AP1000 Probabilistic Risk Assessment

Instructions for Inserting Revision 2 Change Pages and Tabs

(April 2003)

Volume 1

Remove the Revision No. 1 "AP1000 Document Cover Sheet" from the front of the volume, and insert the Revision No. 2 "AP1000 Document Cover Sheet."

Then after the AP1000 Volume 1 Title Page (color), remove the following pages and insert the Revision 2 pages as follows:

Remove Pages	Insert Pages
i (Rev. 1)/ii (Rev. 1) through xcix (Rev. 1)/c (Rev. 1)	i (Rev. 2)/ii (Rev. 2) through xcix (Rev. 2)/c (Rev. 2)

Then after page ciii (Rev. 1)/civ (Rev. 1), insert pages cv (Rev. 2)/cvi (Rev. 2) and cvii (Rev. 2)/Blank.

After Tab 6, "Success Criteria Analysis," remove the following pages and insert the Revision 2 pages as follows:

Remove Pages	Insert Pages
6-17 (Rev. 1)/6-18 (Rev. 1)	6-17 (Rev. 2)/6-18 (Rev. 1)
6-27 (Rev. 1)/6/28 (Rev. 1)	6/27 (Rev. 1)/6/28 (Rev. 2)
6-31 (Rev. 1)/6-32 (Rev. 1) and 6-33 (Rev. 1)/6-34 (Rev. 1)	6-31 (Rev. 1)/6-32 (Rev. 2) and 6-33 (Rev. 2)/6-34 (Rev. 1)
6-37 (Rev. 1)/6-38 (Rev. 1) through 6-41 (Rev. 1)/6-42 (Rev. 1)	6-37 (Rev. 2)/6-38 (Rev. 2) through 6-41 (Rev. 2)/6-42 (Rev. 1)
6-49 (Rev. 1)/6-50 (Rev. 1) through 6-53 (Rev. 1)/6-54 (Rev. 1)	6-49 (Rev. 1)/6-50 (Rev. 2) through 6-53 (Rev. 2)/6-54 (Rev. 1)
6-69 (Rev. 1)/6-70 (Rev. 1)	6-69 (Rev. 2/6-70 (Rev. 1)

Volume 2

After the AP1000 Volume 2 Title Page (color), remove the following pages and insert the Revision 2 pages as follows:

Remove Pages	Insert Pages
i (Rev. 1)/ii (Rev. 1) through xcix (Rev. 1)/c (Rev. 1)	i (Rev. 2)/ii (Rev. 2) through xcix (Rev. 2)/c (Rev. 2)

Then after page ciii (Rev. 1)/civ (Rev. 1), insert pages cv (Rev. 2)/cvi (Rev. 2) and cvii (Rev. 2)/Blank.

After Tab 24 "Containment Isolation," remove the following pages and insert the Revision 2 pages as follows:

Remove Pages	Insert Pages
24-17 (Rev. 0)/24-18 (Rev. 0)	24-17 (Rev. 2)/24-18 (Rev. 0)
24-21 (Rev. 0)/24-22 (Rev. 0) and 24-23 (Rev. 0)/24-24 (Rev. 0)	24-21 (Rev. 0)/24-22 (Rev. 2) and 24-23 (Rev. 2)/24-24 (Rev.0)
24-27 (Rev. 0)/24-28 (Rev. 0)	24-27 (Rev. 2)/24-28 (Rev. 0)

After Tab 30 "Human Reliability Analysis," remove the following page and insert the Revision 2 pages as follows:

Remove Pages	Insert Pages
30-27 (Rev. 1)/30-28 (Rev. 1)	30-26a (Rev. 2)/30-26b (Rev. 2) and 30-27 (Rev. 2)/30-28 (Rev. 2)

Volume 3

After the AP1000 Volume 3 Title Page (color), remove the following pages and insert the Revision 2 pages as follows:

Remove Pages	Insert Pages
i (Rev. 1)/ii (Rev. 1) through xcix (Rev. 1)/c (Rev. 1)	i (Rev. 2)/ii (Rev. 2) through xcix (Rev. 2)/c (Rev. 2)

Then after page ciii (Rev. 1)/civ (Rev. 1), insert pages cv (Rev. 2)/cvi (Rev. 2) and cvii (Rev. 2)/Blank.

After Tab 35 "Containment Event Tree Analysis," remove the following pages and insert the Revision 2 pages as follows:

Remove Pages	Insert Pages
35-27 (Rev. 1)/35-28 (Rev. 1)	35-27 (Rev. 1)/35-28 (Rev. 2)

After Tab 43 "Release Frequency Quantification," remove the following pages and insert the Revision 2 pages as follows:

Remove Pages	Insert Pages
43-9 (Rev. 1)/43-10 (Rev. 1)	43-9 (Rev. 2)/43-9a (Rev. 2) through 43-10a (Rev. 2)/43-10b (Rev. 2)
43-93 (Rev. 1)/43-94 (Rev. 1)	43-93 (Rev. 1)/43-9a (Rev. 2) through 43-93x (Rev. 2)/43-94 (Rev. 1)
43C-1 (Rev. 1)/43C-2 (Rev. 1)	43C-1 (Rev. 1)/43C-2 (Rev. 2)

Volume 4

After the AP1000 Volume 4 Title Page (color), remove the following pages and insert the Revision 2 pages as follows:

Remove Pages	Insert Pages
i (Rev. 1)/ii (Rev. 1) through xcix (Rev. 1)/c (Rev. 1)	i (Rev. 2)/ii (Rev. 2) through xcix (Rev. 2)/c (Rev. 2)

Then after page ciii (Rev. 1)/civ (Rev. 1), insert pages cv (Rev. 2)/cvi (Rev. 2) and cvii (Rev. 2)/Blank.

After Tab 50 "Importance and Sensitivity Analysis," remove the following pages and insert the Revision 2 pages as follows:

Remove Pages	Insert Pages
50-1 (Rev. 1)/50-2 (Rev. 1)	50-1 (Rev. 2)/50-1a (Rev. 2) and 50-1b (Rev. 2)/50-2 (Rev. 2)
50-13 (Rev. 1)/50-14 (Rev. 1)	50-13 (Rev. 1)/50-14 (Rev. 2)
50-119 (Rev. 1)/Blank	50-119 (Rev. 1)/50-120 (Rev. 2)

After Tab 54 "Low-Power and Shutdown Risk Assessment," remove the following pages and insert the Revision 2 pages as follows:

Remove Pages	Insert Pages
54-1 (Rev. 0)/54-2 (Rev. 0) through 54-73 (Rev. 0)/54-74 (Rev. 0)	54-1 (Rev. 2)/54-2 (Rev. 2) through 54-135 (Rev. 2)/54-136 (Rev. 2)

Volume 4 (Cont.)

After Tab 56 "Internal Flooding Analysis," remove the following pages and insert the Revision 2 pages as follows:

Remove Pages	Insert Pages
56-1 (Rev. 0)/56-2 (Rev. 0)	56-1 (Rev. 2)/56-2 (Rev. 0)
56-9 (Rev. 0)/56-10 (Rev. 0)	56-9 (Rev. 0)/56-10 (Rev. 2)
56-17 (Rev. 0)/56-18 (Rev. 0) and 56-19 (Rev. 0)/56-20 (Rev. 0)	56-17 (Rev. 2)/56-18 (Rev. 2) and 56-19 (Rev. 0)/56-20 (Rev. 2)
56-35 (Rev. 0)/56-36 (Rev. 0) and 56-37 (Rev. 0)/56-38 (Rev. 0)	56-35 (Rev. 0)/56-36 (Rev. 2) through 56-38k (Rev. 2/56-38l (Rev. 2)
56-47 (Rev. 0)/56-48 (Rev. 0) and 56-53 (Rev. 0)/Blank	56-47 (Rev. 2)/56-48 (Rev. 2) and 56-55 (Rev. 2)/Blank

After Tab 57 "Fire Risk Assessment," remove the following pages and insert the Revision 2 pages as follows:

Remove Pages	Insert Pages
57-13 (Rev. 1)/57-14 (Rev. 1) and 57-15 (Rev. 1)/57-16 (Rev. 1)	57-13 (Rev. 1)/57-14 (Rev. 2) through 57-15b (Rev. 2)/57-16 (Rev. 1)

After Tab 59 "PRA Results and Insights," remove the following pages and insert the Revision 2 pages as follows:

Remove Pages	Insert Pages
59-23 (Rev. 1)/59-24 (Rev. 1)	59-23 (Rev. 2)/59-23a (Rev. 2) and 59-23b (Rev. 2)/59-24 (Rev. 1)
59-33 (Rev. 1)/59-34 (Rev. 1)	59-33 (Rev. 1)/59-34 (Rev. 2)
59-71 (Rev. 1)/59-72 (Rev. 1)	59-71 (Rev. 1)/59-72 (Rev. 2)

Volume 5

After the AP1000 Volume 5 Title Page (color), remove the following pages and insert the Revision 2 pages as follows:

Remove Pages	Insert Pages
i (Rev. 1)/ii (Rev. 1) through xcix (Rev. 1)/c (Rev. 1)	i (Rev. 2)/ii (Rev. 2) through xcix (Rev. 2)/c (Rev. 2)

Then after page ciii (Rev. 1)/civ (Rev. 1), insert pages cv (Rev. 2)/cvi (Rev. 2) and cvii (Rev. 2)/Blank.

After Tab "Appendix A," remove the following pages and insert the Revision 2 pages as follows:

Remove Pages	Insert Pages
A-11 (Rev. 1)/A-12 (Rev. 1)	A-11 (Rev. 1)/A-12 (Rev. 2)
A-23 (Rev. 1)/A-24 (Rev. 1) through A-27 (Rev. 1)/A-28 (Rev. 1)	A-23 (Rev. 2)/A-24 (Rev. 2) through A-27 (Rev. 2)/A-28 (Rev. 1)
A-31 (Rev. 1)/A-32 (Rev. 1)	A-31 (Rev. 2)/A-32 (Rev. 1)
A-33 (Rev. 1)/A-34 (Rev. 1)	A-33 (Rev. 2)/A-33a (Rev. 2) and A-33b (Rev. 2)/A-34 (Rev. 1)
A-43 (Rev. 1)/A-44 (Rev. 1)	A-43 (Rev. 1)/A-44 (Rev. 2)
A-57 (Rev. 1)/A-58 (Rev. 1) through A-65 (Rev. 1)/A-66 (Rev. 1)	A-57 (Rev. 2)/A-58 (Rev. 2) through A-65 (Rev. 1)/A-66 (Rev. 2)

Then after page A-103 (Rev. 1)/A-104 (Rev. 1), insert pages A-103a (Rev. 2)/A-103b (Rev. 2) and A-103c (Rev. 2)/A-103d (Rev. 2)

A-151 (Rev. 1)/A-152 (Rev. 1)	A-151 (Rev. 2)/A-152 (Rev. 2)
A-165 (Rev. 1)/A-166 (Rev. 1)	A-165 (Rev.2)/A-166 (Rev. 2)

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After Tab "Appendix D," remove the following pages and insert the Revision 2 pages as follows:

Remove Pages	Insert Pages
D-13 (Rev. 1)/D-14 (Rev. 1)	D-13 (Rev. 2)/D-14 (Rev. 2)
D-35 (Rev. 1)/D-36 (Rev. 1)	D-35 (Rev. 2)/D-36 (Rev. 2)

Volume 1

AP1000 DOCUMENT COVER SHEET

TDC: _____ Permanent File: _____ S _____

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AP1000 DOCUMENT NO.	REVISION NO.		ASSIGNED TO
APP-GW-GL-022	2	Page 1 of 1	W – R. P. Vijuk

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ATTACHMENTS:	DCP #/REV. INCORPORATED IN THIS DOCUMENT REVISION: Class 3 revision to correct input to latest available (DCP APP-GW-GL-700), to expand documentation per RAI requests.
CALCULATION/ANALYSIS REFERENCE: N/A	

ELECTRONIC FILENAME	ELECTRONIC FILE FORMAT	ELECTRONIC FILE DESCRIPTION

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Probabilistic Risk Assessment, Revision 2

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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)
43	93-93x	Editorial
43C	43C-2	720.043 (R1)
50	50-1	
50	50-1a and 50-1b	Editorial
50	50-14	720.039 (R2)
50	50-14a	720.039 (R2)
50	50-14b	Editorial
54	54-1 through 54-131	720.038 (R2)

REVISION 2 CHANGE ROADMAP (Cont.)

Section	Page No.	Type of Change[1]
56	56-1	720.038 (R1) Editorial
56	56-9	Editorial
56	56-17 and 56-18	Editorial
56	56-20	Editorial
56	56-36 and 56-37	Editorial
56	56-38	Editorial 720.038 (R1)
56	56-38a through 56-38k	720.038 (R1)
56	56-38l	Editorial
56	56-47 through 56-49	Editorial
56	56-51	Editorial
56	56-54 and 56-55	720.038 (R1)
57	57-14 and 57-15	280.011 (R1)
57	57-15a and 57-15b	Editorial
59	59-23 and 59-23a	720.038 (R1)
59	59-23b	Editorial
59	59-34	720.038 (R1)
59	59-72	720.038 (R1)
Appendix A	A-12	Editorial
Appendix A	A-24 through A-26	440.014 (R1)
Appendix A	A-26a	440.014 (R1) 720.024 (R1)
Appendix A	A-26b	Editorial
Appendix A	A-27	720.012 (R1)
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
Appendix A	A-57 through A-61	720.012 (R1)
Appendix A	A-63	720.012 (R1)
Appendix A	A-66	720.012 (R1)
Appendix A	A-103a through A-103b	440.014 (R1)
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.

above). Note that the containment recirculation success criteria is dependent on containment isolation; as a result, containment isolation is modeled in the event trees.

Impact of CVS operation on depressurization, gravity injection, and PRHR operation. The status of the chemical and volume control system is not evaluated for events other than steam generator tube rupture, very small LOCA/RCS leak, and steamline breaks. Continuous or intermittent operation of the CVS is not expected to adversely affect depressurization or gravity injection because CVS injection flow is much smaller than that from the CMTs or accumulators. In addition, CVS operation can only have a secondary impact on RCS pressure during depressurization because opening of the ADS valves provides large vent holes.

The PRA success criteria analysis sensitivity to numbers of CMTs and accumulators bounds the impact of possible CVS operation.

For steam generator tube rupture, CVS operation is modeled for auxiliary pressurizer spray, but normal CVS operation will not adversely affect event mitigation. Further, for SGTR, ADS operation is not required if CVS operation for sprays is successful, so there are no interactions of concern. Cooldown is accomplished via cooling from the intact steam generator or with PRHR operation.

Potential impacts of CVS operation on PRHR operation were investigated as part of the AP600/AP1000 testing program. Those tests provide data to confirm that successful core cooling in the AP1000 will not be impeded by CVS operation.

6.3.3.2 Passive Residual Heat Removal System Performance and Criteria

Use of PRHR at low RCS pressure. No credit is taken in the loss of RCS inventory event tree models (Chapter 4) for heat removal through the PRHR heat exchanger once RCS pressure drops to the accumulator empty pressure. In those models, once the accumulators empty, heat removal and inventory control occur via CMT or IRWST injection.

6.3.3.3 Decay Heat Removal Systems

As discussed earlier, following a reactor trip, decay heat removal is provided by the startup feedwater system or, if startup feedwater is unavailable, the PRHR system. With PRHR system operation but no startup feedwater, RCS pressure may initially rise, but the opening of the pressurizer safety valves is not expected to occur. If the safety valves were to open, CMTs may be actuated to provide RCS inventory makeup as necessary, but CMT injection is not required to prevent core damage (Appendix A).

If startup feedwater and PRHR both operate, RCS cooldown is more rapid. When the RCS temperature is cooled to below the steam generator secondary side temperature, the SFW heat removal becomes ineffective.

6.3.4 Sequence Success Criteria Summary

The success criteria for each success path in the at-power core damage event trees are summarized in Table 6-2 and the accompanying notes. These constitute the set of conditions defined as being necessary to avoid core damage.

In the table, the sequence success criteria are organized by function e.g., reactivity control, inventory control, and so forth, and, within each function listing, by type of event e.g., transient, small LOCA, and so forth. The success sequence identifiers correspond to those used in Chapter 4, except that, where all success paths for an event type are covered by a single criterion, the notation (all) is used in place of the success sequence number. Additional details regarding the success criteria and bases for each individual event tree top event case are provided in Table 6-1.

It is important to note that, in general, these are not best-estimate success criteria. Criteria have been selected to bound the spectra of conditions identified in Appendix A as being important for the various event categories, in order to avoid quantifying uncertainty bounds for the success criteria.

For example, if the analyses described in Appendix A identified that a set of success criteria for avoiding core damage was sensitive to (more restrictive without) the operation of a particular system, but that particular system was not modeled in the event trees, then that set of success criteria was adjusted to cover the case where that system was not operating. A particular example of this is containment isolation. Containment isolation is modeled on most of the event trees. However, as discussed in Appendix A, the effect of failure to isolate the containment is considered in all success criteria. The success criteria for operation have been defined to cover the more limiting case of containment isolation failure. Another example is passive containment cooling; its impact is also discussed in Appendix A and reflected in the success criteria.

In making adjustments to the sequence success criteria, the ADS criteria have generally been selected as the variables, since ADS incorporates the greatest degree of redundancy (in terms of total number of valves). Criteria for systems for which two full-capacity elements are provided, such as core makeup tanks, accumulators, and so forth, have generally been set as one out of two success, consistent with the design philosophy. Thus, for a sequence for which core damage was predicted with a given set of success criteria, the ADS success criteria were changed until core damage was avoided, with the other criteria held constant.

6.4 Event Tree Top Events Success Criteria

Three tables are provided in this section. They provide:

- Internal event tree top event success criteria and basis (6-1)
- Summary of success criteria for the mitigating systems (6-2)
- Summary of success criteria for operator actions and mission times (6-3)

In this section, the success criteria are described for each event tree top event case, and the bases for the success criteria are presented. For any given system modeled in the event trees,

Table 6-1 (Sheet 8 of 34)

SUMMARY OF EVENT TREE TOP EVENTS SUCCESS CRITERIA
(Internal Initiating Events at Power Cases)

Event Case Name	Top Event Name	Event Trees	Success Criteria	Manual Actions	Dependencies and Modeled Actuations	Mission Time	Basis
ADUM Partial Depressurization PRHR Fails	ADS-P	MLOCA CMTLB	2 out of 4 ADS stages 2, 3 valves and isolation valves open **OR** 1 out of 4 ADS stage 4 valves open	Credit given for manual actuation only. [Operator Actions: LPM-MAN02, AND-MAN01]	None	24 hours	A Chap11 A A3.3 D 6.3
ADV Partial Depressurization PRHR successful, CMT successful	ADS-P	SLOCA, RCSLK, PRSTR, SGTRC	2 out of 4 ADS stages 2,3 valves and isolation valves open **OR** 1 out of 4 ADS stage 4 valves open	Credit given for manual actuation if automatic actuation fails. [Operator Actions: LPM-MAN01, AND-MAN01]	Automatic actuation via PMS (stage 1: low CMT water level plus CMT actuation signal; stages 2,3: stage 1 + delay; stage 4: low-2 CMT level + CMT stage 3 signal + delay + pressure interlock).	24 hours	A Chap11 A A3.2 D 6.3
ADZ Partial Depressurization PRHR successful, CMT Fails	ADS-P	SLOCA, RCSLK, PRSTR, SGTRC, SLB-U, SLB-D, SLB-V	2 out of 4 ADS stages 2,3 valves and isolation valves open **OR** 1 out of 4 ADS stage 4 valves open	Credit is given for manual actuation only. [Operator Actions: LPM-MAN01, AND-MAN01]	None	24 hours	A Chap11 A A3.3 D 6.3
BL Steamline break occurs inside containment	BL	SLB-U	Main steamline break occurs upstream of Main Steam Isolation Valves in portion of the line inside containment.	None	None	Not Applicable	A Chap31

Table 6-1 (Sheet 9 of 34)

SUMMARY OF EVENT TREE TOP EVENTS SUCCESS CRITERIA
(Internal Initiating Events at Power Cases)

Event Case Name	Top Event Name	Event Trees	Success Criteria	Manual Actions	Dependencies and Modeled Actuations	Mission Time	Basis
CDS Condensate system provides makeup to deaerator storage tank following reactor trip *(This forms a part of the FWF, FWT, SFWT cases and is not used separately; also see COND)*	MFW, SFW	TRANS, LRCS, LMFW1, LMFW, POWEX, LCCW	1 out of 3 condensate pumps provides flow to the deaerator storage tank AND Condensate regulating valves provide automatic flow control	None.	Automatic PLS control	24 hours	D 10.4.7 A Chap14
CIA Steam Line Isolation following steamline break	MSISO	SLB-D, SLB-U	Main steam isolation valve in each main steam line closed.	Credit given for manual closure of isolation valves if automatic actuation fails. [Operator Actions: CIA-MAN01]	Automatic actuation via PMS (low steam line pressure, low-2 SG NR level).	24 hours	D 15.1.5
CIB Manual SG Isolation following SGTR	SGISO	SGTR	One isolation valve in each line connected with the affected steam generator closed AND Reclosure of any faulted steam generator PORV or safety valves that initially open when steam lines are isolated (See SLSOV3)	Credit given only for manual closure of isolation valves. [Operator Actions: CIB-MAN00, CIB-MAN01]	None	24 hours	D 15.6.3

Table 6-1 (Sheet 12 of 34)

SUMMARY OF EVENT TREE TOP EVENTS SUCCESS CRITERIA
(Internal Initiating Events at Power Cases)

Event Case Name	Top Event Name	Event Trees	Success Criteria	Manual Actions	Dependencies and Modeled Actuations	Mission Time	Basis
COND Main Condenser and full steam dump following reactor trip *(This forms a part of the FWF, FWT, SFWT cases and is not used separately; also see CDS)*	MFW, SFW	TRANS, LRCS, LMFW1, LMFW, POWEX, LCCW	3 out of 6 steam dump valves open to accommodate post-reactor-trip steam load to condenser and provide source of water for the deaerator storage tank AND Condenser available, including operation of 1 out of 2 Circulating Water trains to maintain condenser vacuum.	None	Automatic PLS control of steam dump, feedwater, and circulating water trains	24 hours	A Chap14 D 10.4.4 D 10.4.7
COND1 Main condenser and secondary heat removal via steam dump for SGTR depressurization	SGDEP	SGTR	1 out of 6 steam dump valves open for secondary heat removal AND Condenser available, including operation of 1 out of 2 Circulating Water trains to maintain condenser vacuum.	Credit given for manual steam dump valves control. [Operation Actions: CIB-MAN00, DUMP-MAN01]	Automatic PLS control of steam dump, feedwater, and circulating water trains	24 hours	A Chap14 D 10.4.4 D 10.4.7
CSAX CVS Auxiliary Prz Spray	PRDEP	SGTR	1 out of 2 CVS makeup pumps delivers flow to the pressurizer spray header	Credit given only for manual actuation, and for action to align suction to the spent fuel pool when BAT empties. [Operator Actions: CIB-MAN00, CVN-MAN00]	None.	6 hours	A Chap15 D 6.3 D 15.6.3

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SUMMARY OF EVENT TREE TOP EVENTS SUCCESS CRITERIA
(Internal Initiating Events at Power Cases)

Event Case Name	Top Event Name	Event Trees	Success Criteria	Manual Actions	Dependencies and Modeled Actuations	Mission Time	Basis
CSBOR1 CVS RCS boration following ATWS	BOMAN	ATWS, ATW-T	1 out of 2 CVS makeup pumps delivers contents of boric acid tank to the reactor coolant system.	Credit given only for manual actuation. [Operator Actions: ATW-MAN11, CVN MAN02,]	None	6 hours	A Chap15 D 9.3.6
CVS1 CVS RCS makeup	CVCS	PRSTR, SGTR RCSLK	1 out of 2 CVS makeup pumps delivers flow to the Reactor Coolant system	Credit given for operator action to start standby charging pump if aligned pump fails. [Operator Actions: CVN-MAN03]	Automatic PLS actuation (low prz water level relative to programmed level).	Demand	A Chap15 D 9.3.6
CSP CVS or Manual control of PRHR	CVCS	SLB-D, SLB-U, SLB-V	1 out of 2 CVS makeup pumps delivers flow to the Reactor Coolant system OR PRHR manually regulated (stopped initially to limit cooldown, restarted as necessary to remove core heat)	Credit given for manual control of the PRHR system and for operator action to start standby charging pump if aligned pump fails. [Operator Actions: CVN-MAN03, PRN-MAN03]	Automatic CVS actuation via PLS (low prz water level relative to programmed level)or on CMT actuation signal.	6 hours (CVS), 24 hours (PRHR)	A Chap15 D 6.3 D 15.1.5
DAS DAS - MG-Set Trip & Turbine Trip, ATWS with loss of main feed	DAS	ATWS, ATW-S	Successful generation of DAS signal to trip control rod motor-generator (MG) sets	Credit for manual actuation of DAS if automatic actuation fails. [Operator Actions: ATW-MAN04]	Automatic DAS actuation on low WR SG level	Demand	A Chap27 A A4

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SUMMARY OF EVENT TREE TOP EVENTS SUCCESS CRITERIA
(Internal Initiating Events at Power Cases)

Event Case Name	Top Event Name	Event Trees	Success Criteria	Manual Actions	Dependencies and Modeled Actuations	Mission Time	Basis
DAS1 DAS - MG-Set Trip & Turbine Trip, ATWS with main feed available	DAS	ATW-T	Successful generation of DAS signal to trip control rod motor-generator (MG) sets	Credit for manual actuation of DAS if automatic actuation fails. [Operator Actions: ATW-MAN06]	Automatic DAS actuation on low WR SG level	Demand	A Chap27 O (1)
DGEN Emergency Diesel Generators operate following LOOP	DGEN	LOSP	Emergency Diesel Generators start to supply power to the associated AC power trains within 30 minutes of LOOP and continue until offsite power is restored AND Successful operation of any load shed and sequencing necessary for diesel generator operation	Credit given for manual diesel generator actuation (from the main control room) if automatic actuation fails [Operator Actions: ZON-MAN01]	Automatic actuation of each diesel generator on actuation of the associated bus undervoltage relay; Manual actuation via PLS	2.5 hours	A Chap22
FWF Main Feedwater (Loss of feed to 1 SG)	MFW	LMFW1	1 out of 2 main feedwater trains (condensate pump, FW booster pump, FW pump, FW control valve) delivers flow from deaerator storage tank to the 1 available steam generator AND Condenser and Turbine Bypass available (see COND) AND Feed from condenser to deaerator storage tank (see CDS)	None	Automatic control via PLS	24 hours	A Chap14 D 10.4.7 D 15.2.7

O (1) With main feedwater available, the RCS heatup for an ATWS precursor would be relatively slow. Credit is also given for operator action via DAS. The time available is 10 minutes based on engineering judgment.

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SUMMARY OF EVENT TREE TOP EVENTS SUCCESS CRITERIA
(Internal Initiating Events at Power Cases)

Event Case Name	Top Event Name	Event Trees	Success Criteria	Manual Actions	Dependencies and Modeled Actuations	Mission Time	Basis
FWT Main Feedwater available after reactor trip	MFW	TRANS, LRCS, POWEX, LCCW, ATW-T	1 out of 2 main feedwater trains (condensate pump, FW booster pump, FW pump, FW control valve) deliver flow from deaerator storage tank to 1 out of 2 steam generators **AND** Condenser and Turbine Bypass available (see COND) **AND** Feed from condenser to deaerator storage tank (see CDS)	None	Automatic control via PLS	24 hours	A Chap14 D 10.4.7 D 15.2.7
IW1A Gravity Injection	IRWST	SI-LB	IRWST injection into the RCS through 1 out of 2 check valve/squib valve paths in 1 out of 1 intact injection line.	Credit given for manual activation of squib valves if automatic actuation fails. [Operator Actions: ADN-MAN01]	None	24 hours	A Chap12 A A3.2 D 6.3
IW1AM Gravity Injection	IRWST	SI-LB	IRWST injection into the RCS through 1 out of 2 check valve/squib valve paths in 1 out of 1 intact injection line.	Credit given for manual actuation only [Operation Actions: ADN-MAN01]	None	24 hours	A Chap12 A A3.2 D 6.3

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SUMMARY OF EVENT TREE TOP EVENTS SUCCESS CRITERIA
(Internal Initiating Events at Power Cases)

Event Case Name	Top Event Name	Event Trees	Success Criteria	Manual Actions	Dependencies and Modeled Actuations	Mission Time	Basis
IW2ABBM Gravity Injection	IRWST	LOSP	IRWST injection into the RCS through 1 out of 2 check valve/squib valve paths in 1 out of 2 injection lines.	Credit given for manual actuation only. [Operator Actions: ADN-MAN01]	None	24 hours	A Chap12 A A3.3 D 6.3
MGSET M-G sets trip	MGSET	ATWS, ATW-S, ATW-T	The MGSET exciter coil breaker opens on 2 out of 2 MG sets following DAS signal.	None	Actuation via DAS	Demand	O (2)
PCB Adequate passive containment cooling water drain, after SBO	CHR	LOSP	1 out of 3 PCS water drain valve paths open	None	None	24 hours	A Chap13 D 6.2 D 6.3
PCP Adequate passive containment cooling water drain	CHR	LOSP	1 out of 3 PCS water drain valve paths open	None	None	24 hours	A Chap13 D 6.2 D 6.3

O (2) The DAS reactor trip function is implemented via opening an MG set field breaker in each of the two parallel MG sets.

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SUMMARY OF EVENT TREE TOP EVENTS SUCCESS CRITERIA
(Internal Initiating Events at Power Cases)

Event Case Name	Top Event Name	Event Trees	Success Criteria	Manual Actions	Dependencies and Modeled Actuations	Mission Time	Basis
PCT Adequate passive containment cooling water drain	CHR	LLOCA, SPADS, MLOCA, CMTLB, SI-LB, SLOCA, PRSTR, RCSLK, SGTR, TRANS, LRCS, MFW1, POWEX, LCCW, LMFW, LCOND, LCAS, SLB-D, SLB-U, SLB-V, ATWS, ATW-S, ATW-T	1 out of 3 PCS water drain valve paths open	None	None	24 hours	A Chap13 D 6.2 D 6.3
PRES Adequate Pressure Relief during ATWS	PRES	ATWS, ATW-S	2 out of 2 Pressurizer Safety Valves open	None	None	Demand	A A4

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SUMMARY OF EVENT TREE TOP EVENTS SUCCESS CRITERIA
(Internal Initiating Events at Power Cases)

Event Case Name	Top Event Name	Event Trees	Success Criteria	Manual Actions	Dependencies and Modeled Actuations	Mission Time	Basis
PRESU Adequate Pressure Relief during ATWS	PRES	ATWS, ATW-S	2 out of 2 Pressurizer Safety Valves in open position AND adequate reactivity feedback to maintain RCS pressure below ASME service level C limit	None	None	Demand	S, A A4
PRI PRHR Isolation	PRISO	PRSTR	1 out of 1 MOVs on the PRHR inlet line close AND 2 out of 2 AOVs on PRHR outlet line reclose.	Credit given only for manual actuation. [Operator Actions: PRI-MAN01]	None	24 hours	A Chap8 A A3.3 D 6.3
PRL PRHR	PRHR	PRSTR, RCSLK, SLOCA, SGTRC	1 out of 2 AOVs in the PRHR heat exchanger outlet line opens to allow flow through the heat exchanger AND 1 out of 2 AOVs in the IRWST gutter drain line close to divert water into the IRWST	Credit given for manual actuation if automatic actuation fails. [Operator Actions: PRN-MAN02, HPM-MAN01]	Automatic actuation via PMS (CMT actuation signal) or DAS (low wide-range SG level OR high RCS hot leg temperature, depending on the initiating event)	24 hours	A Chap8 A A3.2 D 6.3 D 15.6.3
PRP PRHR following LOOP	PRHR	LOSP	1 out of 2 AOVs on the PRHR heat exchanger outlet line opens to allow flow through the heat exchanger AND 1 out of 2 AOVs in the IRWST gutter drain line close to divert water into the IRWST	Credit given for manual actuation if automatic actuation fails. [Operator Actions: PRN-MAN02, HPM-MAN01]	Automatic actuation via PMS (low NR SG water level coincident with low SFW flow), PMS and DAS (low WR SG water level), or DAS (high hot leg temperature	24 hours	A Chap8 A A3.2 D 6.3 D Chap15

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SUMMARY OF EVENT TREE TOP EVENTS SUCCESS CRITERIA
(Internal Initiating Events at Power Cases)

Event Case Name	Top Event Name	Event Trees	Success Criteria	Manual Actions	Dependencies and Modeled Actuations	Mission Time	Basis
PRS PRHR	PRHR	SGTR	1 out of 2 AOVs on the PRHR heat exchanger outlet line opens to allow flow through the heat exchanger AND 1 out of 2 AOVs in the IRWST gutter drain line close to divert water into the IRWST	Credit given for manual actuation if automatic actuation fail. [Operator Actions: PRN-MAN02, HPM-MAN01]	Automatic actuation via PMS (CMT actuation signal following low prz pressure S signal)	24 hours	A Chap8 A A3.2 D Chap15
PRT PRHR	PRHR	TRANS, LRCS, LMFW1, LMFW, POWEX, LCCW, LCOND, SLB-U, SLB-D, SLB-V	1 out of 2 AOVs on the PRHR heat exchangers outlet line open to allow flow through the heat exchanger AND 1 out of 2 AOVs in the IRWST gutter drain line close to divert water into the IRWST	Credit given for manual actuation if automatic actuation fails. [Operator Actions: PRN-MAN01, HPM-MAN01]	Automatic actuation via PMS (low NR SG water level coincident with low SFW flow), PMS and DAS (low WR SG water level), or DAS (high hot leg temperature)	24 hours	A Chap8 A A3.2 D 6.3 D Chap15
PRTA PRHR	PRHR	ATWS, ATW-S	1 out of 2 AOVs on the PRHR heat exchanger outlet line open to allow flow through the heat exchanger AND 1 out of 2 AOVs in the IRWST gutter drain line close to divert water into the IRWST	None	Automatic actuation via PMS (low NR SG water level coincident with low SFW flow), PMS and DAS (low WR SG water level), or DAS (high hot leg temperature	24 hours	A A4.2

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SUMMARY OF EVENT TREE TOP EVENTS SUCCESS CRITERIA
(Internal Initiating Events at Power Cases)

Event Case Name	Top Event Name	Event Trees	Success Criteria	Manual Actions	Dependencies and Modeled Actuations	Mission Time	Basis
PRW PRHR	PRHR	LCAS, LOSP	1 out of 2 AOVs on the PRHR heat exchangers common outlet line open to allow flow through the heat exchanger AND 1 out of 2 AOVs in the IRWST gutter drain line close to divert water into the IRWST	None	Valves will open on loss of support (air or dc power) resulting from the initiating event. Automatic actuation via PMS or DAS (low WR SG water level) would also be expected	24 hours	A Chap8 A A3.2 D 6.3
PRSOV Pressurizer Safety Valves reclose	PRSOV	TRANS, LRCS, LMFW1, POWEX, LMFW, LCCW, LCAS, LOSP, ATWS, LCOND	2 out of 2 pressurizer safety valves reclose after opening	None	None	Demand	O (3)
R05 Grid recovery	R05	LOSP	Offsite power recovered within 0.5 hour.	None	None	Demand	O (4)
RCL RCP Trip	CMT	SLOCA, SGTR, PRSTR, RCSLK, SLB-D, SLB-U, SLB-V	4 out of 4 Reactor Coolant Pumps tripped.	Credit for manual tripping of RCPs if automatic trip fails. [Operator Actions: RCN-MAN01]	Automatic actuation via PMS (CMT actuation), or DAS (low prz level).	Demand	D Chap15

O (3) Reclosure of the pressurizer safety valves conservatively assumes that both safety valves open during these transients.
O (4) AP1000 evaluations indicate that following a loss of main feedwater, there is more than an hours worth of water inventory contained in the steam generators. This more than justifies the 30-minute offsite power recovery time assumed in this event.

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SUMMARY OF EVENT TREE TOP EVENTS SUCCESS CRITERIA
(Internal Initiating Events at Power Cases)

Event Case Name	Top Event Name	Event Trees	Success Criteria	Manual Actions	Dependencies and Modeled Actuations	Mission Time	Basis
RCN RCP Trip	CMT	MLOCA, CMTLB, SI-LB	4 out of 4 Reactor Coolant Pumps tripped.	Credit for manual tripping of RCPs if automatic trip fails. [Operator Actions: RCN-MAN01]	Automatic actuation via PMS (CMT actuation), or DAS (low prz level).	Demand	D Chap15
RCT RCP Trip	CMT	TRANS, LMFW1, POWEX, LMFW, LCOND, LCCW, LCAS, ATWS, ATW-S, ATW-T	4 out of 4 Reactor Coolant Pumps tripped.	Credit for manual tripping of RCPs if automatic trip fails. [Operator Actions: RCN-MAN01]	Automatic actuation via PMS (CMT actuation).	Demand	D Chap15
RECIRCB Water Recirculation to RCS, station blackout	RECIR	LOSP	1 out of 4 containment recirc paths open; 2 paths have a check valve in series with a squib valve and the other 2 paths have a squib valve. AND 1 IRWST injection path remains open; each IRWST path has a check valve in series with a squib valve	Credit given for manual opening of squib recirculation valves if automatic actuation fails. [Operator Actions: REN-MAN02, REN-MAN04, RHN-MAN06]	Automatic actuation via PMS (Low-3 IRWST water level and ADS signal)	24 hours	A Chap12 A A3.5

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SUMMARY OF EVENT TREE TOP EVENTS SUCCESS CRITERIA
(Internal Initiating Events at Power Cases)

Event Case Name	Top Event Name	Event Trees	Success Criteria	Manual Actions	Dependencies and Modeled Actuations	Mission Time	Basis
RNR RNS	NRHR	TRANS, LRCS, LMFW1, POWEX, LMFW, LCOND, LCAS, SLB-U, SLB-D, SLB-V, SLOCA, MLOCA, CMTLB, PRSTR, RCSLK, SGTR, ATWS, ATW-S, ATW-T	1 out of 2 RNS pumps inject from the cask washdown pit into the RCS (2 out of 2 containment isolation MOVs open AND 1 out of 2 NRHR pumps/heat exchangers operate) **AND EITHER** 1 out of 4 containment recirc paths open; 2 paths have a check valve in series with a squib valve and the other 2 paths have a squib valve (if only one RNS pump is running) **OR** 2 out of 4 containment recirc paths open; 2 paths have a check valve in series with a squib valve and the other 2 paths have a squib valve (if both pumps are running) **OR** 1 out of 4 containment recirc paths open; 2 paths have a check valve in series with a squib valve and the other 2 paths have a squib valve (if both pumps are running AND operators throttle RNS flowrate to limit pump suction requirements).	Credit given for manual actuation of RNS injection. Credit is given for manual backup of automatic opening of the recirculation line squib valves. [Operator Actions: RHN-MAN01, REN-MAN02, REN-MAN04, RHN-MAN06]	None	24 hours	A Chap17 A A3.2 A A3.3 D 6.3

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SUMMARY OF EVENT TREE TOP EVENTS SUCCESS CRITERIA
(Internal Initiating Events at Power Cases)

Event Case Name	Top Event Name	Event Trees	Success Criteria	Manual Actions	Dependencies and Modeled Actuations	Mission Time	Basis
RNN RNS Cooling of IRWST	NRHR	TRANS, LRCS, LMFW1, POWEX, LMFW, LCOND, LCAS	1 out of 2 RNS pumps circulate IRWST water with CCW cooling (i.e., 2 out of 2 containment isolation MOVs open AND 1 out of 2 NRHR pumps operate) AND CCW cooling is provided to an operable RNS HX	Credit given for manual actuation of RNS actuation. [Operator Actions: RNH-MAN01, RNA-MAN09]	None	24 hours	A Chap17 D 5.4.7.1
RNNP RNS Cooling of IRWST, LOOP with power recovery	NRHR	LOSP	1 out of 2 RNS pumps circulate IRWST water with CCW cooling (i.e., 2 out of 2 containment isolation MOVs open AND 1 out of 2 NRHR pumps operate) AND CCW cooling is provided to an operable RNS HX	Credit given for manual actuation of RNS actuation. [Operator Actions: RNH-MAN01, RNH-MAN09]	None	24 hours	A Chap17 D 5.4.7.1
RTPMS Reactor Trip via PMS	RTPMS	ATWS, ATW-S	Trip signal provided to the reactor trip breakers in both protection system cabinets AND 1 out of 2 reactor trip breakers open on each path of 1 out of 2 protection system cabinets	Credit is given for manual actuation as a backup to automatic actuation [Operator Actions: ATW-MAN03]	Automatic actuation via PMS (several signals anticipated for each initiating event)	Demand	A A4.2 O (5)

O (5) In an ATWS, peak RCS pressure is reached in about 2 minutes (refer to PRA Appendix Figure A4.2.1-1). Credit is taken in the PRA for manual reactor trip in 1 minute or less.

Table 6-1 (Sheet 32 of 34)

SUMMARY OF EVENT TREE TOP EVENTS SUCCESS CRITERIA
(Internal Initiating Events at Power Cases)

Event Case Name	Top Event Name	Event Trees	Success Criteria	Manual Actions	Dependencies and Modeled Actuations	Mission Time	Basis
RTPMS1 Reactor Trip via PMS	RTPMS	ATW-T	Trip signal provided to the reactor trip breakers in both protection system cabinets AND 1 out of 2 reactor trip breakers open on each path of 1 out of 2 protection system cabinets	Credit is given for manual actuation as a backup to automatic actuation [Operator Actions: ATW-MAN05]	Automatic actuation via PMS (several signals anticipated for each initiating event)	Demand	A A4.2 O (6)
RTSTP Manual Actuation of Rod Control System for RCCA Insertion	RTSTP	ATWS, ATW-S	Operator manually initiates control rod insertion via rod control system AND at least one bank of control rods insertion for at least 1 minute	Credit is given only for manual actuation of the rod control system [Operator Actions: ATW-MAN01]	Manual actuation via PLS for rod control system.	Demand	O (7)
SDMAN Manual controlled shutdown	SDMAN	RCSLK	Operators perform a controlled shutdown of the reactor after recognizing that an RCS leak is in progress	Credit is given only for manual action [Operator Actions: RTN-MAN01]	Control systems necessary to establish stable shutdown	Demand	D 9.3.6.4 A 4.8.1
SFW Startup Feedwater (condensate system unavailable)	SFW	LCOND	1 out of 2 Startup Feedwater pumps deliver flow from the condensate storage tank to 1 out of 2 SGs.	Credit given for manual actuation if automatic actuation fails. [Operator Actions: FWN-MAN02, HPM-MAN01, REG-MAN00]	Automatic actuation via PLS (low NR SG water level or low FW flow)	24 hours	A Chap14 D 10.4.7 D 15.2.7
SFW1 Startup Feedwater (SGTR)	SFW	SGTR	1 out of 2 Startup Feedwater pumps delivers flow from the condensate storage tank to the intact steam generator.	Credit given for manual actuation if automatic actuation fails. [Operator Actions: FWN-MAN02, HPM-MAN01, REG-MAN00]	Automatic actuation via PLS (low NR SG water level or low FW flow)	24 hours	A Chap14 D 10.4.7 D 15.6.3

O (6) With main feedwater available, the RCS heatup for an ATWS precursor would be relatively slow. Credit is given for operator action to trip the reactor within 10 minutes. The time window of 10 minutes is based on engineering judgment.
O (7) Note that for AP1000, this event case has no meaning since the UET is 0.

Table 6-1 (Sheet 33 of 34)

SUMMARY OF EVENT TREE TOP EVENTS SUCCESS CRITERIA
(Internal Initiating Events at Power Cases)

Event Case Name	Top Event Name	Event Trees	Success Criteria	Manual Actions	Dependencies and Modeled Actuations	Mission Time	Basis
SFWA Startup Feedwater (ATWS)	PRHR2	ATWS, ATW-S	1 out of 2 startup feedwater pumps deliver flow from the condensate storage tank to 2 out of 2 steam generators	None	Automatic actuation via PLS (low NR SG water level or low FW flow)	24 hours	A A4.2
SFWM Startup Feedwater (Instrument Air failure)	SFW	LCAS	1 out of 2 Startup Feedwater trains deliver flow from the condensate storage tank to 1 out of 2 SGs AND Operators locally operate feed reg valves	Credit for manual actuation if automatic actuation fails, plus required manual action to regulate SFW flow following loss of instrument air initiating event. [Operator Actions: FWN-MAN02, HPM-MAN01, REG-MAN00]	Automatic actuation via PLS (low NR SG water level or low FW flow)	24 hours	A Chap14 D 10.4.7 D 15.2.7
SFWP Startup Feedwater (LOOP)	SFW	LOSP	1 out of 2 Startup Feedwater pumps deliver flow from the condensate storage tank to 1 out of 2 SGs, following power recovery or successful diesel generator start/load.	Credit given for manual actuation if automatic actuation fails. [Operator Actions: FWN-MAN03, HPM MAN01, REG-MAN00]	Automatic actuation via PLS (low NR SG water level or low FW flow)or diesel generator sequence	24 hours	A Chap14 D 10.4.7 D 15.2.7
SFWT Startup Feedwater	SFW	TRANS, LRCS, LMFW1, POWEX, LCCW, LMFW	1 out of 2 Startup Feedwater pumps deliver flow to 1 out of 2 steam generators from the condensate storage tank OR 1 out of 2 Startup Feedwater pumps deliver flow to 1 out of 2 steam generators from the deaerator storage tank AND Condenser and Turbine Bypass available (see COND) AND Feed from condenser to deaerator storage tank (see CDS)	Credit given for manual actuation if automatic actuation fails. [Operator Actions: FWN-MAN02, HPM MAN01, REG-MAN00]	Automatic actuation and control via PLS (low NR SG water level or low FW flow)	24 hours	A Chap14 D 10.4.7 D 15.2.7

Table 6-1 (Sheet 34 of 34)

SUMMARY OF EVENT TREE TOP EVENTS SUCCESS CRITERIA
(Internal Initiating Events at Power Cases)

Event Case Name	Top Event Name	Event Trees	Success Criteria	Manual Actions	Dependencies and Modeled Actuations	Mission Time	Basis
SGHL SG overfill protection for SGTR	SGISO	SGTR	Chemical and Volume Control system isolated. AND Startup FW flow to faulted SG isolated.	Credit given for manual actuation and automatic actuation. [Operator Actions: SGHL-MAN01]	Automatic actuation via PMS (High-2 steam generator water level).	Demand	D 15.6.3
SGTR Tube rupture given MSLB or consequential SLB with 2 SG Blowdown	NSGTR	SLB-D, SLB-U, SLB-V	No consequential steam generator tube rupture in either blowing down steam generator	None	None.	Demand	A Chap31
SGTR1 Tube Rupture given MSLB with 1 SG Blowdown	NSGTR	SLB-U	No consequential steam generator tube rupture in the blowing down steam generator	None	None	Demand	A Chap31
SLSOV Reclosure of Main Steamline Valves	SLSOV	TRANS, POWEX, LCCW, LRCS	Reclosure of the power-operated relief valve (PORV) or associated PORV block valve, AND reclosure of the one open safety valve in each main steamline, given unavailability of condenser steam dump	None	Steam generator PORV actuation via PLS	Demand	O (8)
SLSOV1 Reclosure of Main Steamline Valves	SLSOV	LMFW1, LMFW, LCCW, LCOND, LOSP	Reclosure of the power-operated relief valve (PORV) or associated PORV block valve, AND reclosure of the two open safety valves in each main steamline, given unavailability of condenser steam dump	None	Steam generator PORV actuation via PLS	Demand	O (8)
SLSOV2 Reclosure of Main Steamline Valves	SLSOV	LCAS	Reclosure of one PORV and one safety valve on the main steamline from the ruptured generator	None	Steam generator PORV actuation via PLS	Demand	O (8)
SLSOV3 Reclosure of Main Steamline Valves	SGISO	SGTR	Reclosure of one PORV and one safety valve on the main steamline from the ruptured steam generator	None	Steam generator PORV actuation via PLS	Demand	O (8)

O (8) Reclosure of steam generator PORV or SV depends on how many are open during an event. For transients without severe secondary side heatup (SLSOV) and for SGTRs (SLSOV3), it is conservatively assumed that one steam generator PORV and safety valve/steam generator would open. For a transient with loss of instrument air (SLSOV2), or for a transient with a secondary side heatup (SLSOV1), two SVs/steam generator are conservatively assumed to open. The number of valves that open in these events is based on engineering judgment.

Table 6-2 (Sheet 1 of 9)

SUMMARY OF SUCCESS CRITERIA FOR THE MITIGATING SYSTEMS

Function/Accident Initiator	Success Sequence Identifiers	Success Criteria	Basis
Reactivity Control			
• Transient (except spurious trip or manual shutdown), small and medium loss of coolant accidents, RCS leak, steam generator tube rupture, PRHR heat exchanger tube rupture	TRA-OK (all) NLO-OK (all) SLO-OK (all) RLK-OK1 SGR-OK (all) LSP-OK (all) SBO-OK (all)	Reactor trip[1] OR Turbine trip via the diverse actuation system[2] and manual boration[3]	Ref. 6-4, Chap. 15 PRA Appendix A (ATWS) Reference 6-3,6-5
• Transient with cooldown of the reactor coolant system	SLB-OK (all)	Reactor trip and automatic or manual boration[3]	Ref. 6-4, Chap. 15
• Large loss of coolant accident	LLO-OK1	Not required[4]	Ref. 6-4, Chap. 15 (LLOCA)
Overpressure Control			
• Anticipated transient without scram	ATW-OK[1-6]	2 out of 2 pressurizer safety valves[2]	PRA Appendix A (ATWS) Ref. 6-3
• Transients	TRA-OK1 TRA-OK2 LSP-OK2 ATW-OK[7-9]	Secondary side cooling[6] OR	Design Basis:
	TRA-OK3 LSP-OK3 SBO-OK1	Passive residual heat removal operation OR	Ref. 6-4 Ch. 15, Ref. 6-5
	TRA-OK[4-7] LSP-OK[4-7] SBO-OK[2-3]	Opening of one pressurizer safety valve or opening of reactor coolant system depressurization (ADS) valves[5]	PRA Appendix A

Table 6-3 (Sheet 2 of 4)

SUMMARY OF SUCCESS CRITERIA FOR OPERATOR ACTIONS AND MISSION TIMES

Operator Action Identifier	Operator Action Description/Where Performed	Used in Event Tree Cases	Available Operator Response Time (Minutes)	Reference/ Basis
CIC-MAN01	Isolate containment following core damage/In control room	CIC	120 (except LLOCA pre-core damage)	O, E
CMN-MAN01	Actuate CMTs if automatic actuation fails/In control room	CM1A, CM2AB, CM2L, CM2P, CM2NL, CM2SL	20 minutes for MLOCA, CMTLB, SI-LB; 30 minutes for others	A O, E
CMN-REC01	Actuate CMT injection after core damage/In control room	CMBOTH, CM2LLT	>60 (Based on CMN-MAN01)	O, E
CVN-MAN00	Align CVS auxiliary spray for SGTR/In control room	CSAX	30	O, E
CVN-MAN02	Align CVS boration following ATWS/In control room	CSBOR1	60	O, E
CVN-MAN03	Start CVS standby pump if aligned pump fails/In control room	CVS1, CSP	30	A, E
DUMP-MAN01	Control steam dump during SGTR/ In control room	COND1	>30	A, E
FWN-MAN02	Start startup feedwater pumps if automatic actuation fails/In control room	SFW, SFW1, SFWM, SFWT	>30	O, E
FWN-MAN03	Start startup feedwater pumps if automatic actuation fails (LOOP)/ In control room	SFWP	30	O, E
HPM-MAN01	Recognize need for high pressure decay heat removal/In control room	PRL, PRP, PRS, PRT, SFW, SFW1, SFWM, SFWP, SFWT	30	A, O, E
LPM-MAN01	Recognize need for RCS depressurization/In control room	AD1, AD1A, ADA, ADR, ADS, ADT, ADZ, ADV, ADW, CM2AB, CM2SL	30 (Transients, SLOCA)	A, E
LPM-MAN02	Recognize need for RCS depressurization/In control room	ADQ, ADUM, ADAB, ADAL, ADB, ADM, ADR, ADRA, ADU, CM1A, CM2L, CM2NL, CM2P	20	A, E

Table 6-3 (Sheet 3 of 4)

SUMMARY OF SUCCESS CRITERIA FOR OPERATOR ACTIONS AND MISSION TIMES

Operator Action Identifier	Operator Action Description/Where Performed	Used in Event Tree Cases	Available Operator Response Time (Minutes)	Reference/ Basis
LPM-REC01	Recognize need for RCS depressurization following core damage/In control room	ADQLT, ADTLT, CMBOTH, CM2LLT	>30 (Based on LPM-MAN01)	O, E
PCN-MAN01	Recognize need and actuate passive containment cooling water/ In control room	PCT	>120	E
PRI-MAN01	Recognize and isolate ruptured PRHR heat exchanger/In control room	PRI	>30	E, A
PRN-MAN01	Actuate PRHR heat removal (transient)/In control room	PRT	30	A, E
PRN-MAN02	Actuate PRHR heat removal (LOCA or LOOP)/In control room	PRL, PRP, PRS	30	A, E
PRN-MAN03	Control (stop/restart) PRHR heat removal (SLB)/In control room	CSP	>30 (initial actions)	O, E
RCN-MAN01	Trip all reactor coolant pumps if automatic trip fails/In control room	RCL, RCT, RCN	(Consistent with CMT actuation timing)	A, O, E
REC-MANDAS	Recognize need and manually actuate DAS/In control room	(All cases with PMS and DAS actuation where credit is taken for operator action)	(Consistent with timing for related PMS actuation actions)	D, E
REG-MAN00	Regulate startup feedwater following loss of air/Outside control room	SFW, SFW1, SFWM, SFWP, SFWT	>30	O, E
REN-MAN02	Recognize need and open containment recirculation valves/ In control room	RECIRB, RECIRC, RECIRP, RNP, RNR	>60	A, O, E
REN-MAN03	Recognize need and open containment recirculation valves after core damage/In control room	IWF	>120	E
REN-MAN04	Recognize need and open containment recirculation valves given failure of IRWST low level signal	RECIRB, RECIRC, RECIRP, RNP, RNR	60	A, O, E