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6	6-28	720.024 (R1)
6	6-32 and 6-33	720.024 (R1)
6	6-37 through 6-39	720.024 (R1)
6	6-41	720.024 (R1)
6	6-50 through 6-53	720.024 (R1)
6	6-69	720.029 (R1)
24	24-17	720.046 (R1)
24	24-22 and 24-23	720.046 (R1)
24	24-27	720.046 (R1)
30	30-26a through 30-28	720.029 (R1)
35	35-28	720.043 (R1)
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43	43-9b	Editorial
43	43-10a	720.039 (R2)
43	43-10b	Editorial
43	43-93a through 43-93w	720.039 (R2)
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43C	43C-2	720.043 (R1)
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50	50-14	720.039 (R2)
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56	56-38l	Editorial
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59	59-23 and 59-23a	720.038 (R1)
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Appendix A	A-31	720.012 (R1)
Appendix A	A-33	720.010 (R1)
Appendix A	A-33a and A-33b	Editorial
Appendix A	A-44	Editorial
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Appendix A	A-103c and A-103d	720.012 (R1)
Appendix A	A-151 and A-152	720.013 (R1)
Appendix A	A-165 and A-166	720.013 (R1)

REVISION 2 CHANGE ROADMAP (Cont.)

Section	Page No.	Type of Change[1]
Appendix D	D-13 and D-14	720.080 (R1)
Appendix D	D-35 and D-36	720.080 (R1)

1. Changes incorporated as a result of Westinghouse responses to NRC Request for Additional Information (RAI) identified by RAI number.

Table 24-2 (Sheet 2 of 5)

SCREENING ANALYSIS EVALUATION

System	Line	Penetration Number	Applicable Screening Criteria	Retain for Further Evaluation (Yes/No)	Comments
SGS	Startup feedwater 02	P33	1, 6	Yes	Steam generator tubes are the barriers between RCS and startup feedwater system.
SGS	SG blowdown out 01	P27	1, 6	Yes	Steam generator tubes are the barriers between RCS and main steam system. Specific analysis of steam generator tube rupture and steam line break is required.
SGS	SG blowdown out 02	P28	1, 6	Yes	Steam generator tubes are the barriers between RCS and main steam system. Specific analysis of steam generator tube rupture and steam line break is required.
CVS	Charging in	P07	6	No	Flow coming from letdown path can be discharged outside containment in case of rupture or excessive leakage in system portion outside containment. In the letdown line, two normally open isolation valves closing on PZR low-low level are also provided.
CVS	Letdown out	P06	6	Yes	In the letdown line, two normally open valves closing on PZR low-low level are provided. In case of leakage/rupture outside containment during letdown operations, flow through V006 is reduced by a flow orifice (flow permitted 100 gpm less that CVS makeup capacity). Flow through WLS RCDT is parallel to the orifice through valves V045 and V047 and is not affected by a break or leak upstream of the orifice.

Table 24-2 (Sheet 3 of 5)

SCREENING ANALYSIS EVALUATION

System	Line	Penetration Number	Applicable Screening Criteria	Retain for Further Evaluation (Yes/No)	Comments
CVS	H2 inject to RCS	P08	2, 3, 6	No	Additional check valves inside containment, bottle outside containment
CVS	Spent resin flush out	P05	3, 5	No	Line size is 2 in., locked closed valves administratively controlled
DWS	Demin water in	P10	3, 5	No	Line size is 2 in., locked closed manual valve/administratively controlled
VFS	Containment air filter supply	P30		Yes	
VFS	Containment air filter exhaust	P32		Yes	
VWS	Fan coolers in	P35	1	No	Closed system inside containment
VWS	Fan coolers out	P34	1	No	Closed system inside containment
FPS	Fire protection in standpipe system	P12	5	No	Locked closed valve administratively controlled
CAS	Instrument air in	P01		Yes	
CAS	Service air in	P02	5	No	Locked closed valve administratively controlled

Table 24-3 CONTAINMENT PENETRATIONS NOT SCREENED OUT FOR NORMAL OPERATION AT POWER ANALYSIS
1. CAS-instrument air (penetration number 1)
2. WLS-normal containment sump (1,2) (penetration number 38)
3. VFS-purge supply (1,3) (penetration number 30)
4. VFS-purge exhaust (1,3) (penetration number 32)
5. SGS - main steam lines, main feedwater lines, startup feedwater lines, and SG blowdown lines (4) (penetration numbers 23-28, 31, 33)

Notes:
1. Valves for this penetration are actuated by DAS.
2. During accident conditions, the penetration is assumed to be open due to condensed water collection in the containment sump.
3. The penetration is conservatively assumed to be open about 12 percent of normal operation time to provide radiological and pressure control of the containment.
4. For SGTR and main steam line breaks only

Table 24-4

LIST OF SYSTEM FAULT TREES

Fault Tree Name	Description
CIC	Failure of containment isolation following transients, LOCAs, LOOP, and station blackout events which lead to core damage starting from normal at-power conditions
CIA	Failure to isolate both main steam lines following a steam line break accident
CIB	Failure to manually isolate the affected steam generator following a steam generator tube rupture event

Table 24-5a

FAULT TREE CIC SUCCESS CRITERIA SUMMARY

Event Description	Failure of containment isolation following transients, LOCAs, LOOP, and station blackout events which lead to core damage starting from normal at-power conditions
Success Configuration	One isolation valve in each penetration closed
System Initial Status	All subject valves open
Mission Time	Close on demand; 72 hours to remain closed
Components Required to Change Status	CV – V015 (CAS) From: open To: closed Butterfly – V014 (CAS) From: open To: closed V003/V004 (VFS) From: open To: closed V009/V010 (VFS) From: open To: closed Globe – V045/V047 (CVS) From: open To: closed[1] Plug – V055/V057 (WLS) From: open To: closed
Initiating Signals	Containment isolation T-signal generated by High containment pressure signal DAS actuation signal (VFS and WLS only)
Operator Actions	Manual closure of isolation valves if automatic actuation fails (CIC-MAN01)

Note:

1. There are two air-operated WLS valves, V004 and V006, shown in Fault Tree CIC that were incorrectly entered. Instead, two air-operated CVS valves, V045 and V047, should have been included in this fault tree. The failure contribution of the two air-operated CVS valves is compensated for by the two air-operated WLS valves incorrectly shown in the fault tree; therefore, there is minimal to no difference involved in the quantification of the fault tree.

   The two CVS valves, V045 and V047, had been originally screened out because of a letdown orifice located in the line. However, the WLS RCDT line ties into the line downstream of the letdown orifice and these valves are unaffected by a break upstream of the letdown orifice.

Table 24-5b

FAULT TREE CIA SUCCESS CRITERIA SUMMARY

Event Description	Failure to isolate both main steam lines following a main steam line break accident
Success Configuration	One main steam isolation valve in each line closed; bypass valves remain closed
System Initial Status	Isolation valves open; bypass valves closed
Mission Time	Close on demand; 24 hours to remain closed
Components Required to Change Status	AOV – V040B/V040A (SGS) From: open To: closed – V240B/V240A (SGS) From: open To: closed
Initiating Signals	Low steam line pressure
Operator Actions	Manual closure of isolation valves if automatic actuation fails (CIA-MAN01)

Table 24-5c

FAULT TREE CIB SUCCESS CRITERIA SUMMARY

Event Description	Failure to manually isolate the affected steam generator following a steam generator tube rupture event			
Success Configuration	One isolation valve in each line connected with the ruptured steam generator closed (includes steam lines, feed lines, and SG blowdown lines)			
System Initial Status	All valves open			
Mission Time	Not applicable (demand failure)			
Components Required to Change Status	AOV	– V040B/V250B/	From: open	To: closed
		V074B/V075B	From: open	To: closed
	MOV	– V027B	From: open	To: closed
		– V233B	From: closed	To: open
	CV	– V058B	From: open	To: closed
	Pneumatic	– V057B	From: open	To: closed
Initiating Signals	None (manual action)			
Operator Actions	Manual closure of isolation valves (CIB-MAN00 and CIB-MAN01)			

Note:
The startup feedwater system (SFW) isolation was not modeled in the CIB fault tree. The containment isolation valves are motor-operated MOV067A and MOV067B; air-operated AOV255A and AOV255B; and check valves CV256A and CV256B. These valves are outside of containment and exist in separate lines from the main feedwater system. AOV255A and B are normally closed and fail closed valves.

Isolation of MFW path (through closure of valves AOV057, or AOV250 or CV058) is included in the fault tree CIB. Isolation of the SFW path (through valves MOV067, AOV255 or CV256) is not included. The failure probability that the normally closed AOV is open, AND both valves fail upon receipt of a PMS signal AND the check valve fails, is small compared to failure of the MFW penetration valves to close, which is already modeled. The failure probability of the fault tree CIB is calculated to be 4.85E-03 per year. The failure probability of MOV067 and AOV255 is relatively small and would not significantly affect the results.

Table 24-6

NOTES RELATED TO SYSTEM FAULT TREE ASSUMPTIONS

None

Table 24-7 (Sheet 1 of 3)

SYSTEM DEPENDENCY MATRIX

Components Identification Type/Name	Supporting Systems												
	Electric Power												Compressed and Instrument Air System
	125 VDC Class 1E										Actuation Signals (Manual & Automatic Available)		
	A	B	C	D	IDSA DD 1	IDSB DD 1	IDSC DD 1	IDSD DD 1	IDSB DK 1	IDSD DK 1	PMS	DAS	
Containment Isolation													
CAS AOV-V014				X				X			X (1)		X
VFS AOV-V003	X				X						X (1)	X	X
VFS AOV-V004				X				X			X (1)	X	X
VFS AOV-V009				X				X			X (1)	X	X
VFS AOV-V010	X				X						X (1)	X	X
WLS AOV-V055	X				X						X (1)	X	X
WLS AOV-V057				X				X			X (1)	X	X
SGS Isolation													
MOV-V027A		X				X			X		X (2)		
MOV-V027B				X				X		X	X (2)		
AOV-V074A				X				X			X (4)		X

Table 24-8

COMPONENT TEST ASSUMPTIONS

Components Identification Type/Name	Expected Frequency of Test
Containment Isolation	
CAS-CV-V015	24 months
CAS-AOV-V014	24 months
CVS-AOV-V045/V047	3 months
WLS-V055/V057	3 months
VFS-AOV-V003/V004	3 months
VFS-V009/V010	3 months
SGS Isolation	
AOV-V040A/V040B	3 months
AOV-V240A/V240B	3 months
AOV-V233A/V233B	3 months
MOV-V027A/V027B	3 months
AOV-V057A/V057B	3 months
CV-V015A/V015B	3 months
CV-V058A/V058B	3 months
CV-V256A/V256B	3 months
AOV-V074A/V074A	3 months
AOV-V250A/V250B	3 months
AOV-V075A/V075B	3 months

Table 24-9

COMPONENT MAINTENANCE ASSUMPTIONS

Component Identification Type/Name	Expected Frequency of Maintenance	Expected for Outage Time Maintenance
Component maintenance is assumed to be performed during shutdown operations for the containment isolation valves; therefore, no component maintenance is modeled.	N/A	N/A

Table 24-10

OPERATOR ACTIONS AND MISPOSITION ANALYSIS SUMMARY

Event Name	Description
CIC-MAN01	Failure to recognize the need and close isolation valves, if valves stay open in transient, LOCAs, LOOP, or station blackout events (starting from normal operation) which lead to core damage
CIA-MAN01	Failure to manually isolate main steam line isolation valves if automatic isolation fails, given a steam line break
CIB-MAN00	Failure to recognize the need to close SG isolation valves given a SG tube rupture accident
CIB-MAN01	Failure to manually isolate ruptured SG, given a SG tube rupture accident

Table 24-11

COMMON CAUSE FAILURE ANALYSIS SUMMARY

Event Name	Description
CIX-AV-LA	Common cause failure of all containment isolation air-operated valves to close on demand (fault tree CIC)

CIT-MAN0S is quantified as follows:

Item No.	Subtask Description for CIT-MAN0S	Mean HEP	Stress Level	Source: Table 30A-4 (Item)	Recovery Factor	Modified HEP
1	Failure to respond to one of three alarms	2.7E-03	5	48	4.05E-02	5.47E-04
2	Select wrong control for one of two instrument-air lines	1.3E-03 x 2 = 2.6E-03	5	29	4.05E-02	5.27E-04
3	Omit one of two steps to close instrument-air lines	3.8E-03 x 2 = 7.6E-03	5	9	4.05E-02	1.54E-03
4	Select wrong control for one of two liquid waste lines	1.3E-03 x 2 = 2.6E-03	5	29	4.05E-02	5.27E-04
5	Omit one of two steps to close liquid waste lines	3.8E-03 x 2 = 7.6E-03	5	9	4.05E-02	1.54E-03
6	Select wrong control for one of one containment purge line	1.3E-03	5	29	4.05E-02	2.63E-04
7	Omit one of one step to close containment purge line	3.8E-03	5	9	4.05E-02	7.70E-04
8	Omit steps to close remaining containment isolation lines	3.8E-03	5	9	4.05E-02	7.70E-04
	Total HEP = Item 1 + Item 2 + Item 3 + Item 4 + Item 5 + Item 6 + Item 7 + Item 8					6.48E-03

Notes:
1. Recovery is evaluated by "item 40 in HRA data table" x "stress level" x "0.1"; where item 40 represents recovery by STA, and 0.1 is recovery by SRO.
2. "Modified HEP" = "mean HEP" x "stress level" x "recovery factor."
3. It is assumed that the operator is required to isolate about 10 lines for this event. Isolation of three lines is fully modeled in items 2 through 7. Complete dependency is assumed in the actions to isolate the remaining seven lines; this is modeled as an error of omission shown in item 8.

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30.6.16 CMN-MAN01 (Actuate Core Makeup Tank)

The CMN-MAN01 operator action evaluates the probability of failure to actuate the core makeup tank (CMT), if automatic actuation fails during a loss-of-coolant accident.

The time windows for scenarios requiring core makeup tanks actuation are outlined in Subsection 30.6.2. Although a time window of 30 minutes for diagnosis and task performance is defined for the small LOCA/transient initiating event cases, evaluation of core makeup tank related human errors is based on the more limiting case (medium LOCA) with a time window of 20 minutes and an estimated actual time of 15 minutes to diagnose and actuate core makeup tanks. It is conservatively assumed that the crew will take about 15 minutes to go through the procedures to diagnose the event and actuate the core makeup tanks. The shift technical advisor is believed to be present during the event, but no credit is taken for recovery by the shift technical advisor.

The following assumptions are used as input to the quantification of CMN-MAN01:

- Procedure (LONG/SHORT): LONG
- Time window: 15 minutes
- Estimated actual time: approximately 15 minutes
- Cues: cues are addressed in LPM-MAN01 and LPM-MAN02 for applicable initiating events
- Stress level: HIGH (multiplier of 5 is applied)
- Recovery by: senior reactor operator

CMN-MAN01 is quantified as follows:

Item No.	Subtask Description for CMN-MAN01	Mean HEP	Stress Level	Source: Table 30A-4 (Item)	Recovery Factor	Modified HEP
1	Select wrong control to align CMT A or B injection line	1.3E-03 x 2 = 2.6E-03	5	29	1.00E-01	1.30E-03
2	Omit step to align CMT A or B injection line	3.8E-03 x 2 = 7.6E-03	5	9	1.00E-01	3.80E-03
	Total HEP = Item 1 + Item 2					5.10E-03

Note:
1. "Modified HEP" = "mean HEP" x "stress level" x "recovery factor."

30.6.17 CMN-REC01 (Actuate the Core Makeup Tanks)

The CMN-REC01 operator action evaluates the probability of failure to actuate the core makeup tanks after core damage.

The following assumptions are used as input to the quantification of CMN-REC01:

- There is a very long time between performing CMN-MAN01 and when CMN-REC01 is required.
- Based on engineering judgment, CMN-REC01 is assumed to have a low dependency on CMN-MAN01.