Control Center (MOV Control)

MOVs are controlled from Motor Control Centers (MCCs) located near the penetrations for that division. A single hot short across a relay in the MCC could cause a MOV to open. The two MOVs in an each of the ADS Stage 1, 2, or 3 lines are controlled from different cabinets in the MCC. Thus, two hot shorts can cause spurious actuation of ADS Stage 1, 2, or 3, one short in each of the two MCC cabinets controlling the MOVs in the same line.

Cables from Squib Valve Controller Cabinets to Squib Valves

Squib valve circuits use less than 50 V; therefore, squib valve cables are classified as instrumentation. There is not sufficient power available from other instrumentation circuits for hot shorts to cause spurious squib valve firing. This form of fire-induced spurious actuation is not credible. Squib valve spurious actuation resulting from hot shorts to another squib valve cable is acceptable because these shorts will not cause actuation until an intended actuation of the other squib. The normal actuation order of squib valves is such that the ADS Stage 4 valves actuate first.

Cables from MCC to dc MOVs

In the dc MOV cables, four hot shorts of proper polarity are required for spurious actuation of MOVs. Two of these shorts must be to conductors external to the cable and two shorts could be to internal conductors. Thus, for spurious Stage 1, 2, or 3 ADS actuation eight hot shorts are required (four external to the cable and four internal to the cable). Fire-induced spurious actuation is not considered credible.

Non1E Equipment/Penetration Room (12321)

The DAS squib valve controller cabinet is located in Room 12321.

Manual Actuation Cables

Squib valve arm/actuate circuits use less than 50 V; therefore, squib valve cables are classified as instrumentation. For spurious actuation of squib valves to occur due to hot shorts in these cables, a sequence of hot shorts would be required – two hot shorts in the "arm" circuit, followed by removal of one of these shorts, followed (within a few minutes) by two hot shorts in the "fire" circuit. This is not considered credible.

Squib Valve Controller Cabinets

A squib valve controller cabinet containing multiple squib valve controller circuits provides firing power for each squib valve. Power to each squib valve controller is normally removed and provided by the DAS switches in the control room when needed for arming (charging) the circuit. The circuitry of the controller is designed so that the arming signal must be removed before the firing signal is provided. Normally, there is no power in the squib valve controller cabinet; therefore, hot shorts, and thus spurious actuation, are not possible.

Cables from Squib Valve Controller Cabinets to Squib Valves

Squib valve circuits use less than 50 V; therefore, squib valve cables are classified as instrumentation. There is not sufficient power available from other instrumentation circuits for hot shorts causing to cause spurious squib valve firing. This form of fire-induced spurious actuation is not credible. Squib valve spurious actuation resulting from hot shorts to another squib valve cable is acceptable because these shorts will not cause actuation until an intended actuation of the other squib. The normal actuation order of squib valves is such that the ADS Stage 4 valves actuate first.

Containment

Sensor Cables

Fire-induced spurious actuation of the automatic actuation circuits requires a fire in at least two divisions. Multiple shorts in two divisions can produce a spurious actuation. For example, hot shorts of proper impedance could produce false low-pressurizer pressure signals in two divisions resulting in an automatic CMT actuation (2-out-of-4 divisions). Following the CMT actuation, a spurious automatic ADS signal could be produced if hot shorts in two divisions generate low CMT level signals. This spurious actuation scenario requires fires affecting two divisions, then two hot shorts of proper impedance for false, but valid, signals in the 4-20 mA loops. The short in the 4-20 mA circuit must have an impedance that gives a spurious signal that is in the valid range for that loop. The PMS system rejects the first out-of-range signal and simply place that channel in bypass. The second division with a spurious signal (either out of range or in range) results in a partial trip for that channel (1-out-of-4) but no actuation (2-out-of-4 not satisfied). A hot short of proper impedance is a low-probability event. Also, as the spurious signals are occurring, the DDS alarms, informing the operator that the redundant channels are not in agreement. The operator should respond to this alarm. Fire-induced spurious actuation that results in a breach of high/low pressure boundary is not credible for this scenario.

Cables from Squib Valve Controller Cabinets to Squib Valves

Squib valve circuits use less than 50 V; therefore, squib valve cables are classified as instrumentation. There is not sufficient power available from other instrumentation circuits for hot shorts to cause spurious squib valve firing. This form of fire-induced spurious actuation is not credible. Squib valve spurious actuation resulting from hot shorts to another squib valve cable is acceptable because these shorts will not cause actuation until an intended actuation of the other squib. The normal actuation order of squib valves is such that the ADS Stage 4 valves actuate first.

Cables from MCC to dc MOVs

In the dc MOV cables, four hot shorts of proper polarity are required for spurious actuation of MOVs. Two of these shorts must be to conductors external to the cable and two shorts could be to internal conductors. Thus, for spurious Stage 1, 2, or 3 ADS actuation eight hot shorts are required (four external to the cable and four internal to the cable). Fire-induced spurious actuation is not considered credible.

Head Vent Valve Cables

Head vent valve circuits are two-pole, energize-to-actuate, ungrounded dc. Spurious actuation of one valve requires two hot shorts. Onerous actuation of head vents requires four hot shorts (two shorts, one in each of two divisions, for two vent valves). The cables for the control of one head vent valve in each flow path are enclosed in steel conduit up to the valve to prevent a fire inside containment from spuriously actuating two head vent valves in one flow path.

MOVs

A fire physically located at or near an MOV will not cause the valve to stroke (actuate).

Squib Valves

A fire physically located at or near a squib valve has the potential to cause the propellant to ignite, causing the valve to actuate.

Head Vent Valves

A fire physically located at or near a head vent valve will not cause the valve to stroke (actuate).