

19A Event Trees for Core Damage Sequences Initiated During Power Operation

Appendix 19A presents the event trees that delineate the core-damage sequences for internal events initiated during power operation. The event trees and summary of top events are provided in the following figures and tables, respectively:

Event Tree	Event Tree Description	Table and Figure Number
31BDA	Loss of Divisional Emergency AC Power	19A-1
ATWS	Failure to Scram Following Loss of Main Feedwater	19A-2
GT	General transient	19A-3
IND SGTR	Induced Steam Generator Tube Rupture	19A-4
ISL-CCW RCPTB	ISLOCA Due to RCP Thermal Barrier Tube Break	19A-5
ISL-CVCS HPTR	ISLOCA Due to Tube Rupture in CVCS High Pressure Cooler	19A-6
ISL-CVCS INJ	ISLOCA Due to Rupture of High Pressure CVCS Pipe Outside Containment	19A-7
ISL-CVCS REDS	ISLOCA Due to Spurious Opening of Reducing Station	19A-8
ISL-SIS LHSI	ISLOCA Due to Break in LHSI Cold Leg Injection Valves with LHSI Rupture in Respective SAB	19A-9
ISL-SIS MHSI	ISLOCA Due to Break in MHSI Cold Leg Injection Valves with MHSI Rupture in Respective SAB	19A-10
ISL-SIS RHR	ISLOCA Due to Failure of Suction Line MOVs and Subsequent RHR Line Rupture in Respective SAB	19A-11
LBOP	Loss of Balance of Plant Closed Loop Cooling Water or Auxiliary Cooling Water	19A-12
LLOCA	Large Loss-of-Coolant Accident	19A-13
LOC	Loss of Main Condenser	19A-14
LOCCW	Loss of Component Cooling Water or Emergency Service Water	19A-15
LOMFW	Loss of Main Feedwater	19A-16
LOOP	Loss of Offsite Power	19A-17
MLOCA	Medium Loss-of-Coolant Accident	19A-18
MSSV	Spurious Opening of Main Steam Safety Valve	19A-19
SGTR	Steam Generator Tube Rupture	19A-20
SLBI	Steam-Line Break Inside Containment	19A-21
SLBO	Steam-Line Break Outside Containment	19A-22
SLOCA	Small Loss-of-Coolant Accident	19A-23

In each case, the summary tables provide the following information:

- The definition of the top event. Note that some of the top events are configured differently for particular branch points. These configurations reflect conditions (e.g., different success criteria or timing) presented by the initiating event or by other failures in the sequence. The event trees denote these conditional states by an integer at relevant branch points. These conditional states are identified in the table as well.
- The success criteria for the top event.
- The corresponding failure event that is developed for purposes of evaluating the core-damage sequence.
- The description for the failure event.

Table 19A-1—Event Tree Headings for Initiating Event 31BDA: Loss of Divisional Emergency AC Power
Sheet 1 of 3

Event Tree Top Event		Success Criteria	Failure Event	Event Description
31BDA	Loss of divisional emergency AC (switchgear 31BDA)	—	IE 31BDA (initiator)	Loss of divisional emergency AC (switchgear 31BDA)
RCP LOCA	RCP seal LOCA does not occur	Seal injection with CVCS or seal cooling with CCWS or standstill seal actuation or seals withstand challenge	RCP LOCA (FT top gate)	RCP seal LOCA
MHSI	Medium-head safety injection available	1 of 4 MHSI pumps supply flow	MHSI 4/4	Failure of 4 out of 4 MHSI trains
OP FCD	Operators initiate fast cooldown within 40 min (Condition 1)	Action within 40 min	OPE-FCD-40M (basic event)	Operators fail to initiate fast cooldown for SLOCA
MFW	Main feedwater available	1 of 3 MFW pumps available to deliver flow to 1 of 4 steam generators (main condenser required with turbine bypass)	MFW (FT top gate)	Failure of the MFWS to deliver flow to 1 of 4 SGs or failure of main condenser with turbine bypass
SSS	Startup and shutdown system available for Secondary heat removal (Condition 1) Partial cooldown (Condition 2) Fast cooldown (Condition 3)	SSS flow to 1 of 4 steam generators for secondary heat removal SSS flow to 1 of 4 steam generators for partial cooldown SSS flow to 1 of 4 steam generators for fast cooldown	SSS (FT top gate)	Failure of startup and shutdown system to deliver flow to 1 of 4 steam generators

Table 19A-1—Event Tree Headings for Initiating Event 31BDA: Loss of Divisional Emergency AC Power
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Event Tree Top Event		Success Criteria	Failure Event	Event Description
EFW	EFW available for: Secondary heat removal (Condition 1) Partial cooldown (Condition 2) Fast cooldown (Condition 3)	1 of 4 EFW trains available for secondary heat removal 1 of 4 EFW trains available for partial cooldown 1 of 4 EFW trains available for fast cooldown	EFW (FT top gate)	Failure of secondary heat removal and secondary cooldown
EFW PBF	EFW maintains pressure boundary conditions	4 of 4 EFW storage pools maintain integrity OR operators maintain adequate inventory after leak	EFW PBF (FT top gate)	Failure of EFW due to loss of inventory upon failure of pressure boundary
OP FB	Operators initiate feed-and-bleed cooling for: Transient, within 90 min (Condition 1) SLOCA (i.e., RCP seal LOCA), within 40 min (Condition 2)	Initiation of feed-and-bleed within 90 min Initiation of feed-and-bleed within 40 min	OPE-FB-90M (basic event) OPE-FB-40M (basic event)	Operators fail to initiate feed-and-bleed within 90 min for transient Operators fail to initiate feed-and-bleed for SLOCA
PBL	Primary bleed available (Condition 1)	3 of 3 PSVs or 1 of 2 SADVs and steam generator relief (4 SG)	PBL (FT top gate)	Failure of a PSV and both SADVs or steam generator relief valves (MSRTS and safeties) on a steam generator
MHSI 01	MHSI available for feed-and-bleed cooling	1 of 4 MHSI pumps available	MHSI 4/4 FB (FT top gate)	Failure of 4 of 4 MHSI trains for feed and bleed
ACC	Accumulator injection available (Condition 1)	1 of 4 accumulators available	ACC 4/4 (FT top gate)	Failure of 4 of 4 accumulator trains

Table 19A-1—Event Tree Headings for Initiating Event 31BDA: Loss of Divisional Emergency AC Power
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Event Tree Top Event		Success Criteria	Failure Event	Event Description
LHSI	LHSI available for injection and containment heat removal, for: Feed-and-bleed cooling (Condition 1) SLOCA (RCP seal LOCA) (Condition 2)	1 of 4 LHSI pumps available 1 of 4 LHSI pumps available (SI signal required)	LHSI CHR 4/4 (FT top gate)	Failure of 4 of 4 LHSI trains (injection/CHR mode) Failure of 4 of 4 LHSI trains (injection/CHR mode, SI signal needed)
SAHR	Severe accident heat removal through recirculation line	1 of 1 SAHR pump available in recirculation mode	SAHR IRWST (FT top gate)	Failure of SAHRS to provide cooling to the IRWST

Table 19A-2—Event Tree Headings for ATWS: Failure to Scram Following Loss of Main Feedwater
Sheet 1 of 2

Event Tree Top Event		Success Criteria	Failure Event	Event Description
ATWS	Failure to scram following transient	—	ATWS (consequence)	ATWS
PSR	Pressurizer relief with RCP shutdown	Main feedwater available AND 3 of 3 PSR valves open (1 of 3 if RCPs trip)	PSR (FT top gate)	Failure of pressurizer relief or corresponding RCP shutdown during ATWS event
PSV	Pressurizer safety valves reclose	3 of 3 PSR valves reclose	PSV (FT top gate)	Failure of pressurizer relief valves to reclose after opening
EBS	Boration via extra borating system (EBS) for: Intact RCS, PSVs reclose (Condition 1) Stuck-open PSV (Condition 2)	1 of 2 EBS trains available—manual actuation in ATWS 2 of 2 EBS trains available—manual actuation in ATWS	EBS ATWS 2/2 (FT top gate) EBS ATWS ½ (FT top gate)	Failure of boration via EBS—ATWS1 (1 of 2 EBS trains required) Failure of boration via EBS—ATWS2 (2 of 2 EBS trains required)
EFW	EFW available for: Secondary heat removal (Condition 7) Partial cooldown (Condition 8)	EFW to 2 of 4 steam generators available for secondary heat removal with relief by MSRTs EFW to 2 of 4 steam generators available for partial cooldown with relief by MSRTs	EFW ATWS (FT top gate)	Failure of secondary heat removal and secondary cooldown (3 of 4 steam generators)—ATWS

Table 19A-2—Event Tree Headings for ATWS: Failure to Scram Following Loss of Main Feedwater
Sheet 2 of 2

Event Tree Top Event		Success Criteria	Failure Event	Event Description
EFW PBF	EFW maintains pressure boundary conditions	4 of 4 EFW storage pools maintain integrity OR operators maintain adequate inventory after leak	EFW PBF (FT top gate)	Failure of EFW due to loss of inventory upon failure of pressure boundary
MHSI	MHSI available (Condition 2)	2 of 4 MHSI pumps available	MHSI 3/4 (FT top gate)	Failure of 3 of 4 MHSI trains
LHSI	LHSI available for injection and containment heat removal, safety injection signal required (Condition 2)	1 of 4 LHSI pumps available (SI signal required)	LHSI CHR 4/4 (FT top gate)	Failure of 4 of 4 LHSI trains (injection/CHR mode, SI signal needed)
SAHR	Severe accident heat removal through recirculation line	1 of 1 SAHR pump available in recirculation mode	SAHR IRWST (FT top gate)	Failure of SAHRS to provide cooling to the IRWST

Table 19A-3—Event Tree Headings for Initiating Event GT: General Transient
Sheet 1 of 2

Event Tree Top Event		Success Criteria	Failure Event	Event Description
GT	General transient (including turbine trip and reactor trip)	—	IE GT (initiator)	General transient (including turbine trip and reactor trip)
RT	Reactor trip (Condition 1 signals – high RCS pressure or high steam line pressure)	2 out of 4 RPS input signals and 1 out of 2 twice for reactor trip breakers or 2 out of 4 contactors	RT1 (FT top gate)	Failure of reactor trip 1 (turbine-trip type events)
MFW	Main feedwater available	1 of 3 MFW pumps available to deliver flow to 1 of 4 steam generators (main condenser required with turbine bypass)	MFW (FT top gate)	Failure of the MFWs to deliver flow to 1 of 4 SGs or failure of main condenser with turbine bypass
SSS	Startup and shutdown system available for secondary heat removal (Condition 1)	SSS flow to 1 of 4 steam generators for secondary heat removal	SSS (FT top gate)	Failure of startup and shutdown system to deliver flow to 1 of 4 steam generators
EFW	EFW available for secondary heat removal (Condition 1)	1 of 4 EFW trains available for secondary heat removal	EFW (FT top gate)	Failure of secondary heat removal and secondary cooldown
EFW PBF	EFW maintains pressure boundary conditions	4 of 4 EFW storage pools maintain integrity OR operators maintain adequate inventory after leak	EFW PBF (FT top gate)	Failure of EFW due to loss of inventory upon failure of pressure boundary
OP FB	Operators initiate feed and bleed cooling for transient, within 90 min (Condition 1)	Initiation of feed and bleed within 90 min	OPE-FB-90M (basic event)	Operators fail to initiate feed and bleed within 90 min for transient
PBL	Primary bleed available (Condition 1)	3 of 3 PSVs or 1 of 2 SADV and steam generator relief (4 SG)	PBL (FT top gate)	Failure of a PSV and both SADVs or steam generator relief valves (MSRTS and MSSVs) on a steam generator

Table 19A-3—Event Tree Headings for Initiating Event GT: General Transient
Sheet 2 of 2

Event Tree Top Event		Success Criteria	Failure Event	Event Description
MHSI 01	MHSI available for feed and bleed cooling	1 of 4 MHSI pumps available	MHSI 4/4 FB (FT top gate)	Failure of 4 of 4 MHSI trains for feed and bleed
ACC	Accumulator injection available (Condition 1)	1 of 4 accumulators available	ACC 4/4 (FT top gate)	Failure of 4 of 4 accumulator trains
LHSI	LHSI available for injection and containment heat removal, for feed and bleed cooling (Condition 1)	1 of 4 LHSI pumps available	LHSI CHR 4/4 (FT top gate)	Failure of 4 of 4 LHSI trains (injection/CHR mode)
SAHR	Severe accident heat removal through recirculation line	1 of 1 SAHR pump available in recirculation mode	SAHR IRWST (FT top gate)	Failure of SAHRS to provide cooling to the IRWST

Table 19A-4—Event Tree Headings for Initiating Event IND SGTR: Induced Steam Generator Tube Rupture

Event Tree Top Event		Success Criteria	Failure Event	Event Description
IND SGTR	Induced steam generator tube rupture	—	IE IND SGTR (initiator)	Induced SGTR
EFW	EFW available for PCD (Condition 4)	1 of 3 EFW trains available for secondary heat removal	EFW SGTR (FT top gate)	Failure of 3 of 3 EFW trains (with MSRTs)
EFW PBF	EFW maintains pressure boundary conditions	4 of 4 EFW storage pools maintain integrity OR operators maintain adequate inventory after leak	EFW PBF (FT top gate)	Failure of EFW due to loss of inventory upon failure of pressure boundary
OP RHR	Operators initiate secondary cooldown and align RHR in 4 hr (Condition 1)	Initiation of secondary cooldown within 4 hr	OPE-RHR-4H (basic event)	Operators fail to initiate RHR within 4 hr
RHR	RHR	1 of 4 LHSI pumps available for RHR	RHR 4/4 (FT top gate)	Failure of 4 of 4 LHSI trains for RHR

**Table 19A-5—Event Tree Headings for Initiating Event ISL-CCW RCPTB:
ISLOCA Due to RCP Thermal Barrier Tube Break**

Event Tree Top Event		Success Criteria	Failure Event	Event Description
ISL-CCW-RCPTB	ISLOCA due to break in RCP thermal barrier tube, allowing overpressure of CCW piping	—	IE IND SGTR (initiator)	ISLOCA due to break in RCP thermal barrier tube, allowing overpressure of CCW piping
OP RHR	Operators initiate secondary cooldown and align RHR in 4 hr (Condition 1)	Initiation of secondary cooldown within 4 hr	OPE-RHR-4H (basic event)	Operators fail to initiate RHR within 4 hr
RHR	RHR	1 of 4 LHSI pumps available for RHR	RHR 4/4 (FT top gate)	Failure of 4 of 4 LHSI trains for RHR

**Table 19A-6—Event Tree Headings for Initiating Event ISL-CVCS HPTR:
ISLOCA Due to Tube Rupture in CVCS High Pressure Cooler**

Event Tree Top Event		Success Criteria	Failure Event	Event Description
ISL-CVCS HPTR	ISLOCA due to rupture of tube in CVCS high pressure cooler (0.4" tube)	—	IE ISL-CVCS HPTR (initiator)	ISLOCA due to rupture of tube in CVCS high pressure cooler
OP RHR	Operators initiate secondary cooldown and align RHR; medium dependence conditional on failure to isolate the ISLOCA (Condition 2)	Initiation of secondary cooldown with medium dependence	OPD-RHR4H/ISLOCA (basic event)	Operators fail to initiate RHR within 4 hr; medium dependence conditional on failure to isolate ISLOCA
RHR	RHR	1 of 4 LHSI pumps available for RHR	RHR 4/4 (FT top gate)	Failure of 4 of 4 LHSI trains for RHR

**Table 19A-7—Event Tree Headings for Initiating Event ISL-CVCS INJ:
ISLOCA Due to Rupture of High Pressure CVCS Pipe Outside Containment**

Event Tree Top Event		Success Criteria	Failure Event	Event Description
ISL-CVCS INJ	ISLOCA due to rupture of high pressure CVCS pipe outside containment	—	IE ISL-CVCS INJ (initiator)	ISLOCA due to rupture of high pressure CVCS pipe outside containment

**Table 19A-8—Event Tree Headings for Initiating Event ISL-CVCS REDS:
ISLOCA Due to Spurious Opening of Reducing Station**

Event Tree Top Event		Success Criteria	Failure Event	Event Description
ISL-CVCS REDS	ISLOCA due to spurious opening of reducing station	—	IE ISL-CVCS HPTR (initiator)	ISLOCA due to rupture of tube in CVCS high pressure cooler
OP RHR	Operators initiate secondary cooldown and align RHR; medium dependence conditional on failure to isolate the ISLOCA (Condition 2)	Initiation of secondary cooldown with medium dependence	OPE/D-RHR4H/ISLOCA (basic event)	Operators fail to initiate RHR within 4 hr; medium dependence conditional on failure to isolate ISLOCA
RHR	RHR	1 of 4 LHSI pumps available for RHR	RHR 4/4 (FT top gate)	Failure of 4 of 4 LHSI trains for RHR

**Table 19A-9—Event Tree Headings for Initiating Event ISL-SIS LHSI:
ISLOCA Due to Break in LHSI Cold Leg Injection Valves with LHSI Rupture in Respective SAB**

Event Tree Top Event		Success Criteria	Failure Event	Event Description
ISL-SIS LHSI	ISLOCA due to break in LHSI cold leg injection valves with LHSI break in respective SAB	—	IE ISL-SIS LHSI-CL8 (initiator)	ISLOCA due to break in LHSI cold leg injection valves with LHSI break in respective SAB

**Table 19A-10—Event Tree Headings for Initiating Event ISL-SIS MHSI:
ISLOCA Due to Break in MHSI Cold Leg Injection Valves with MHSI Rupture in Respective SAB**

Event Tree Top Event		Success Criteria	Failure Event	Event Description
ISL-SIS MHSI	ISLOCA due to break in MHSI cold leg injection valves with MHSI break in respective SAB	—	IE ISL-SIS MHSI-CL6 (initiator)	ISLOCA due to break in MHSI cold leg injection valves with MHSI break in respective SAB

**Table 19A-11—Event Tree Headings for Initiating Event ISL-SIS RHR:
ISLOCA Due to Failure of Suction Line MOVs and Subsequent RHR Line Rupture in Respective SAB**

Event Tree Top Event		Success Criteria	Failure Event	Event Description
ISL-SIS RHR	ISLOCA due to failure of suction line MOVs and subsequent RHR line rupture in respective SAB	—	IE ISL-SIS RHR-CL1 (initiator)	ISLOCA due to failure of suction line MOVs and subsequent RHR line rupture in respective SAB

**Table 19A-12—Event Tree Headings for Initiating Event LBOP:
Loss of Balance of Plant Closed Loop Cooling Water or Auxiliary Cooling Water**

Event Tree Top Event		Success Criteria	Failure Event	Event Description
LBOP	Loss of balance of plant closed loop cooling water or auxiliary cooling water	—	IE LBOP (initiator)	Loss of balance of plant closed loop cooling water or auxiliary cooling water
RT	Reactor trip (Condition 2 signals – low DNBR or low steam generator level)	2 out of 4 RPS input signals and 1 out of 2 twice for reactor trip breakers or 2 out of 4 contactors	RT2 (FT top gate)	Failure of reactor trip 2 (loss-of-feedwater type events)
EFW	EFW available for secondary heat removal (Condition 1)	1 of 4 EFW trains available for secondary heat removal	EFW (FT top gate)	Failure of secondary heat removal and secondary cooldown
EFW PBF	EFW maintains pressure boundary conditions	4 of 4 EFW storage pools maintain integrity OR operators maintain adequate inventory after leak	EFW PBF (FT top gate)	Failure of EFW due to loss of inventory upon failure of pressure boundary
OP FB	Operators initiate feed and bleed cooling for transient, within 90 min (Condition 1)	Initiation of feed and bleed within 90 min	OPE-FB-90M (basic event)	Operators fail to initiate feed and bleed within 90 min for transient
PBL	Primary bleed available (Condition 1)	3 of 3 PSVs or 1 of 2 SADV and steam generator relief (4 SG)	PBL (FT top gate)	Failure of a PSV and both SADVs or steam generator relief valves (MSRTs and MSSVs) on a steam generator
MHSI 01	MHSI available for feed and bleed cooling	1 of 4 MHSI pumps available	MHSI 4/4 FB (FT top gate)	Failure of 4 of 4 MHSI trains for feed and bleed
ACC	Accumulator injection available (Condition 1)	1 of 4 accumulators available	ACC 4/4 (FT top gate)	Failure of 4 of 4 accumulator trains
LHSI	LHSI available for injection and containment heat removal, for feed and bleed cooling (Condition 1)	1 of 4 LHSI pumps available	LHSI CHR 4/4 (FT top gate)	Failure of 4 of 4 LHSI trains (injection/CHR mode)
SAHR	Severe accident heat removal through recirculation line	1 of 1 SAHR pump available in recirculation mode	SAHR IRWST (FT top gate)	Failure of SAHRs to provide cooling to the IRWST

Table 19A-13—Event Tree Headings for Initiating Event LLOCA: Large Loss-of-Coolant Accident

Event Tree Top Event		Success Criteria	Failure Event	Event Description
LLOCA	Large LOCA	—	IE LLOCA (initiator)	Large LOCA (> 6" in diameter)
MHSI	MHSI available	1 of 4 MHSI trains available for injection (Train 4 failed by initiator)	MHSI 4/4 (FT top gate)	Failure of 4 of 4 MHSI trains (Train 4 failed by initiator)
ACC	Accumulator injection available with Success of MHSI (Condition 2)	1 of 3 accumulators	ACC 3/3	Failure of 3 of 3 accumulator trains (train 4 unavailable due to initiator)
	Failure of MHSI (Condition 4)	2 of 3 accumulators	ACC 2/3	Failure of 2 of 3 accumulator trains (train 4 unavailable due to initiator)
LHSI	LHSI available for injection and containment heat removal, with actuation via safety injection signal required (Condition 2)	1 of 4 LHSI pumps available (Train 4 failed by initiator)	LHSI CHR 4/4 (FT top gate)	Failure of 4 of 4 LHSI trains (injection/CHR mode); SI signal needed (Train 4 failed by initiator)

Table 19A-14—Event Tree Headings for Initiating Event LOC: Loss of Main Condenser
Sheet 1 of 2

Event Tree Top Event		Success Criteria	Failure Event	Event Description
LOC	Loss of main condenser (including MSIV closure)	—	IE LOC (initiator)	Loss of main condenser
RT	Reactor trip (Condition 2 signals – low DNBR or low steam generator level)	2 out of 4 RPS input signals and 1 out of 2 twice for reactor trip breakers or 2 out of 4 contactors	RT2 (FT top gate)	Failure of reactor trip 2 (loss-of-feedwater type events)
SSS	Startup and shutdown system available for secondary heat removal (Condition 1)	SSS flow to 1 of 4 steam generators for secondary heat removal	SSS (FT top gate)	Failure of startup and shutdown system to deliver flow to 1 of 4 steam generators
EFW	EFW available for secondary heat removal (Condition 1)	1 of 4 EFW trains available for secondary heat removal	EFW (FT top gate)	Failure of secondary heat removal and secondary cooldown
EFW PBF	EFW maintains pressure boundary conditions	4 of 4 EFW storage pools maintain integrity OR operators maintain adequate inventory after leak	EFW PBF (FT top gate)	Failure of EFW due to loss of inventory upon failure of pressure boundary
OP FB	Operators initiate feed and bleed cooling for transient, within 90 min (Condition 1)	initiation of feed and bleed within 90 min	OPE-FB-90M (basic event)	Operators fail to initiate feed and bleed within 90 min for transient
PBL	Primary bleed available (Condition 1)	3 of 3 PSVs or 1 of 2 SADV and steam generator relief (4 SG)	PBL (FT top gate)	Failure of a PSV and both SADVs or steam generator relief valves (MSRTS and MSSVs) on a steam generator
MHSI 01	MHSI available for feed and bleed cooling	1 of 4 MHSI pumps available	MHSI 4/4 FB (FT top gate)	Failure of 4 of 4 MHSI trains for feed and bleed
ACC	Accumulator injection available (Condition 1)	1 of 4 accumulators available	ACC 4/4 (FT top gate)	Failure of 4 of 4 accumulator trains

Table 19A-14—Event Tree Headings for Initiating Event LOC: Loss of Main Condenser
Sheet 2 of 2

Event Tree Top Event		Success Criteria	Failure Event	Event Description
LHSI	LHSI available for injection and containment heat removal, for feed and bleed cooling (Condition 1)	1 of 4 LHSI pumps available	LHSI CHR 4/4 (FT top gate)	Failure of 4 of 4 LHSI trains (injection/CHR mode)
SAHR	Severe accident heat removal through recirculation line	1 of 1 SAHR pump available in recirculation mode	SAHR IRWST (FT top gate)	Failure of SAHRS to provide cooling to the IRWST

Table 19A-15—Event Tree Headings for Initiating Event LOCCW: Loss of CCWS or ESWS
Sheet 1 of 3

Event Tree Top Event		Success Criteria	Failure Event	Event Description
LOCCW	Consequence*—loss of component cooling water or emergency service water	—	LOCCW (consequence)	Loss of component cooling water or emergency service water
RCP LOCA	RCP seal LOCA does not occur	Seal injection with CVCS or seal cooling with CCWS or standstill seal actuation or seals withstand challenge	RCP LOCA (FT top gate)	RCP seal LOCA
MHSI	MHSI available	1 of 4 MHSI trains available for injection	MHSI 4/4 (FT top gate)	Failure of 4 of 4 MHSI trains
OP FCD	Operators initiate fast cooldown (Condition 1)	Initiation within 40 min	OPE-FCD-40M (basic event)	Operators fail to initiate fast cooldown for SLOCA
MFW	Main feedwater available	1 of 3 MFW pumps available to deliver flow to 1 of 4 steam generators (main condenser required with turbine bypass)	MFW (FT top gate)	Failure of the MFWS to deliver flow to 1 of 4 SGs or failure of main condenser with turbine bypass
SSS	Startup and shutdown system available for: Secondary heat removal (Condition 1) Partial cooldown (Condition 2) Fast cooldown (Condition 3)	SSS flow to 1 of 4 steam generators for secondary heat removal SSS flow to 1 of 4 steam generators for partial cooldown SSS flow to 1 of 4 steam generators for fast cooldown	SSS (FT top gate)	Failure of startup and shutdown system to deliver flow to 1 of 4 steam generators

Table 19A-15—Event Tree Headings for Initiating Event LOCCW: Loss of CCWS or ESWS
Sheet 2 of 3

Event Tree Top Event		Success Criteria	Failure Event	Event Description
EFW	EFW available for Secondary heat removal (Condition 1) Partial cooldown (Condition 2) Fast cooldown (Condition 3)	1 of 4 EFW trains available for secondary heat removal 1 of 4 EFW trains available for partial cooldown 1 of 4 EFW trains available for fast cooldown	EFW (FT top gate)	Failure of secondary heat removal and secondary cooldown
EFW PBF	EFW maintains pressure boundary conditions	4 of 4 EFW storage pools maintain integrity OR operators maintain adequate inventory after leak	EFW PBF (FT top gate)	Failure of EFW due to loss of inventory upon failure of pressure boundary
OP FB	Operators initiate feed and bleed cooling for: Transient, within 90 min (Condition 1) SLOCA (RCP seal LOCA), within 40 min (Condition 2)	Initiation of feed and bleed within 90 min Initiation of feed and bleed within 40 min	OPE-FB-90M (basic event) OPE-FB-40M (basic event)	Operators fail to initiate feed and bleed within 90 min for transient Operators fail to initiate feed and bleed for SLOCA
PBL	Primary bleed available (Condition 1)	3 of 3 PSVs or 1 of 2 SADV and steam generator relief (4 SGs)	PBL (FT top gate)	Failure of a PSV and both SADVs or steam generator relief valves (MSRTS and MSSVs) on a steam generator
MHSI 01	MHSI available for feed and bleed cooling	1 of 4 MHSI pumps available	MHSI 4/4 FB (FT top gate)	Failure of 4 of 4 MHSI trains for feed and bleed
ACC	Accumulator injection available (Condition 1)	1 of 4 accumulators available	ACC 4/4 (FT top gate)	Failure of 4 of 4 accumulator trains

Table 19A-15—Event Tree Headings for Initiating Event LOCCW: Loss of CCWS or ESWS
Sheet 3 of 3

Event Tree Top Event		Success Criteria	Failure Event	Event Description
LHSI	LHSI available for injection and containment heat removal, for:			
	Feed-and-bleed cooling (Condition 1)	1 of 4 LHSI pumps available	LHSI CHR 4/4 (FT top gate)	Failure of 4 of 4 LHSI trains (injection/CHR mode)
	SLOCA (RCP seal LOCA) (Condition 2)	1 of 4 LHSI pumps available (SI signal required)	LHSI CHR 4/4 (FT top gate)	Failure of 4 of 4 LHSI trains (injection/CHR mode, SI signal needed)
	Only injection required, FCD (Condition 3)	1 of 4 LHSI pumps available (injection only, SI signal required)	LHSI INJ 4/4 (FT top gate)	Failure of 4 of 4 LHSI trains (injection mode only)
SAHR	Severe accident heat removal through recirculation line	1 of 1 SAHR pump available in recirculation mode	SAHR IRWST (FT top gate)	Failure of SAHRS to provide cooling to the IRWST

*This event tree structure is used for several initiating events involving losses of the CCWS or ESWS, including events LOCCW1, LOCCW12, LOCCW14-CH1, LOCCW14-CH12, LOCCW1L, LOCCW-ALL and LOCCW-CH1L.

Table 19A-16—Event Tree Headings for Initiating Event LOMFW: Loss of Main Feedwater
Sheet 1 of 2

Event Tree Top Event		Success Criteria	Failure Event	Event Description
LOMFW	Total loss of main feedwater	—	IE LOMFW (initiator)	Total loss of main feedwater
RT	Reactor trip (Condition 2 signals – low DNBR or low steam generator level)	2 out of 4 RPS input signals and 1 out of 2 twice for reactor trip breakers or 2 out of 4 contactors	RT2 (FT top gate)	Failure of reactor trip 2 (loss-of-feedwater type events)
SSS	Startup and shutdown system available for secondary heat removal (Condition 1)	SSS flow to 1 of 4 steam generators for secondary heat removal	SSS (FT top gate)	Failure of startup and shutdown system to deliver flow to 1 of 4 steam generators
EFW	EFW available for secondary heat removal (Condition 1)	1 of 4 EFW trains available for secondary heat removal	EFW (FT top gate)	Failure of secondary heat removal and secondary cooldown
EFW PBF	EFW maintains pressure boundary conditions	4 of 4 EFW storage pools maintain integrity OR operators maintain adequate inventory after leak	EFW PBF (FT top gate)	Failure of EFW due to loss of inventory upon failure of pressure boundary
OP FB	Operators initiate feed and bleed cooling for transient, within 90 min (Condition 1)	initiation of feed and bleed within 90 min	OPE-FB-90M (basic event)	Operators fail to initiate feed and bleed within 90 min for transient
PBL	Primary bleed available (Condition 1)	3 of 3 PSVs or 1 of 2 SADV and steam generator relief (4 SG)	PBL (FT top gate)	Failure of a PSV and both SADVs or steam generator relief valves (MSRTS and MSSVs) on a steam generator
MHSI 01	MHSI available for feed and bleed cooling	1 of 4 MHSI pumps available	MHSI 4/4 FB (FT top gate)	Failure of 4 of 4 MHSI trains for feed and bleed
ACC	Accumulator injection available (Condition 1)	1 of 4 accumulators available	ACC 4/4 (FT top gate)	Failure of 4 of 4 accumulator trains

Table 19A-16—Event Tree Headings for Initiating Event LOMFW: Loss of Main Feedwater
Sheet 2 of 2

Event Tree Top Event		Success Criteria	Failure Event	Event Description
LHSI	LHSI available for injection and containment heat removal, for feed and bleed cooling (Condition 1)	1 of 4 LHSI pumps available	LHSI CHR 4/4 (FT top gate)	Failure of 4 of 4 LHSI trains (injection/CHR mode)
SAHR	Severe accident heat removal through recirculation line	1 of 1 SAHR pump available in recirculation mode	SAHR IRWST (FT top gate)	Failure of SAHRS to provide cooling to the IRWST

Table 19A-17—Event Tree Headings for Initiating Event LOOP: Loss of Offsite Power
Sheet 1 of 3

Event Tree Top Event		Success Criteria	Failure Event	Event Description
LOOP	Loss of offsite power	—	IE LOOP (initiator)	Loss of offsite power
EDG	EDG buses available	1 of 4 EDGs available	EDG (FT top gate)	Failure of EDG buses
RT	Reactor trip (Condition 1 signals – high RCS pressure or high steam line pressure)	2 out of 4 RPS input signals and 1 out of 2 twice for reactor trip breakers or 2 out of 4 contactors	RT1 (FT top gate)	Failure of reactor trip 1 (turbine trip-type events)
I&C	Power supply for I&C available for 2-hr duration of LOOP	1 of 4 I&C buses available	I&C (FT top gate)	Failure of I&C buses during a LOOP
MSR	Main steam relief (Condition 1)	Steam relief from 4 of 4 steam generators secondary heat removal mode	MSR (FT top gate)	Failure of steam relief from 1 of 4 steam generators
RCP LOCA	RCP seal LOCA does not occur	Seal injection with CVCS or seal cooling with CCWS or standstill seal actuation or seals withstand challenge	RCP LOCA (FT top gate)	RCP seal LOCA
REC LOOP	Recovery of offsite power within: 1 hr (Condition 1) (RCP seal LOCA) 2 hr (Condition 2)	Recovery within 1 hr Recovery within 2 hr	REC OSP 1HR REC OSP 2 HR (basic events)	Failure to recover offsite power within 1 hr Failure to recover offsite power within 2 hr
SBO	Station blackout diesel-generator buses available	Div 1 or Div 4 BDC bus supplied from either its emergency power bus BDA or its SBO diesel supplied bus BBH	SBO (FT top gate)	Failure of power at 31BDC and 34BDC from both normal, emergency and station blackout diesel generator buses

Table 19A-17—Event Tree Headings for Initiating Event LOOP: Loss of Offsite Power
Sheet 2 of 3

Event Tree Top Event		Success Criteria	Failure Event	Event Description
MHSI	MHSI available	1 of 4 MHSI trains available for injection	MHSI 4/4 (FT top gate)	Failure of 4 of 4 MHSI trains
OP FCD	Operators initiate fast cooldown within 40 minutes No station blackout (Condition 1) Station blackout (Condition 3)	Initiation of fast cooldown within 40 min	OPE-FCD-40M (basic event) OPE-FCD40MSBO (basic event)	Operators fail to initiate fast cooldown within 40 min
EFW	EFW available for: Secondary heat removal (Condition 1) Partial cooldown (Condition 2) Fast cooldown (Condition 3)	1 of 4 EFW trains available for secondary heat removal 1 of 4 EFW trains available for partial cooldown 1 of 4 EFW trains available for fast cooldown	EFW (FT top gate)	Failure of secondary heat removal and secondary cooldown
EFW PBF	EFW maintains pressure boundary conditions	4 of 4 EFW storage pools maintain integrity OR operators maintain adequate inventory after leak	EFW PBF (FT top gate)	Failure of EFW due to loss of inventory upon failure of pressure boundary
OP FB	Operators initiate feed and bleed cooling for Transient, within 90 min (Condition 1) SLOCA (RCP seal LOCA), within 40 min (Condition 2)	Initiation of feed and bleed within 90 min Initiation of feed and bleed within 40 min	OPE-FB-90M (basic event) OPE-FB-40M (basic event)	Operators fail to initiate feed and bleed within 90 min for transient Operators fail to initiate feed and bleed for SLOCA
PBL	Primary bleed available (Condition 1)	3 of 3 PSVs or 1 of 2 SADV and steam generator relief (4 SG)	PBL (FT top gate)	Failure of a PSV and both SADVs or steam generator relief valves (MSRTS and MSSVs) on a steam generator

Table 19A-17—Event Tree Headings for Initiating Event LOOP: Loss of Offsite Power
Sheet 3 of 3

Event Tree Top Event		Success Criteria	Failure Event	Event Description
MHSI 01	MHSI available for feed and bleed cooling	1 of 4 MHSI pumps available	MHSI 4/4 FB (FT top gate)	Failure of 4 of 4 MHSI trains for feed and bleed
ACC	Accumulator injection available (Condition 1)	1 of 4 accumulators available	ACC 4/4 (FT top gate)	Failure of 4 of 4 accumulator trains
LHSI	LHSI available for injection and containment heat removal, for: Feed-and-bleed cooling (Condition 1) SLOCA (RCP seal LOCA) (Condition 2) Only injection required, FCD (Condition 3)	1 of 4 LHSI pumps available 1 of 4 LHSI pumps available (SI signal required) 1 of 4 LHSI pumps available (injection only, SI signal required)	LHSI CHR 4/4 (FT top gate)	Failure of 4 of 4 LHSI trains (injection/CHR mode) Failure of 4 of 4 LHSI trains (injection/CHR mode, SI signal needed) Failure of 4 of 4 LHSI trains (injection mode only)
SAHR	Severe accident heat removal through recirculation line	1 of 1 SAHR pump available in recirculation mode	SAHR IRWST (FT top gate)	Failure of SAHRS to provide cooling to the IRWST

Table 19A-18—Event Tree Headings for Initiating Event MLOCA: Medium Loss-of-Coolant-Accident
Sheet 1 of 2

Event Tree Top Event		Success Criteria	Failure Event	Event Description
MLOCA	Medium LOCA (3 to 6" break)	—	IE MLOCA (initiator)	Medium LOCA (3 to 6" break)
MHSI	MHSI available	1 of 4 MHSI trains available for injection (Train 4 failed by initiator)	MHSI 4/4 (FT top gate)	Failure of 4 of 4 MHSI trains (Train 4 failed by initiator)
OP FCD	Operators initiate fast cooldown within 30 min (Condition 2)	Initiation of fast cooldown within 30 min	OPE-FCD-30M (basic event)	Operators fail to initiate fast cooldown within 30 min for a medium LOCA
MSR	Main steam relief Partial Cooldown (Condition 2) Fast Cooldown (Condition 3)	Steam relief from 4 of 4 steam generators	MSR (FT top gate)	Failure of 1 of 4 steam generator steam relief
OP FB	Operators initiate feed and bleed cooling within 30 min (Condition 3)	Initiation of feed and bleed within 30 min	OPE-FB-30M (basic event)	Operators fail to initiate feed and bleed within 30 min for medium LOCA
PBL	Primary bleed available for medium LOCA (Condition 2)	3 of 3 PSVs or 1 of 2 SADV and steam generator relief from 1 of 4 steam generators	PBL MLOCA (FT top gate)	Failure of a PSV and both SADVs or all steam generator relief valves (MSRTS and MSSVs)
ACC	Accumulator injection available with: Success of MHSI and MSR (Condition 2) Failure of MHSI or MSR (Condition 3)	1 of 3 accumulators available	ACC 3/3	Failure of 3 of 3 accumulator trains (train 4 unavailable due to initiator)

Table 19A-18—Event Tree Headings for Initiating Event MLOCA: Medium Loss-of-Coolant-Accident
Sheet 2 of 2

Event Tree Top Event		Success Criteria	Failure Event	Event Description
LHSI	LHSI available for injection and containment heat removal, for: SI signal not required (Condition 1)	1 of 3 LHSI pumps (Train 4 failed by initiator)	LHSI CHR 4/4 (FT top gate)	Failure of 4 of 4 LHSI trains (injection/CHR mode) (Train 4 failed by initiator)
	SI signal required (Condition 2)	1 of 3 LHSI pumps available (SI signal required) (Train 4 failed by initiator)		Failure of 4 of 4 LHSI trains (injection/CHR mode, SI signal needed) (Train 4 failed by initiator)
SAHR	Severe accident heat removal through recirculation line	1 of 1 SAHR pump available in recirculation mode	SAHR IRWST (FT top gate)	Failure of SAHRS to provide cooling to the IRWST

Table 19A-19—Event Tree Headings for Initiating Event MSSV: Spurious Opening of Main Steam Safety Valve
Sheet 1 of 2

Event Tree Top Event		Success Criteria	Failure Event	Event Description
MSSV	Spurious opening of MSSV	—	IE MSSV (initiator)	Spurious opening of MSSV
MSIV ISO	MSIV isolation of affected steam generators	3 of 4 steam generators isolated	(FT top gates) MSIV ISO SLBI 1	Failure to isolate affected steam generators: 2 blowing down Failure to isolate affected steam generators: 3 or more blowing down
	Two steam generators blowing down (Condition 4)	2 steam generators isolated	MSIV ISO SLBI 2	
	Three steam generators blowing down (Condition 5)	1 steam generator isolated		
EBS	Boration via extra borating system (EBS) for steam line break (Condition 3)	1 of 2 EBS trains available—manual actuation	EBS SLB 2/2 (FT top gate)	Failure of boration via EBS (1 of 2 EBS trains required)
OP RHR	Operators initiate secondary cooldown and align RHR (Condition 1)	Initiation of secondary cooldown within 4 hours	OPE-RHR-4H (basic event)	Operators fail to initiate RHR within 4 hr
EFW	EFW available for: Secondary heat removal, three steam generators available (Condition 5)	1 of 3 EFW trains available for secondary heat removal	EFW SLB 3/3 (FT top gate)	Failure of secondary heat removal and secondary cooldown
	Secondary heat removal, two steam generators available (Condition 6)	1 of 2 EFW trains available for secondary heat removal	EFW SLB 2/2 (FT top gate)	
EFW PBF	EFW maintains pressure boundary conditions	4 of 4 EFW storage pools maintain integrity OR operators maintain adequate inventory after leak	EFW PBF (FT top gate)	Failure of EFW due to loss of inventory upon failure of pressure boundary

Table 19A-19—Event Tree Headings for Initiating Event MSSV: Spurious Opening of Main Steam Safety Valve
Sheet 2 of 2

Event Tree Top Event		Success Criteria	Failure Event	Event Description
RHR	RHR available for secondary heat removal	1 of 4 LHSI pumps available for RHR	RHR 4/4 (FT top gate)	Failure of 4 of 4 LHSI trains for RHR
OP FB	Operators initiate feed and bleed cooling within 90 min (Condition 1)	Initiation of feed and bleed within 90 min	OPE-FB-90M (basic event)	Operators fail to initiate feed and bleed within 90 min for transient
PBL	Primary bleed available (Condition 1)	3 of 3 PSVs or 1 of 2 SADV and steam generator relief (4 SG)	PBL (FT top gate)	Failure of a PSV and both SADVs or steam generator relief valves (MSRTS and MSSVs) on a steam generator
MHSI 01	MHSI available for feed and bleed cooling	1 of 4 MHSI pumps available	MHSI 4/4 FB (FT top gate)	Failure of 4 of 4 MHSI trains for feed and bleed
ACC	Accumulator injection available (Condition 1)	1 of 4 accumulators available	ACC 4/4 (FT top gate)	Failure of 4 of 4 accumulator trains
LHSI	LHSI available for injection and containment heat removal, for feed and bleed cooling (Condition 1)	1 of 4 LHSI pumps available	LHSI CHR 4/4 (FT top gate)	Failure of 4 of 4 LHSI trains (injection/CHR mode)
SAHR	Severe accident heat removal through recirculation line	1 of 1 SAHR pump available in recirculation mode	SAHR IRWST (FT top gate)	Failure of SAHRS to provide cooling to the IRWST

Table 19A-20—Event Tree Headings for Initiating Event SGTR: Steam Generator Tube Rupture
Sheet 1 of 2

Event Tree Top Event		Success Criteria	Failure Event	Event Description
SGTR	Steam generator tube rupture	—	IE SGTR (initiator)	Steam generator tube rupture
SG ISO	Operators isolate affected steam generators	Automatic isolation or operator isolation	SG ISO (FT top gate)	Failure to isolate affected steam generator
SSS	Startup and shutdown system available for secondary heat removal (Condition 4)	SSS flow to 1 of 3 steam generators for secondary heat removal	SSS SGTR (FT top gate)	Failure of startup and shutdown system to deliver flow to 1 of 3 steam generators
EFW	EFW available for partial cooldown, three steam generators available (Condition 4)	1 of 3 EFW trains available for partial cooldown	EFW SGTR	Failure of 1 of 3 EFW trains (with MSRTs)
EFW PBF	EFW maintains pressure boundary conditions	4 of 4 EFW storage pools maintain integrity OR operators maintain adequate inventory after leak	EFW PBF (FT top gate)	Failure of EFW due to loss of inventory upon failure of pressure boundary
OP RHR	Operators initiate secondary cooldown and align RHR (Condition 1)	initiation of secondary cooldown within 4 hours	OPE-RHR-4H (basic event)	Operators fail to initiate RHR within 4 hr
RHR	RHR available for secondary heat removal	1 of 4 LHSI pumps available for RHR	RHR 4/4 (FT top gate)	Failure of 4 of 4 LHSI trains for RHR
OP FB	Operators initiate feed and bleed cooling within 90 min (Condition 1)	initiation of feed and bleed within 90 min	OPE-FB-90M (basic event)	Operators fail to initiate feed and bleed within 90 min for transient
PBL	Primary bleed available (Condition 1)	3 of 3 PSVs or 1 of 2 SADV and steam generator relief (4 SG)	PBL (FT top gate)	Failure of a PSV and both SADVs or steam generator relief valves (MSRTS and MSSVs) on a steam generator

Table 19A-20—Event Tree Headings for Initiating Event SGTR: Steam Generator Tube Rupture
Sheet 2 of 2

Event Tree Top Event		Success Criteria	Failure Event	Event Description
MHSI 01	MHSI available for feed and bleed cooling	1 of 4 MHSI pumps available	MHSI 4/4 FB (FT top gate)	Failure of 4 of 4 MHSI trains for feed and bleed
ACC	Accumulator injection available (Condition 1)	1 of 4 accumulators available	ACC 4/4 (FT top gate)	Failure of 4 of 4 accumulator trains
LHSI	LHSI available for injection and containment heat removal for feed and bleed cooling (Condition 1)	1 of 4 LHSI pumps available	LHSI CHR 4/4 (FT top gate)	Failure of 4 of 4 LHSI trains (injection/CHR mode)
SAHR	Severe accident heat removal through recirculation line	1 of 1 SAHR pump available in recirculation mode	SAHR IRWST (FT top gate)	Failure of SAHRS to provide cooling to the IRWST

Table 19A-21—Event Tree Headings for Initiating Event SLBI: Steam-Line Break Inside Containment
Sheet 1 of 2

Event Tree Top Event		Success Criteria	Failure Event	Event Description
SLBI	Steam-line break inside containment	—	IE SLBI (initiator)	Initiator—large steam-line break inside containment
MSIV ISO	MSIV isolation of affected steam generators	3 of 4 steam generators isolated	(FT top gates) MSIV ISO SLBI 1	
	Two steam generators blowing down (Condition 4)	2 steam generators isolated		Failure to isolate affected steam generators: 2 blowing down
	Three steam generators blowing down (Condition 5)	1 steam generator isolated	MSIV ISO SLBI 2	Failure to isolate affected steam generators: 3 blowing down
FW ISO	MFV and SSS isolated to affected steam generator(s): One steam generator (Condition 1)	Feedwater lines to 1 of 1 affected steam generator isolated	FW ISO TR4 (FT top gate)	Failure to isolate feedwater to steam generator 4
	Two steam generators (Condition 2)	Feedwater lines to 2 of 2 affected steam generators isolated	FW ISO (FT top gate)	Failure to isolate feedwater to two affected steam generators
EBS	Boration via extra borating system (EBS) for steam line break (Condition 3)	1 of 2 EBS trains available—manual actuation	EBS SLB 2/2 (FT top gate)	Failure of boration via EBS (1 of 2 EBS trains required)
OP RHR	Operators initiate secondary cooldown and align RHR (Condition 1)	initiation of secondary cooldown within 4 hr	OPE-RHR-4H (basic event)	Operators fail to initiate RHR within 4 hr;

Table 19A-21—Event Tree Headings for Initiating Event SLBI: Steam-Line Break Inside Containment
Sheet 2 of 2

Event Tree Top Event		Success Criteria	Failure Event	Event Description
EFW	EFW available for: Secondary heat removal, three steam generators available (Condition 5)	1 of 3 EFW trains available for secondary heat removal	EFW SLB 3/3 (FT top gate)	Failure of secondary heat removal and secondary cooldown
	Secondary heat removal, two steam generators available (Condition 6)	1 of 2 EFW trains available for secondary heat removal	EFW SLB 2/2 (FT top gate)	
EFW PBF	EFW maintains pressure boundary conditions	4 of 4 EFW storage pools maintain integrity OR operators maintain adequate inventory after leak	EFW PBF (FT top gate)	Failure of EFW due to loss of inventory upon failure of pressure boundary
RHR	RHR available for secondary heat removal	1 of 4 LHSI pumps available for RHR	RHR 4/4 (FT top gate)	Failure of 4 of 4 LHSI trains for RHR
OP FB	Operators initiate feed and bleed cooling within 90 min (Condition 1)	initiation of feed and bleed within 90 min	OPE-FB-90M (basic event)	Operators fail to initiate feed and bleed within 90 min for transient
PBL	Primary bleed available (Condition 1)	3 of 3 PSVs or 1 of 2 SADV and steam generator relief (4 SG)	PBL (FT top gate)	Failure of a PSV and both SADVs or steam generator relief valves (MSRTS and MSSVs) on a steam generator
MHSI 01	MHSI available for feed and bleed cooling	1 of 4 MHSI pumps available	MHSI 4/4 FB (FT top gate)	Failure of 4 of 4 MHSI trains for feed and bleed
ACC	Accumulator injection available (Condition 1)	1 of 4 accumulators available	ACC 4/4 (FT top gate)	Failure of 4 of 4 accumulator trains
LHSI	LHSI available for injection and containment heat removal, for feed and bleed cooling (Condition 1)	1 of 4 LHSI pumps available	LHSI CHR 4/4 (FT top gate)	Failure of 4 of 4 LHSI trains (injection/CHR mode)
SAHR	Severe accident heat removal through recirculation line	1 of 1 SAHR pump available in recirculation mode	SAHR IRWST (FT top gate)	Failure of SAHRS to provide cooling to the IRWST

Table 19A-22—Event Tree Headings for Initiating Event SLBO: Steam-Line Break Outside Containment
Sheet 1 of 3

Event Tree Top Event		Success Criteria	Failure Event	Event Description
SLBO	Steam-line break downstream of MSIV	—	IE SLBI (initiator)	Initiator—large steam-line break inside containment
MSIV ISO	MSIV isolation of affected steam generators, with:	4 of 4 steam generators isolated		
	One steam generator blowing down (Condition 1)	3 steam generators isolated	MSIV ISO SLBO 1/4	Failure of 1 of 4 MSIV train to isolate
	Two steam generators blowing down (Condition 2)	2 steam generator isolated	MSIV ISO SLBO 2/4	Failure of 2 of 4 MSIV trains to isolate
	Three steam generators blowing down (Condition 3)	1 steam generator isolated	MSIV ISO SLBO 3/4	Failure of 3 of 4 MSIV trains to isolate
EBS	Boration via extra borating system (EBS) for steam line break (Condition 3)	1 of 2 EBS trains available—manual actuation	EBS SLB 2/2 (FT top gate)	Failure of boration via EBS (1 of 2 EBS trains required)
OP RHR	Operators initiate secondary cooldown and align RHR (Condition 1)	Initiation of secondary cooldown within 4 hr	OPE-RHR-4H (basic event)	Operators fail to initiate RHR within 4 hr

Table 19A-22—Event Tree Headings for Initiating Event SLBO: Steam-Line Break Outside Containment
Sheet 2 of 3

Event Tree Top Event		Success Criteria	Failure Event	Event Description
EFW	EFW available for: Secondary heat removal, four steam generators available (Condition 1)	1 of 4 EFW trains available for secondary heat removal	EFW	Failure of secondary heat removal and secondary cooldown
	Secondary heat removal, three steam generators available (Condition 5)	1 of 3 EFW trains available for secondary heat removal	EFW SLB 3/3 (FT top gate)	Failure of secondary heat removal and secondary cooldown, 3 steam generators available
	Secondary heat removal, two steam generators available (Condition 6)	1 of 2 EFW trains available for secondary heat removal	EFW SLB 2/2 (FT top gate)	Failure of secondary heat removal and secondary cooldown, 2 steam generators available
EFW PBF	EFW maintains pressure boundary conditions	4 of 4 EFW storage pools maintain integrity OR operators maintain adequate inventory after leak	EFW PBF (FT top gate)	Failure of EFW due to loss of inventory upon failure of pressure boundary
RHR	RHR available for secondary heat removal	1 of 4 LHSI pumps available for RHR	RHR 4/4 (FT top gate)	Failure of 4 of 4 LHSI trains for RHR
OP FB	Operators initiate feed and bleed cooling within 90 min (Condition 1)	initiation of feed and bleed within 90 min	OPE-FB-90M (basic event)	Operators fail to initiate feed and bleed within 90 min for transient
PBL	Primary bleed available (Condition 1)	3 of 3 PSVs or 1 of 2 SADV and steam generator relief (4 SG)	PBL (FT top gate)	Failure of a PSV and both SADVs or steam generator relief valves (MSRTS and MSSVs) on a steam generator
MHSI 01	MHSI available for feed and bleed cooling	1 of 4 MHSI pumps available	MHSI 4/4 FB (FT top gate)	Failure of 4 of 4 MHSI trains for feed and bleed
ACC	Accumulator injection available (Condition 1)	1 of 4 accumulators available	ACC 4/4 (FT top gate)	Failure of 4 of 4 accumulator trains

Table 19A-22—Event Tree Headings for Initiating Event SLBO: Steam-Line Break Outside Containment
Sheet 3 of 3

Event Tree Top Event		Success Criteria	Failure Event	Event Description
LHSI	LHSI available for injection and containment heat removal, for feed and bleed cooling (Condition 1)	1 of 4 LHSI pumps available	LHSI CHR 4/4 (FT top gate)	Failure of 4 of 4 LHSI trains (injection/CHR mode)
SAHR	Severe accident heat removal through recirculation line	1 of 1 SAHR pump available in recirculation mode	SAHR IRWST (FT top gate)	Failure of SAHRS to provide cooling to the IRWST

Table 19A-23—Event Tree Headings for Initiating Event SLOCA: Small Loss-of-Coolant Accident
Sheet 1 of 3

Event Tree Top Event		Success Criteria	Failure Event	Event Description
SLOCA	Small loss-of-coolant accident	—	IE SLOCA (initiator)	Initiator—small LOCA (0.6 to 3” equivalent diameter)
MHSI	MHSI available for safety injection	1 of 4 MHSI pumps available	MHSI 4/4 (FT top gate)	Failure of 4 of 4 MHSI trains for safety injection
OP FCD	Operators initiate fast cooldown within 40 min	Initiation of fast cooldown within 40 min	OPE-FCD-40M (basic event)	Operators fail to initiate fast cooldown within 40 min
SSS	Startup and shutdown system available for: Partial cooldown (Condition 2) Fast cooldown (Condition 3)	SSS flow to 1 of 4 steam generators for partial cooldown SSS flow to 1 of 4 steam generators for fast cooldown	SSS (FT top gate)	Failure of startup and shutdown system to deliver flow to 1 of 4 steam generators
EFW	EFW available for Partial cooldown (Condition 2) Fast cooldown (Condition 3)	1 of 4 EFW trains available for partial cooldown 2 of 4 EFW trains available for fast cooldown	EFW (FT top gate)	Failure of secondary heat removal and secondary cooldown
EFW PBF	EFW maintains pressure boundary conditions	4 of 4 EFW storage pools maintain integrity OR operators maintain adequate inventory after leak	EFW PBF (FT top gate)	Failure of EFW due to loss of inventory upon failure of pressure boundary

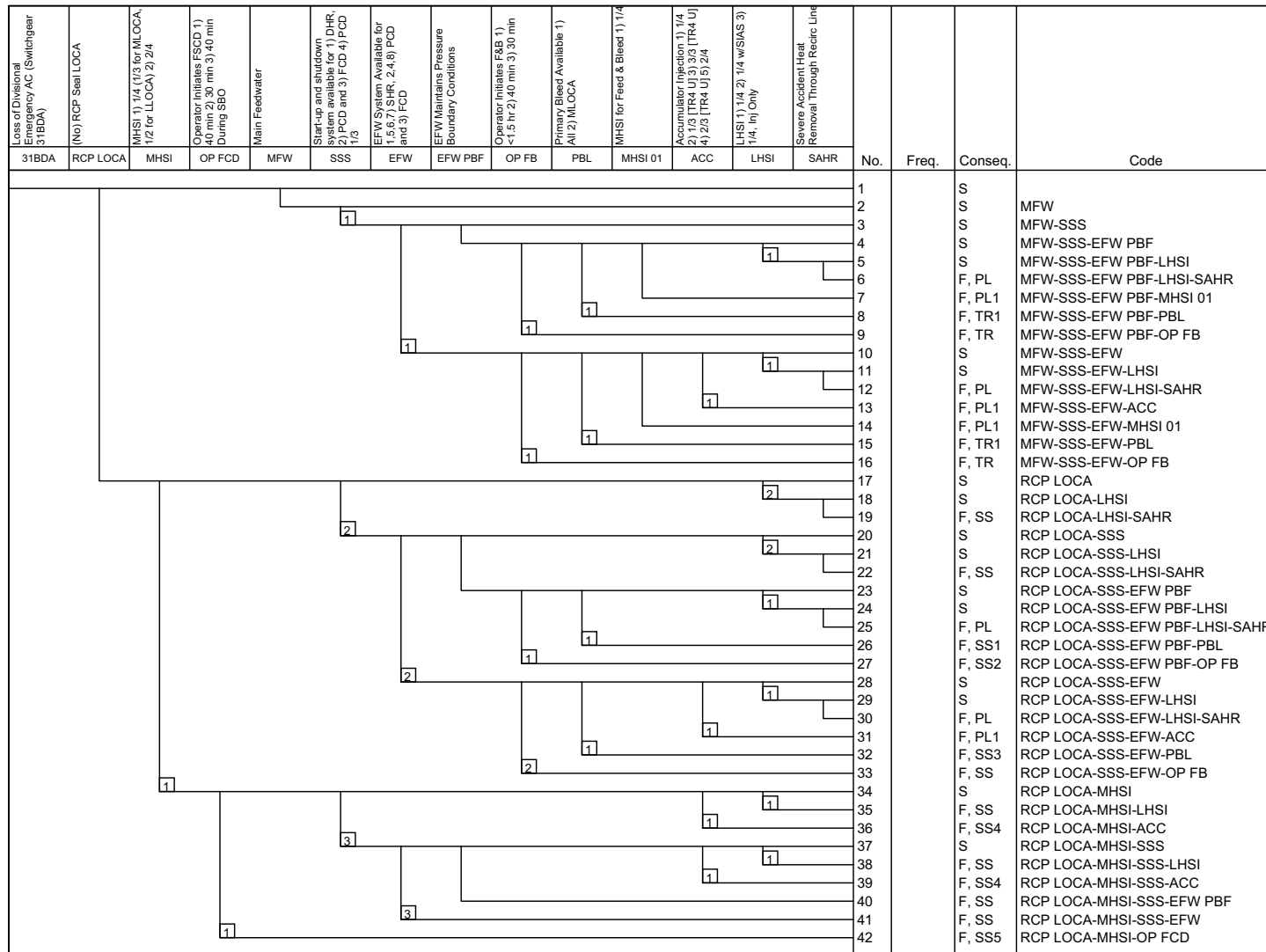
Table 19A-23—Event Tree Headings for Initiating Event SLOCA: Small Loss-of-Coolant Accident
Sheet 2 of 3

Event Tree Top Event		Success Criteria	Failure Event	Event Description
OP FB	Operators initiate feed and bleed cooling within 90 min with EFW success (Condition 1) 40 min with EFW failure (Condition 2)	initiation of feed and bleed within 90 min initiation of feed and bleed within 40 min	OPE-FB-90M (basic event) OPE-FB-40M (basic event)	Operators fail to initiate feed and bleed within 90 min for transient Operators fail to initiate feed and bleed within 40 min for SLOCA
PBL	Primary bleed available (Condition 1)	3 of 3 PSVs or 1 of 2 SADV and steam generator relief (4 SG)	PBL (FT top gate)	Failure of a PSV and both SADVs or steam generator relief valves (MSRTS and MSSVs) on a steam generator
ACC	Accumulator injection available One accumulator needed (Condition 1) Two accumulators needed (Condition 5)	1 of 4 accumulators available 2 of 4 accumulators available	ACC 4/4 (FT top gate) ACC 3/4 (FT top gate)	Failure of 4 of 4 accumulator trains Failure of 3 of 4 accumulator trains
LHSI	LHSI available for injection and containment heat removal, for: Feed-and-bleed cooling (Condition 1) SLOCA (Condition 2)	1 of 4 LHSI pumps available 1 of 4 LHSI pumps available (SI signal required)	LHSI CHR 4/4 (FT top gate)	Failure of 4 of 4 LHSI trains (injection/CHR mode) Failure of 4 of 4 LHSI trains (injection/CHR mode, SI signal needed)

Table 19A-23—Event Tree Headings for Initiating Event SLOCA: Small Loss-of-Coolant Accident
Sheet 3 of 3

Event Tree Top Event		Success Criteria	Failure Event	Event Description
SAHR	Severe accident heat removal through recirculation line	1 of 1 SAHR pump available in recirculation mode	SAHR IRWST (FT top gate)	Failure of SAHRS to provide cooling to the IRWST

Figure 19A-1—Loss of Divisional Emergency AC Power



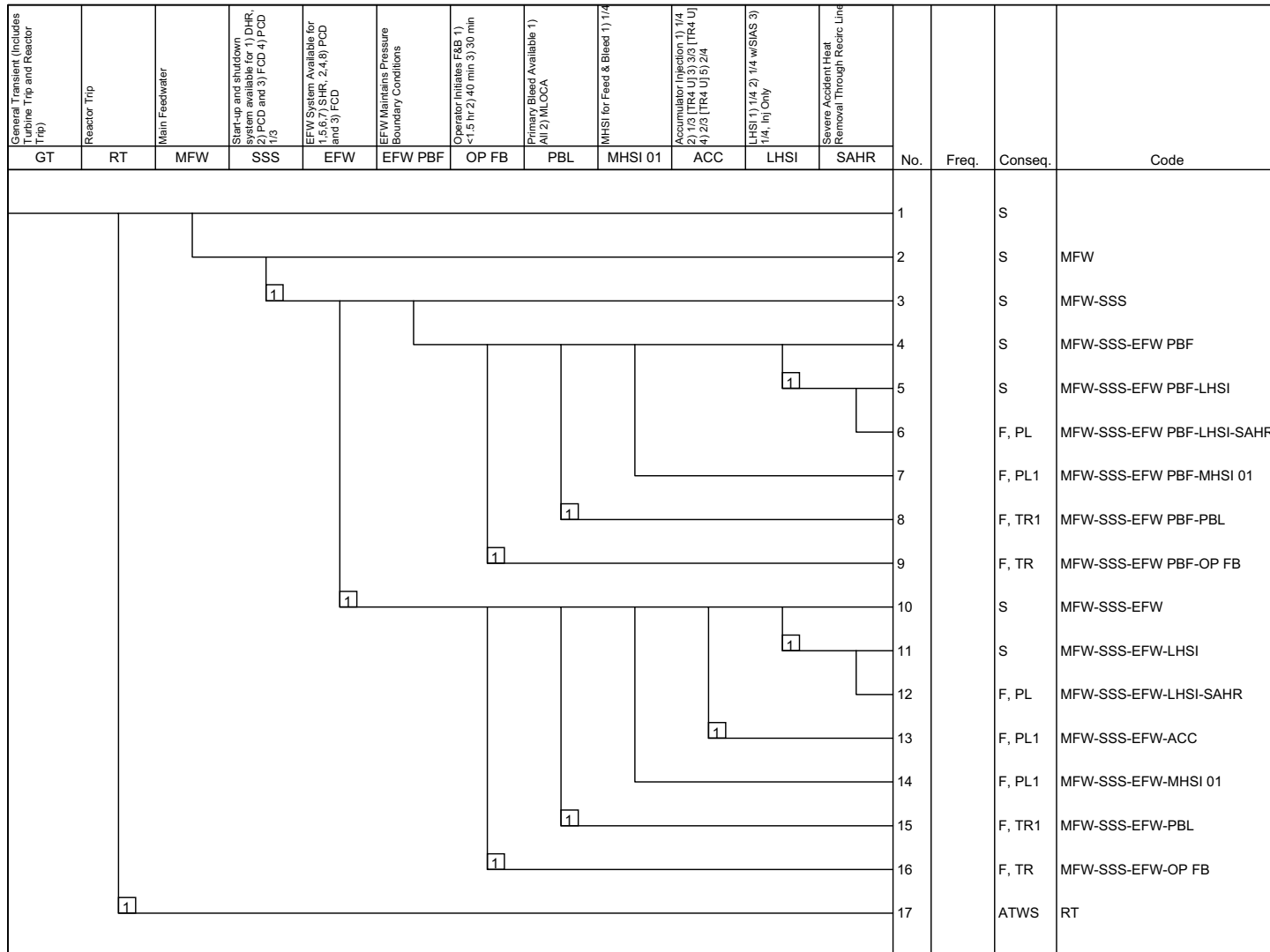
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Figure 19A-2—Failure to Scram Following Transient

ATWS Loss of Main Feedwater	PRZ-Relief With RCP Shutdowns	3/3 PZR Safety Valve Reclosure	Boration with EBS 1) ATWS 1/2 2) ATWS 2/2 3) SLB 1/2	EFW System Available for 1.5, 6.7) SHR, 2.4, 8) PCD and 3) FCD	EFW Maintains Pressure Boundary Conditions	MHSI 1) 1/4 (1/3 for W/LOCA, 1/2 for LLOCA) 2) 2/4	LHSI 1) 1/4 2) 1/4 w/SIAS 3) 1/4, Inj Only	Severe Accident Heat Removal Through Recirc Line	No.	Freq.	Conseq.	Code
ATWS	PSR	PSV	EBS	EFW	EFW PBF	MHSI	LHSI	SAHR				
									1		S	
									2		AF, ATR, F, TR	EFW PBF
				7					3		AF, ATR, F, TR	EFW
			1						4		AAT, AF, AT, F	EBS
									5		S	PSV
							2		6		S	PSV-LHSI
									7		AF, APL, F, PL	PSV-LHSI-SAHR
						2			8		AF, F, PL1, APL1	PSV-MHSI
									9		AF, F, PL1, APL1	PSV-EFW PBF
				8					10		AF, F, PL1, APL1	PSV-EFW
			2						11		AAT, AF, AT, F	PSV-EBS
									12		AF, ARV, F, RV	PSR

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Figure 19A-3—General Transient



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Figure 19A-4—Induced Steam Generator Tube Rupture

Induced Steam Generator Tube Rupture	EFW System Available (for 1, 5, 6, 7) SHR, 2, 4, 8) PCD and 3) FCD	EFW Maintains Pressure Boundary Conditions	Operator Initiates Secondary Cooldown and Aligns RHR in 1) 4 hrs 3) Medium Dep.	RHR 1) 1/4 (1/3 for ISL-CCW RCPTB)	No.	Freq.	Conseq.	Code
IND SGTR	EFW	EFW PBF	OP RHR	RHR				
					1		S	
					2		F, SG	RHR
					3		F, SG	OP RHR
					4		F, SG	EFW PBF
					5		F, SG	EFW

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Figure 19A-5—ISLOCA Due to RCP Thermal Barrier Tube Break

ISLOCA - CCWS RCP Thermal Barrier Tube Break	Operator Initiates Secondary Cooldown and Aligns RHR in 1 1/4 hrs 3) Medium Dep.	RHR 1) 1/4 (1/3 for ISL-CCW RCPTB)	No.	Freq.	Conseq.	Code
ISL-CCW RCPTB	OP RHR	RHR				
			1		S	
			2		F, IS	RHR
			3		F, IS	OP RHR

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Figure 19A-6—ISLOCA Due to Tube Rupture in CVCS High Pressure Cooler

ISLOCA - Tube Rupture High Pressure Letdown Cooler	Operator Initiates Secondary Shutdown and Aligns RHR in 1) 4 hrs 3) Medium Dep.	RHR 1) 1/4 (1/3 for ISL-CCW RCPTB)	No.	Freq.	Conseq.	Code
ISL-CVCS HPTR	OP RHR	RHR				
			1		S	
			2		F, IS	RHR
			3		F, IS	OP RHR

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Figure 19A-7—ISLOCA Due to Rupture of High Pressure CVCS Pipe Outside Containment

ISLOCA - High Pressure CVCS Pipe Rupture Outside Containment				
	No.	Freq.	Conseq.	Code
ISL-CVCS INJ				
	1		F, IS	

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Figure 19A-8—ISLOCA Due to Spurious Opening of Reducing Station

ISLOCA - Spurious Opening of Reducing Station	Operator Initiates Secondary Shutdown and Aligns RHR in 1) 4 hrs 3) Medium Dep.	RHR 1) 1/4 (1/3 for ISL-CCW RCPTB)	No.	Freq.	Conseq.	Code
ISL-CVCS REDS	OP RHR	RHR				
			1		S	
			2		F, IS	RHR
			3		F, IS	OP RHR

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Figure 19A-9—ISLOCA Due to Break in LHSI Cold Leg Injection Valves with LHSI Rupture in Respective SAB

ISLOCA - Break in LHSI Cold Leg Injection Check Valves with LHSI Line Break in Respective SAB				
	No.	Freq.	Conseq.	Code
ISL-SIS LHSI				
	1		F, IS	

EPR6540 T2

Figure 19A-10—ISLOCA Due to Break in MHSI Cold Leg Injection Valves with MHSI Rupture in Respective SAB

ISLOCA - Break in MHSI Cold Leg Injection Check Valves with MHSI Line Break in Respective SAB	No.	Freq.	Conseq.	Code
ISL-SIS MHSI				
	1		F, IS	

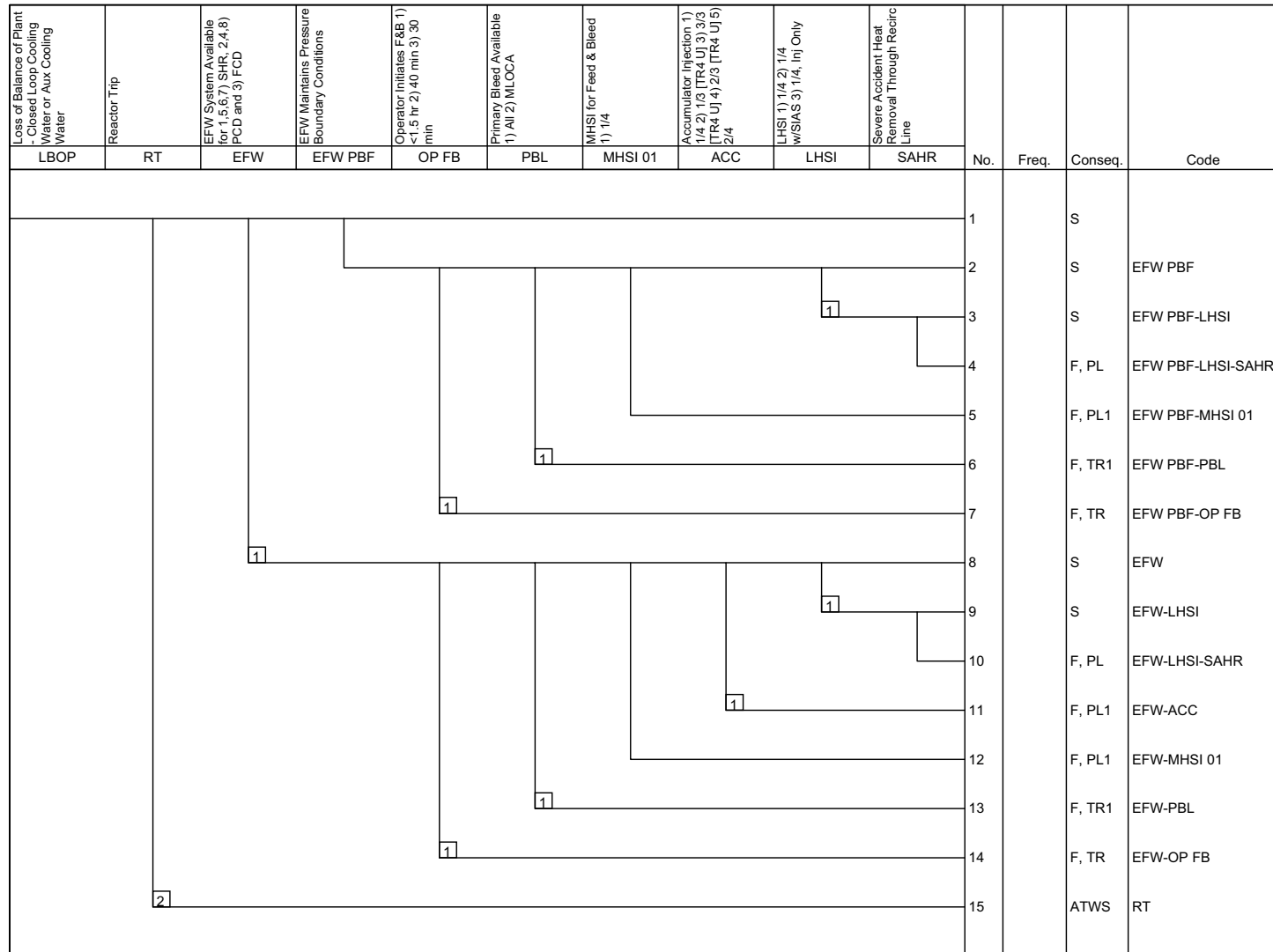
EPR6545 T2

Figure 19A-11—ISLOCA Due to Failure of Suction Line MOVs and Subsequent RHR Line Rupture in Respective SAB

ISLOCA - Failure of Suction Line Isolation MOVs and Subsequent RHR Line Break in Respective SAB	No.	Freq.	Conseq.	Code
ISL-SIS RHR				
	1		F, IS	

EPR6550 T2

Figure 19A-12—Loss of Balance of Plant Closed Loop Cooling Water or Auxiliary Cooling Water



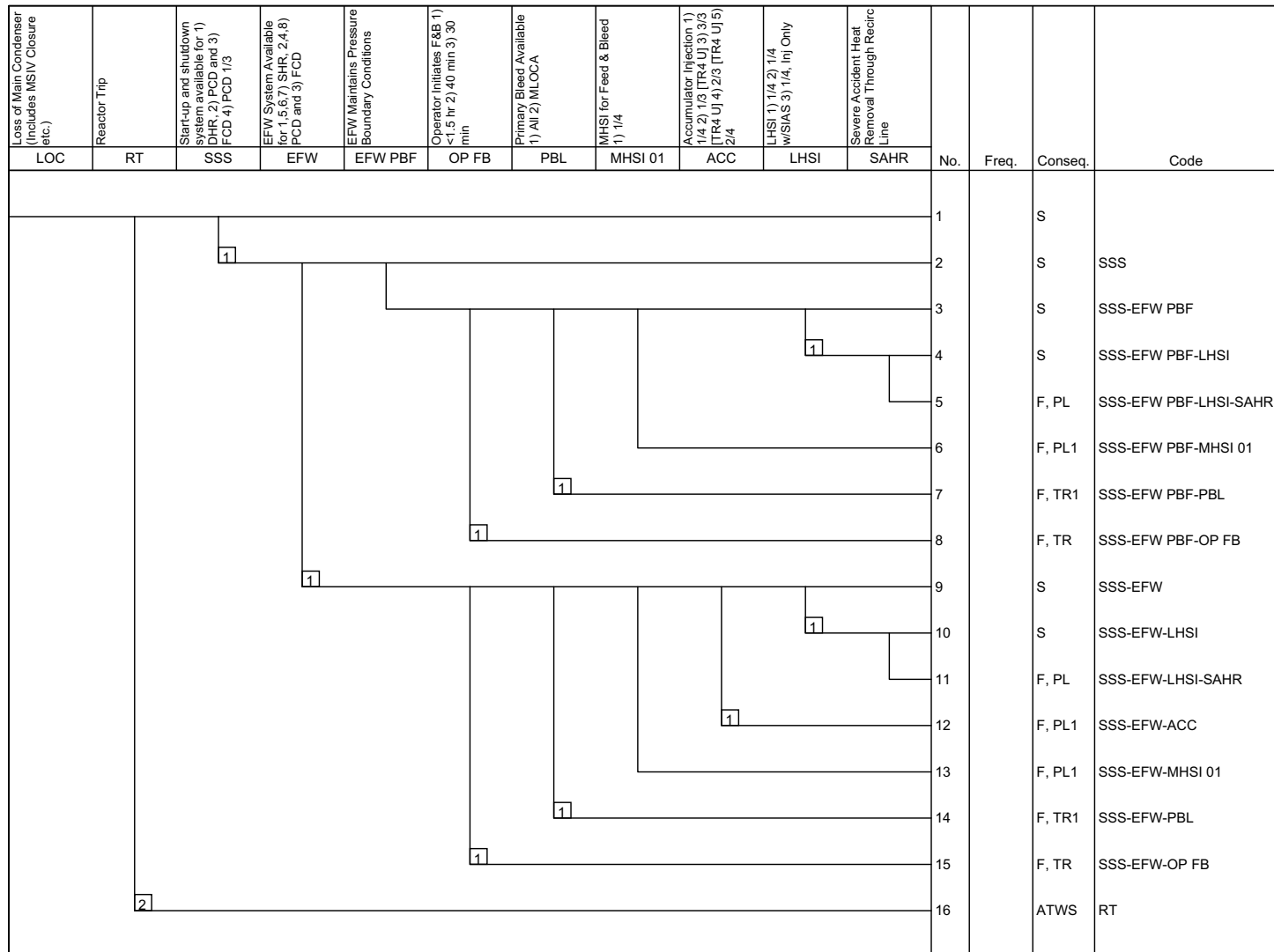
EPR6555 T2

Figure 19A-13—Large Loss-of-Coolant Accident

Large LOCA (>6-Inch Diameter)	MHSI 1) 1/4 (1/3 for MLOCA, 1/2 for LLOCA) 2) 2/4	Accumulator Injection 1) 1/4 2) 1/3 [TR4 U] 3) 3/3 [TR4 U] 4) 2/3 [TR4 U] 5) 2/4	LHSI 1) 1/4 2) 1/4 w/SIAS 3) 1/4, Inj Only	No.	Freq.	Conseq.	Code
LLOCA	MHSI	ACC	LHSI				
				1		S	
			2	2		F, LL	LHSI
		2		3		F, LL1	ACC
	1			4		S	MHSI
			2	5		F, LL	MHSI-LHSI
		4		6		F, LL1	MHSI-ACC

EPR6560 T2

Figure 19A-14—Loss of Main Condenser



EPR6565 T2

Figure 19A-15—Loss of Component Cooling Water or Emergency Service Water

Loss of COW/SESWS	(No) RCP Seal LOCA	MHSI 1) 1/4 (1/3 for MLOCA, 1/2 for LLOCA) 2) 2/4	Operator Initiates FSCD 1) 40 min 2) 30 min 3) 40 min During SBO	Main Feedwater	Start-up and shutdown system available for 1) DHR, 2) PCD and 3) FCD 4) PCD 1/3	EFW System Available for 1.5, 6.7) SHR, 2.4, 8) PCD and 3) FCD	EFW Maintains Pressure Boundary Conditions	Operator Initiates F&B 1) <1.5 hr 2) 40 min 3) 30 min	Primary Bleed Available 1) All 2) MLOCA	MHSI for Feed & Bleed 1) 1/4	Accumulator Injection 1) 1/4 2) 1/3 [TR4 U] 3) 3/3 [TR4 U] 4) 2/3 [TR4 U] 5) 2/4	LHSI 1) 1/4 2) 1/4 w/SAS 3) 1/4, Inj Only	Severe Accident Heat Removal Through Recirc Line	No.	Freq.	Conseq.	Code
LOCCW	RCP LOCA	MHSI	OP FCD	MFW	SSS	EFW	EFW PBF	OP FB	PBL	MHSI 01	ACC	LHSI	SAHR				
					1									1		S	MFW
														2		S	MFW-SSS
														3		S	MFW-SSS-EFW PBF
														4		S	MFW-SSS-EFW PBF-LHSI
														5		F, PL	MFW-SSS-EFW PBF-MHSI 01
														6		F, PL1	MFW-SSS-EFW PBF-PBL
														7		F, TR1	MFW-SSS-EFW PBF-OP FB
														8		F, TR	MFW-SSS-EFW
														9		S	MFW-SSS-EFW-LHSI
														10		F, PL	MFW-SSS-EFW-ACC
														11		F, PL1	MFW-SSS-EFW-MHSI 01
														12		F, PL1	MFW-SSS-EFW-PBL
														13		F, TR1	MFW-SSS-EFW-OP FB
														14		F, TR	RCP LOCA
														15		S	RCP LOCA-LHSI
														16		S	RCP LOCA-LHSI-SAHR
														17		F, SS	RCP LOCA-LHSI-SSS
														18		S	RCP LOCA-LHSI-LHSI
														19		S	RCP LOCA-LHSI-SSS-LHSI
														20		F, SS	RCP LOCA-LHSI-SSS-LHSI-SAHR
														21		S	RCP LOCA-LHSI-SSS-EFW PBF
														22		F, PL	RCP LOCA-LHSI-SSS-EFW PBF-LHSI
														23		F, SS1	RCP LOCA-LHSI-SSS-EFW PBF-PBL
														24		F, SS2	RCP LOCA-LHSI-SSS-EFW PBF-OP FB
														25		S	RCP LOCA-LHSI-SSS-EFW
														26		F, PL	RCP LOCA-LHSI-SSS-EFW-LHSI
														27		F, PL1	RCP LOCA-LHSI-SSS-EFW-ACC
														28		F, SS3	RCP LOCA-LHSI-SSS-EFW-PBL
														29		F, SS	RCP LOCA-LHSI-SSS-EFW-OP FB
														30		S	RCP LOCA-MHSI
														31		F, SS	RCP LOCA-MHSI-SAHR
														32		F, SS	RCP LOCA-MHSI-LHSI
														33		F, SS4	RCP LOCA-MHSI-ACC
														34		S	RCP LOCA-MHSI-SSS
														35		F, SS	RCP LOCA-MHSI-SSS-SAHR
														36		F, SS	RCP LOCA-MHSI-SSS-LHSI
														37		F, SS4	RCP LOCA-MHSI-SSS-ACC
														38		F, SS	RCP LOCA-MHSI-SSS-EFW PBF
														39		F, SS	RCP LOCA-MHSI-SSS-EFW
														40		F, SS5	RCP LOCA-MHSI-OP FCD

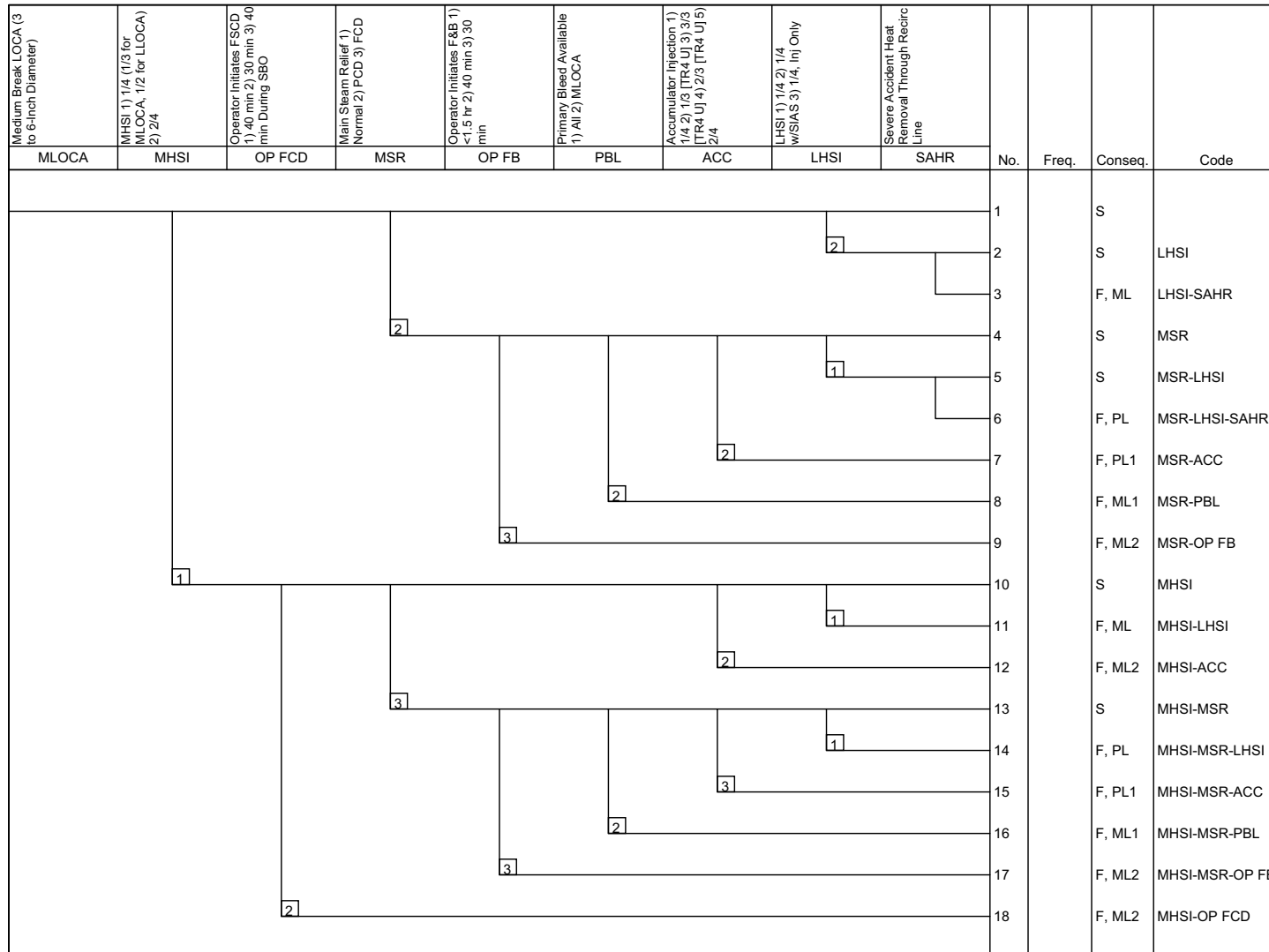
EPR6570 T2

Figure 19A-16—Loss of Main Feedwater

Total Loss of Main Feedwater	Reactor Trip	Start-up and shutdown system available for 1) DHR, 2) PCD and 3) FCD 4) PCD 1/3	EFW System Available for 1) SHR, 2) FCD and 3) FCD	EFW Maintains Pressure Boundary Conditions	Operator Initiates F&B 1) <1.5 hr 2) 40 min 3) 30 min	Primary Bleed Available 1) All 2) MLOCA	MHSI for Feed & Bleed 1) 1/4	Accumulator Injection 1) 1/4 2) 1/3 [TR4 U] 3) 3/3 [TR4 U] 4) 2/3 [TR4 U] 5) 2/4	LHSI 1) 1/4 2) 1/4 w/SIAS 3) 1/4, Inj Only	Severe Accident Heat Removal Through Recirc Line	No.	Freq.	Conseq.	Code
LOMFW	RT	SSS	EFW	EFW PBF	OP FB	PBL	MHSI 01	ACC	LHSI	SAHR				
											1		S	
		1									2		S	SSS
											3		S	SSS-EFW PBF
									1		4		S	SSS-EFW PBF-LHSI
											5		F, PL	SSS-EFW PBF-LHSI-SAHR
											6		F, PL 1	SSS-EFW PBF-MHSI 01
						1					7		F, TR1	SSS-EFW PBF-PBL
					1						8		F, TR	SSS-EFW PBF-OP FB
			1								9		S	SSS-EFW
									1		10		S	SSS-EFW-LHSI
											11		F, PL	SSS-EFW-LHSI-SAHR
								1			12		F, PL 1	SSS-EFW-ACC
											13		F, PL 1	SSS-EFW-MHSI 01
						1					14		F, TR1	SSS-EFW-PBL
					1						15		F, TR	SSS-EFW-OP FB
	2										16		ATWS	RT

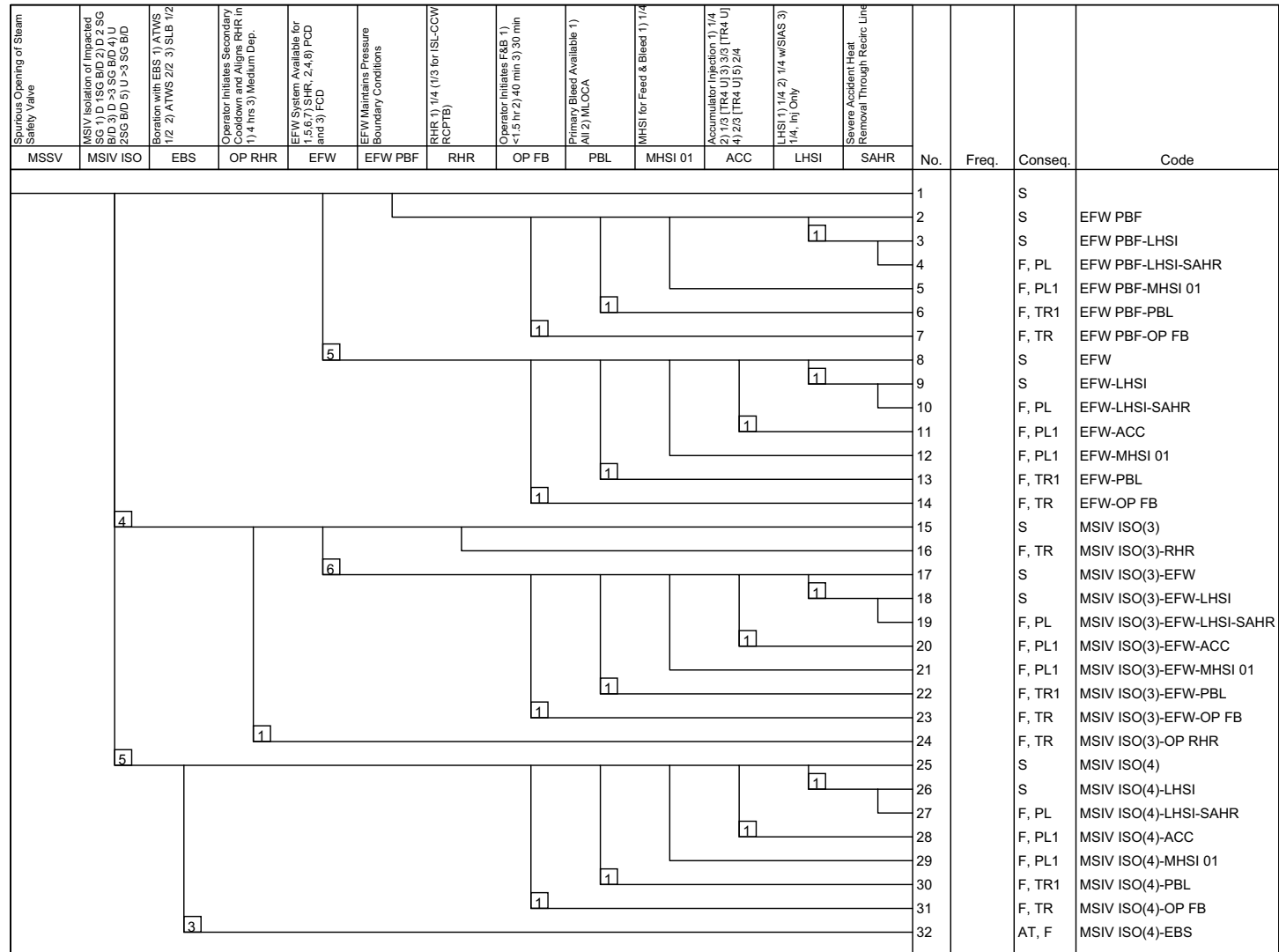
EPR6575 T2

Figure 19A-18—Medium Loss-of-Coolant Accident



EPR6585 T2

Figure 19A-19—Spurious Opening of Main Steam Safety Valve



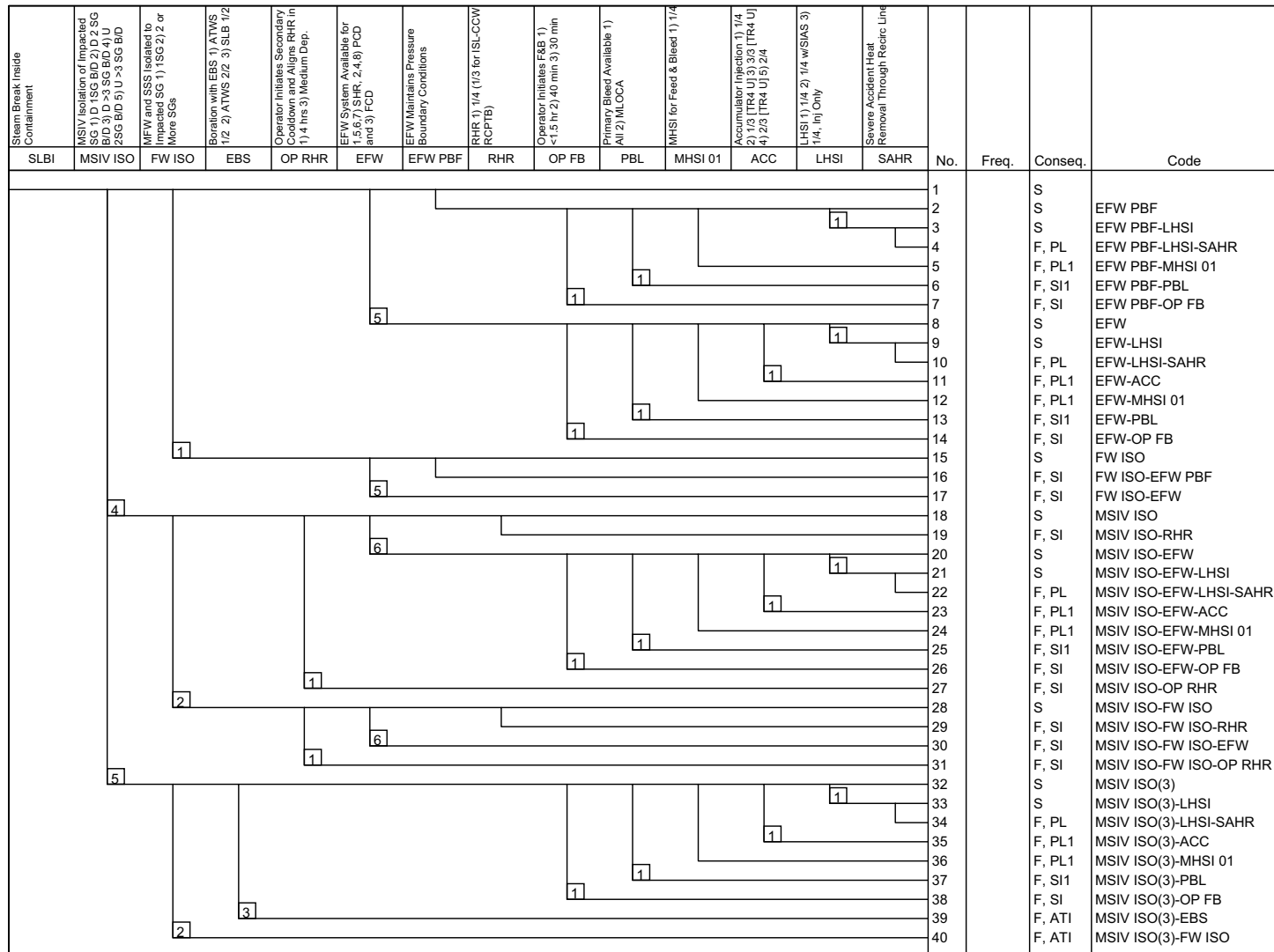
EPR6590 T2

Figure 19A-20—Steam Generator Tube Rupture

Steam Generator Tube Rupture	Operator Isolation of Impacted SG	Start-up and shutdown system available for 1) DHR, 2) PCD and 3) FCD 4) PCD 1/3	EFW System Available for 1.5, 6.7) SHR, 2.4.8) PCD and 3) FCD	EFW Maintains Pressure Boundary Conditions	Operator Initiates Secondary Cooldown and Aligns RHR in 1) 4 hrs 3) Medium Dep.	RHR 1) 1/4 (1/3 for ISL-CCW RCPTB)	Operator Initiates F&B 1) <1.5 hr 2) 40 min 3) 30 min	Primary Bleed Available 1) All 2) MLOCA	MHSI for Feed & Bleed 1) 1/4	Accumulator Injection 1) 1/4 2) 1/3 [TR4 U] 3) 3/3 [TR4 U] 4) 2/3 [TR4 U] 5) 2/4	LHSI 1) 1/4 2) 1/4 w/SIAS 3) 1/4, Inj Only	Severe Accident Heat Removal Through Recirc Line	No.	Freq.	Conseq.	Code
SGTR	SG ISO	SSS	EFW	EFW PBF	OP RHR	RHR	OP FB	PBL	MHSI 01	ACC	LHSI	SAHR	1		S	
		4											2		S	SSS
													3		S	SSS-EFW PBF
												1	4		S	SSS-EFW PBF-LHSI
													5		F, PL	SSS-EFW PBF-LHSI-SAHR
													6		F, PL1	SSS-EFW PBF-MHSI 01(3)
							1						7		F, SG1	SSS-EFW PBF-PBL
			4					1					8		F, SG	SSS-EFW PBF-OP FB
													9		S	SSS-EFW
												1	10		S	SSS-EFW-LHSI
													11		F, PL	SSS-EFW-LHSI-SAHR
												1	12		F, PL1	SSS-EFW-ACC
								1					13		F, PL1	SSS-EFW-MHSI 01
							1						14		F, SG1	SSS-EFW-PBL
													15		F, SG	SSS-EFW-OP FB
													16		S	SG ISO
						1							17		F, SG2	SG ISO-RHR
													18		F, SG2	SG ISO-OP RHR
		4											19		S	SG ISO-SSS
													20		F, SG2	SG ISO-SSS-RHR
						1							21		F, SG2	SG ISO-SSS-OP RHR
													22		S	SG ISO-SSS-EFW PBF
												1	23		S	SG ISO-SSS-EFW PBF-LHSI
													24		F, SG	SG ISO-SSS-EFW PBF-LHSI-SAHR
													25		F, SG	SG ISO-SSS-EFW PBF-MHSI 01
								1					26		F, SG	SG ISO-SSS-EFW PBF-PBL
							1						27		F, SG	SG ISO-SSS-EFW PBF-OP FB
			4										28		S	SG ISO-SSS-EFW
												1	29		S	SG ISO-SSS-EFW-LHSI
													30		F, SG	SG ISO-SSS-EFW-LHSI-SAHR
												1	31		F, SG	SG ISO-SSS-EFW-ACC
													32		F, SG	SG ISO-SSS-EFW-MHSI 01
							1						33		F, SG	SG ISO-SSS-EFW-PBL
								1					34		F, SG	SG ISO-SSS-EFW-OP FB

EPR6595 T2

Figure 19A-21—Steam-Line Break Inside Containment



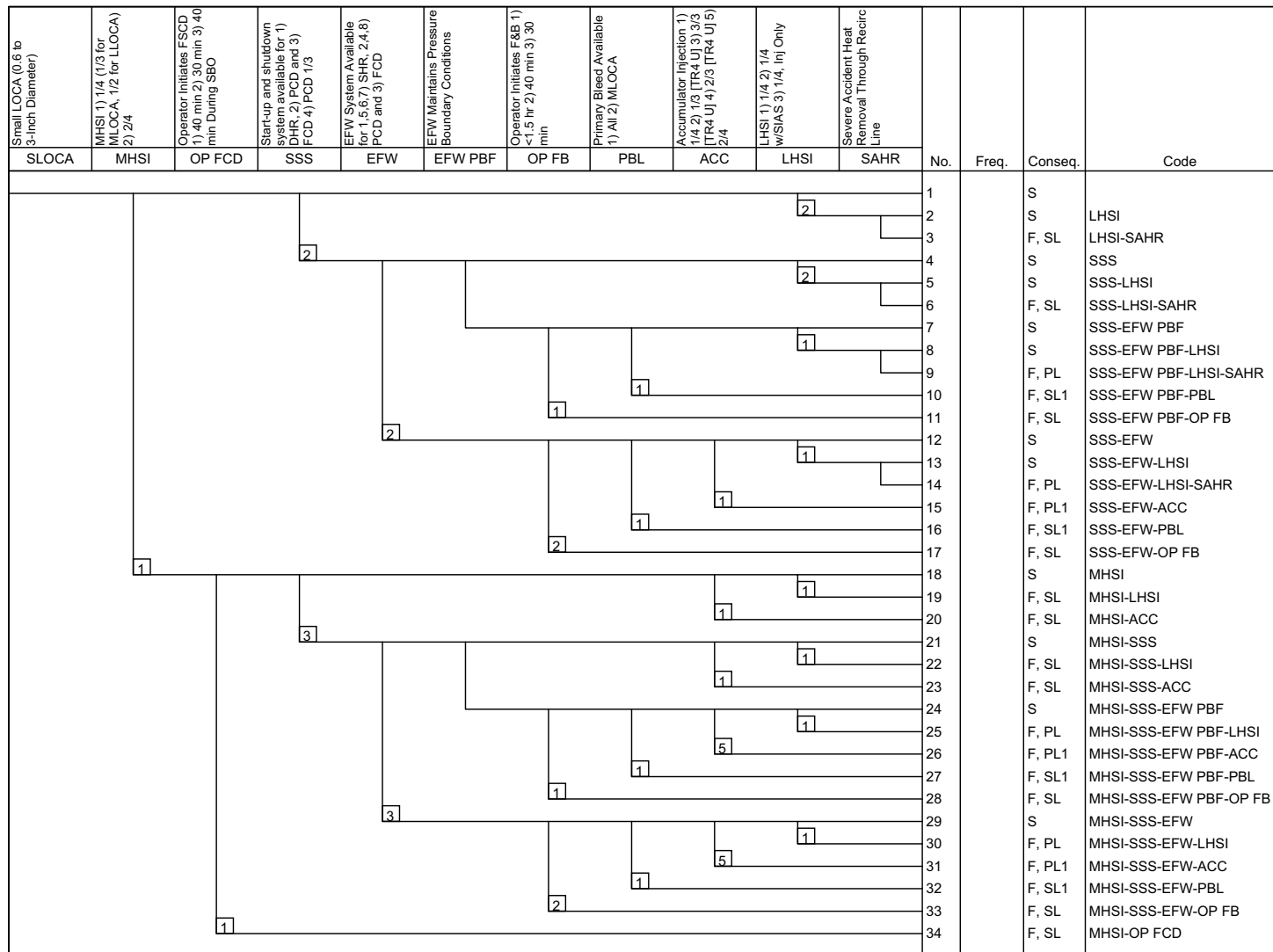
EPR6600 T2

Figure 19A-22—Steam Line Break Outside Containment

Steam Break Downstream of MSIV	MSIV ISO	EBS	OP RHR	EFW	EFW PBF	RHR	OP FB	PBL	MHSI 01	ACC	LHSI	SAHR	No.	Freq.	Conseq.	Code
SLBO	MSIV ISO	EBS	OP RHR	EFW	EFW PBF	RHR	OP FB	PBL	MHSI 01	ACC	LHSI	SAHR				
													1		S	EFW PBF
													2		S	EFW PBF-LHSI
													3		S	EFW PBF-LHSI-SAHR
													4		F, PL	EFW PBF-MHSI 01
													5		F, PL1	EFW PBF-PBL
													6		F, TR1	EFW PBF-OP FB
													7		F, TR	EFW
													8		S	EFW-LHSI
													9		S	EFW-LHSI-SAHR
													10		F, PL	EFW-ACC
													11		F, PL1	EFW-MHSI 01
													12		F, PL1	EFW-PBL
													13		F, TR1	EFW-OP FB
													14		F, TR	MSIV ISO
													15		S	MSIV ISO-EFW PBF
													16		S	MSIV ISO-EFW PBF-LHSI
													17		S	MSIV ISO-EFW PBF-LHSI-SAHR
													18		F, PL	MSIV ISO-EFW PBF-MHSI 01
													19		F, PL1	MSIV ISO-EFW PBF-PBL
													20		F, TR1	MSIV ISO-EFW PBF-OP FB
													21		F, TR	MSIV ISO-EFW
													22		S	MSIV ISO-EFW-LHSI
													23		S	MSIV ISO-EFW-LHSI-SAHR
													24		F, PL	MSIV ISO-EFW-ACC
													25		F, PL1	MSIV ISO-EFW-MHSI 01
													26		F, PL1	MSIV ISO-EFW-PBL
													27		F, TR1	MSIV ISO-EFW-OP FB
													28		F, TR	MSIV ISO(3)
													29		S	MSIV ISO(3)-RHR
													30		F, TR	MSIV ISO(3)-EFW
													31		S	MSIV ISO(3)-EFW-LHSI
													32		S	MSIV ISO(3)-EFW-LHSI-SAHR
													33		F, PL	MSIV ISO(3)-EFW-MHSI 01
													34		F, PL1	MSIV ISO(3)-EFW-PBL
													35		F, TR1	MSIV ISO(3)-EFW-OP FB
													36		F, TR	MSIV ISO(3)-OP RHR
													37		F, TR	MSIV ISO(4)
													38		S	MSIV ISO(4)-LHSI
													39		S	MSIV ISO(4)-LHSI-SAHR
													40		F, PL	MSIV ISO(4)-ACC
													41		F, PL1	MSIV ISO(4)-MHSI 01
													42		F, PL1	MSIV ISO(4)-PBL
													43		F, TR1	MSIV ISO(4)-OP FB
													44		F, TR	MSIV ISO(4)-EBS
													45		AT, F	
													46			

EPR6605 T2

Figure 19A-23—Small Loss-of-Coolant Accident



EPR6610 T2

Next File