

**This excel file is to provide the CDF sequences and calculation summary for the SPAR model example that was used to estimate LERF from C-SGTR sequences as documented in Appendix 2-D of the RASP Handbook Volume 5.**

**Table D-2 Summary Table**

07/27/2017

Category	In 38 CDF seqs.	in Residue (seqs. 39-711)	Total CDF subject to csgtr challenge	p(csgtr)	CDF (csgtr)	LERF (csgtr)
Plant CDF =	2.95E-05 96.26%	1.15E-06	3.07E-05			
1 HDL no RCS loop clearing	4.90E-06	1.90E-07	5.09E-06	0.024	1.2E-07	1.2E-07
2 HDL with RCS loop clearing	2.09E-07	8.13E-09	1.00E-08	1	1.0E-08	1.0E-08
3 Non HDL CDF with subsumed FSG				0.05	3.3E-08	3.3E-08
4 ATWS with failure of pressure relief	3.79E-07	1.47E-08	3.94E-07	0.05	2.0E-08	2.0E-08
5 Large SSB				0.02	3.0E-09	3.0E-09
		<b>Totals =</b>	<b>5.49E-06</b>		<b>1.9E-07</b>	<b>1.9E-07</b>
		% of plant CDF	18%		0.6%	

Note: No CAT-2 sequences were in the top 38 sequences. An examination of lower CDF sequences indicated that CAT-2 frequency is expected to be at the order of 1E-08, which is used in this table. A more rigorous calculation can be done by examining the cutsets with B1 and B2 seal failures coincident with AFW failures.

3.9E-09

This EXCEL file  
RASP Manual Section referring to this document.

Sequence List (4)

Conclusion: For this selected example plant CDF model, based on the top 33 CDF sequences, about 18% of the CDF would be subject to C-SGTR, as shown below.												
These top 33 sequences make up 96% of total plant CDF from internal events.											CDF Seqs 1-38	2.95E-05
											HDL Cat-1 only in 1-38	4.90E-06
											HDL Cat-2 only in 1-38	2.09E-07
											Cat-4 only in 1-38	3.79E-07
<b>04/24/2015 0:00</b>												
<b>VOGTLE SPAR MODEL</b>			<b>Dominant Sequence Results</b>									
			<b>1-38</b>			<b>39-711</b>			<b>1-711</b>			
<b>Totals=</b>			<b>3.07E-05</b>			<b>Plant CDF =</b>			<b>Plant CDF % =</b>			
			2.95E-05			1.15E-06			3.07E-05			
			96.26%			3.74%			100.00%			
Event Tree	Sequence	CDF	Description	AFW	LOOP	EDG	RCS Pressure (/RSD or LPI)	RCP SLOCA, OR LOCA	Category	RPS, RCS PRESS		
1	LONSW	04-02-10	1.67E-05	IEFT-LONSCW, /RPS, /AFW, /PORV, LOCS-NSW, REC-NSW, /RCPT, /RSD, /BP1, BP2, HPI, SSC1			low	182 gpm	OK-1			
2	LOACA	20	2.50E-06	/RPS, AFW, MFW, FAB	Fails		high		cat-1			
3	LOACA	02-02-03	2.23E-06	/RPS, /AFW, /PORV, LOCS, /RCPT, /RSD, /BP1, BP2, /HPI, /SSC, RHR, LPR			low	182 gpm	OK-1			
4	LOACA	02-02-09	1.91E-06	/RPS, /AFW, /PORV, LOCS, /RCPT, /RSD, /BP1, BP2, HPI, /SSC1, LPI			low	182 gpm	OK-1			
5	LONSW	04-03-10	8.36E-07	IEFT-LONSCW, /RPS, /AFW, /PORV, LOCS-NSW, REC-NSW, /RCPT, /RSD, BP1, /BP2, HPI, SSC1			high	76 gpm	OK-1			
6	LOACA	19	5.74E-07	/RPS, AFW, MFW, /FAB, SSCR, HPR	Fails		high		cat-1			
7	ISL-RHR	3	3.89E-07	ISL-RPT-RHR, /ISL-DIAG, ISL-REC-RHR			ISL low		OK-3			
8	TRANS	21-16	3.79E-07	RPS, RCS PRESS			ATWS high		cat-4	ATWS Pres. Spike		
9	MLOCA	03	3.49E-07	/RPS, /HPI-ML, /AFW-ATWS, /SSC, HPR, LPR			low	MLOCA	OK-2			
10	TRANS	20	3.15E-07	/RPS, AFW, MFW, FAB	Fails		high		cat-1			
11	LOOPWR	16-03-10	2.61E-07	/RPS-L, EPS, /AFW-B, /PORV, /RSD-B, /BP1, /BP2, OPR-04H, DGR-04H, AFW-MAN, SG-DEP-LT	Fails	Loop	Fails	high	21 gpm	cat-1		
12	LOOPWR	16-06	2.18E-07	/RPS-L, EPS, /AFW-B, /PORV, /RSD-B, /BP1, BP2, OPR-04H, DGR-04H	Late fails	Loop	Fails	high	182 gpm	cat-1		
13	LONSW	04-04-10	2.09E-07	IEFT-LONSCW, /RPS, /AFW, /PORV, LOCS-NSW, REC-NSW, /RCPT, /RSD, BP1, BP2, HPI-ML, /ACC, /AFW-ATWS, /SSC, LPI			lsc	480 gpm	cat-2			
14	LOOPGR	15	2.08E-07	/RPS-L, /EPS, AFW-L, FAB-L	Fails	Loop		high		cat-1		
15	LOOPGR	16-03-10	1.73E-07	/RPS-L, EPS, /AFW-B, /PORV, /RSD-B, /BP1, /BP2, OPR-04H, DGR-04H, AFW-MAN, SG-DEP-LT	Fails	Loop	Fails	high	21 gpm	cat-1		
16	LOOPWR	16-45	1.64E-07	/RPS-L, EPS, AFW-B, OPR-04H, DGR-04H	Fails	Loop	Fails	high		cat-1		
17	ISL-RHR	4	1.50E-07	ISL-RPT-RHR, ISL-DIAG			ISL low		OK-3			
18	LOOPGR	16-06	1.44E-07	/RPS-L, EPS, /AFW-B, /PORV, /RSD-B, /BP1, BP2, OPR-04H, DGR-04H	Late fails	Loop	Fails	high	182 gpm	cat-1		
19	LODCA	02-02-03	1.21E-07	/RPS, /AFW, /PORV, LOCS, /RCPT, /RSD, /BP1, BP2, /HPI, /SSC, RHR, LPR			low	182 gpm	OK-1			
20	TRANS	02-02-09	1.19E-07	/RPS, /AFW, /PORV, LOCS, /RCPT, /RSD, /BP1, BP2, HPI, /SSC1, LPI			low	182 gpm	OK-1			
21	LOOPSC	15	1.13E-07	/RPS-L, /EPS, AFW-L, FAB-L	Fails	Loop			cat-1			
22	LOACA	02-03-03	1.12E-07	/RPS, /AFW, /PORV, LOCS, /RCPT, /RSD, BP1, /BP2, /HPI, /SSC, RHR, LPR			low	76 gpm	OK-1			
23	LODCA	02-02-09	1.09E-07	/RPS, /AFW, /PORV, LOCS, /RCPT, /RSD, /BP1, BP2, HPI, /SSC1, LPI			low	182 gpm	OK-1			
24	LOOPGR	16-45	1.08E-07	/RPS-L, EPS, AFW-B, OPR-04H, DGR-04H	Fails	Loop	Fails		cat-1			
25	LODCB	02-02-09	1.06E-07	/RPS, /AFW, /PORV, LOCS, /RCPT, /RSD, /BP1, BP2, HPI, /SSC1, LPI			low	182 gpm	OK-1			
26	RXVRUPT	2	1.00E-07	RXVESSEL					OK-4			
27	MLOCA	10	9.74E-08	/RPS, HPI-ML, /ACC, /AFW-ATWS, /SSC, LPI			low	MLOCA	OK-2			

Sequence List (4)

28	LOACA	02-03-09	9.54E-08	/RPS, /AFW, /PORV, LO SC, /RCPT, /RSD, BP1, /BP2, HPI, /SSC1, LPI				low	76 gpm	OK-1		
29	LONSW	04-14-10	8.46E-08	IEFT-LONSCW, /RPS, /AFW, /PORV, LO SC-NSW, REC-NSW, RCPT, HPI-ML, /ACC, /AFW-ATWS, /SSC, LPI				low		OK-1		
30	<b>LOOPGR</b>	<b>02-02-09</b>	<b>8.46E-08</b>	<b>/RPS-L, /EPS, /AFW-L, /PORV-L, LO SC-L, /RSD-L, /BP1, BP2, /OPR-02H, /RPS, /AFW, HPI, /SSC1, LPI</b>		Loop		low	76 gpm	OK-1		
31	SLOCA	03	8.38E-08	/RPS, /AFW, /HPI, /SSC, RHR, LPR				low	SLOCA	OK-1		
32	SGTR	12	8.23E-08	/RPS, /AFW, /HPI, SGI, REFILL1, ECA						SGTR		
33	<b>TRANS</b>	<b>02-02-03</b>	<b>7.91E-08</b>	<b>/RPS, /AFW, /PORV, LO SC, /RCPT, /RSD, /BP1, BP2, /HPI, /SSC, RHR, LPR</b>				low	76 gpm	OK-1		
34	<b>LOOPSC</b>	<b>02-02-09</b>	<b>7.21E-08</b>	<b>/RPS-L, /EPS, /AFW-L, /PORV-L, LO SC-L, /RSD-L, /BP1, BP2, /OPR-02H, /RPS, /AFW, HPI, /SSC1, LPI</b>		Loop			182 gpm	OK-1		
35	LOOPWR	15	6.64E-08	/RPS-L, /EPS, AFW-L, FAB-L	Fails	Loop				cat-1		
36	TRANS	21-14	6.24E-08	RPS, /RCSPRESS, MFW, /AFW-ATWS, BORATION						ATWS		
37	<b>LODCB</b>	<b>02-02-03</b>	<b>5.57E-08</b>	<b>/RPS, /AFW, /PORV, LO SC, /RCPT, /RSD, /BP1, BP2, /HPI, /SSC, RHR, LPR</b>				low		OK-1		
38	LOMFW	20	5.44E-08	/RPS, AFW, MFW, FAB	Fails					cat-1		
39	LOACA	02-04-12	5.18E-08	/RPS, /AFW, /PORV, LO SC, /RCPT, /RSD, BP1, BP2, HPI-ML, /ACC, AFW-ATWS	Fails				480 gpm			
40	LOOPGR	16-10-2	4.81E-08	/RPS-L, EPS, /AFW-B, /PORV, /RSD-B, BP1, BP2, /OPR-02H, /HPI, /SSC, LPR		Loop	Fails		480 gpm			
41	LOCHS	12	4.62E-08	/RPS, AFW, FAB	Fails					cat-1		
42	LOOPSC	16-10-2	4.10E-08	/RPS-L, EPS, /AFW-B, /PORV, /RSD-B, BP1, BP2, /OPR-02H, /HPI, /SSC, LPR		Loop	Fails		480 gpm			
43	LOOPGR	16-04-2	4.07E-08	/RPS-L, EPS, /AFW-B, /PORV, /RSD-B, /BP1, BP2, /OPR-04H, /HPI, /SSC, LPR		Loop	Fails					
44	LOOPGR	16-04-7	4.00E-08	/RPS-L, EPS, /AFW-B, /PORV, /RSD-B, /BP1, BP2, /OPR-04H, HPI, /SSC, LPI		Loop	Fails					
45	<b>LOACA</b>	<b>02-02-10</b>	<b>3.82E-08</b>	<b>/RPS, /AFW, /PORV, LO SC, /RCPT, /RSD, /BP1, BP2, HPI, SSC1</b>								
46	LOMFW	21-16	3.79E-08	RPS, RCSPRESS						cat-4	Pres. Spike	
47	LOCHS	13-16	3.22E-08	RPS, RCSPRESS						cat-4	Pres. Spike	
48	LOACA	21-15	2.86E-08	RPS, /RCSPRESS, MFW, AFW-ATWS	Fails							
49	SGTR	19	2.84E-08	/RPS, AFW, /HPI, /SGI, FAB	Fails					SGTR		
50	<b>LOOPWR</b>	<b>02-02-09</b>	<b>2.71E-08</b>	<b>/RPS-L, /EPS, /AFW-L, /PORV-L, LO SC-L, /RSD-L, /BP1, BP2, /OPR-02H, /RPS, /AFW, HPI, /SSC1, LPI</b>		Loop						
51	LOOPGR	02-05	2.60E-08	/RPS-L, /EPS, /AFW-L, /PORV-L, LO SC-L, /RSD-L, /BP1, BP2, OPR-02H, HPI-L		Loop						
52	ISL-LPI	3	2.27E-08	ISL-RPT-LPI, /ISL-DIAG, ISL-REC-LPI				ISL low				
53	LOACA	02-14-12	2.12E-08	/RPS, /AFW, /PORV, LO SC, RCPT, HPI-ML, /ACC, AFW-ATWS	Fails							
54	LOPPC	15	2.08E-08	/RPS-L, /EPS, AFW-L, FAB-L	Fails	Loop				cat-1		
55	<b>LOOPSC</b>	<b>16-03-10</b>	<b>1.99E-08</b>	<b>/RPS-L, EPS, /AFW-B, /PORV, /RSD-B, /BP1, /BP2, OPR-04H, DGR-04H, AFW-MAN, SG-DEP-LT</b>	Fails	Loop	Fails					
56	LODCB	20	1.86E-08	/RPS, AFW, MFW, FAB	Fails							
57	LLOCA	2	1.79E-08	/ACC, /LPI, LPR-LL					LLOCA	OK-2		
58	SGTR	09	1.72E-08	/RPS, /AFW, /HPI, /SGI, SSC, REFILL1, ECA								
59	LONSW	04-06-10	1.67E-08	IEFT-LONSCW, /RPS, /AFW, /PORV, LO SC-NSW, REC-NSW, /RCPT, RSD, /BP1, /O1, /BP2, O2, HPI, SSC1								
60	LONSW	04-08-10	1.67E-08	IEFT-LONSCW, /RPS, /AFW, /PORV, LO SC-NSW, REC-NSW, /RCPT, RSD, /BP1, O1, /BP2, /O2, HPI, SSC1								
61	LONSW	04-09-10	1.67E-08	IEFT-LONSCW, /RPS, /AFW, /PORV, LO SC-NSW, REC-NSW, /RCPT, RSD, /BP1, O1, /BP2, O2, HPI, SSC1								



	<b>Fault Tree</b>	<b>Description</b>
1	ACC	ACCUMULATOR 3-OF-3
2	AFW	AUXILIARY FEEDWATER
3	AFW-ATWS	AUXILIARY FEEDWATER
4	AFW-B	AUXILIARY FEEDWATER (BLACKOUT)
5	AFW-L	VOGTLE AFW USING LOOP-FTF FAULT TREE FLAGS FAULT TREE
6	AFW-MAN	MANUAL CONTROL AFW
7	BORATION	EMERGENCY BORATION
8	BP1	RCP SEAL STAGE 1 INTEGRITY (BINDING/POPPING)
9	BP2	RCP SEAL STAGE 2 INTEGRITY (BINDING/POPPING)
10	CSI	TERMINATE OR CONTROL SAFETY INJECTION
11	CST-REFILL	CONDENSATE STORAGE TANK REFILL
12	CST-REFILL-LT	CONDENSATE STORAGE TANK REFILL LONG-TERM
13	CST-REFILL-LT1	CONDENSATE STORAGE TANK REFILL LONG-TERM
14	DGR-01H	OPERATOR FAILS TO RECOVER EMERGENCY DIESEL IN 1 HOUR
15	DGR-02H	OPERATOR FAILS TO RECOVER EMERGENCY DIESEL IN 2 HOURS
16	DGR-03H	OPERATOR FAILS TO RECOVER EMERGENCY DIESEL IN 3 HOURS
17	DGR-04H	DIESEL GENERATOR RECOVERY (IN 4 HR)
18	DGR-06H	OPERATOR FAILS TO RECOVER EMERGENCY DIESEL IN 6 HOURS
19	DGR-08H	OPERATOR FAILS TO RECOVER EMERGENCY DIESEL IN 8 HOURS
20	DGR-30M	OPERATOR FAILS TO RECOVER EMERGENCY DIESEL IN 30 MINUTES
21	ECA	DECAY HEAT REMOVAL /RECOVERY (ECA-3.1/3.2)
22	EPS	EMERGENCY POWER
23	FAB	FEED AND BLEED
24	FAB-L	VOGTLE FEED AND BLEED IS UNAVAILABLE using LOOP-FTF
25	FAB-NSW	FEED AND BLEED IS UNAVAILABLE USING LONSW-FTF
26	FAB2	FEED AND BLEED (1 PORV REQUIRED)
27	HPI	HIGH PRESSURE INJECTION
28	HPI-L	HIGH PRESSURE INJECTION
29	HPI-ML	HIGH PRESSURE INJECTION
30	HPR	HIGH PRESSURE RECIRC
31	HPR-L	HIGH PRESSURE RECIRC
32	HPR-ML	HIGH PRESSURE RECIRCULATION
33	HPR1	HIGH PRESSURE RECIRCULATION
34	IE-ISL-HPI	ISLOCA IE 2-CKV HPI interface
35	IE-ISL-LPI	ISLOCA IE 2-CKV LPI interface
36	IE-ISL-RHR	RHR pipe ruptures

37	IE-LOACCW	LOSS OF AUXILIARY COMPONENT COOLING WATER
38	IE-LONSW	LOSS OF NUCLEAR SERVICE COOLING WATER
39	IE-LOOP	LOSS OF OFFSITE POWER
40	IE-SGTR	SG TUBE RUPTURE
41	IE-SLBIC	STEAMLINE BREAK INSIDE CONTAINMENT INITIATOR
42	IEFT-LOACW	AUXILIARY COMPONENT COOLING WATER (IE FT)
43	IEFT-LONSCW	NUCLEAR SERVICE COOLING WATER (IE FAULT TREE)
44	ISL-DIAG	Operators fail to diagnose ISLOCA
45	ISL-REC-HPI	Operators fail to recover (isolate) ISLOCA
46	ISL-REC-LPI	Operators fail to recover (isolate) ISLOCA
47	ISL-REC-RHR	Operators fail to recover (isolate) ISLOCA
48	ISL-RPT-HPI	HPI pipe ruptures
49	ISL-RPT-LPI	LPI pipe ruptures
50	ISL-RPT-RHR	RHR/SDC pipe ruptures
51	LOSC	RCP SEAL COOLING MAINTAINED
52	LOSC-ACCW	LOSS OF SEAL COOLING
53	LOSC-L	VOGTLE RCP SL USING LOOP-FTF FAULT TREE FLAGS
54	LOSC-NSW	LOSS OF SEAL COOLING
55	LOSC-TT	LOSS OF SEAL COOLING (TURBINE TRIP)
56	LPI	LOW PRESSURE INJECTION
57	LPI-NSW	LOW PRESSURE INJECTION - LONSW
58	LPR	LOW PRESSURE RECIRC
59	LPR-LL	LOW PRESSURE RECIRCULATION
60	LPR-NSW	LOW PRESSURE RECIRCULATION - LONSW
61	MFW	MAIN FEEDWATER
62	O1	RCP SEAL STAGE 1 INTEGRITY (O-RING EXTRUSION)
63	O2	RCP SEAL STAGE 2 INTEGRITY (O-RING EXTRUSION)
64	OPR	OFFSITE POWER RECOVERY
65	OPR-01H	OPERATOR FAILS TO RECOVER OFFSITE POWER IN 1 HOUR
66	OPR-02H	OFFSITE POWER RECOVERY IN 2 HRS
67	OPR-03H	OPERATOR FAILS TO RECOVER OFFSITE POWER IN 3 HOURS
68	OPR-04H	OFFSITE POWER RECOVERY (IN 4 HR)
69	OPR-06H	OFFSITE POWER RECOVERY IN 6 HRS
70	OPR-08H	OPERATOR FAILS TO RECOVER OFFSITE POWER IN 8 HOURS
71	OPR-30M	OPERATOR FAILS TO RECOVER OFFSITE POWER IN 30 MINUTES
72	PORV	PORVs ARE CLOSED
73	PORV-B	VOGTLE PORVs/SRVs OPEN DURING STATION BLACKOUT
74	PORV-L	VOGTLE PORVs/SRVs OPEN DURING LOOP
75	PORV1	VOGTLE PORVs/SRVs OPEN DURING TRANSIENTS (AFW FAILED)
76	PORV2	PORVs ARE CLOSED

77	PWR-REC	LATE POWER RECOVERY
78	PWR-REC-06H	LATE POWER RECOVERY (6 HR)
79	PWR-REC-07H	LATE POWER RECOVERY (7 HR)
80	PWR-REC-09H	LATE POWER RECOVERY (9 HR)
81	PWR-REC-15H	LATE POWER RECOVERY (15 HR)
82	PWR-REC-24H	LATE POWER RECOVERY (24 HR)
83	RCPT	REACTOR COOLANT PUMPS TRIPPED
84	RCSPRESS	RCS PRESSURE LIMITED
85	REC-NSW	NSCW RECOVERY
86	REFILL	RWST REFILL
87	REFILL1	RWST REFILL
88	RHR	RESIDUAL HEAT REMOVAL
89	RPS	REACTOR TRIP
90	RPS-L	REACTOR SHUTDOWN
91	RSD	RAPID SECONDARY DEPRESSURIZATION (<1710 PSI IN 2 HR)
92	RSD-B	RAPID SECONDARY DEPRESS
93	RSD-L	RAPID SECONDARY DEPRESS
94	RXVESSEL	REACTOR VESSEL RUPTURES
95	SG-DEP-LT	DEPRESSURIZE SGs
96	SGI	FAULTED STEAM GENERATOR ISOLATION
97	SSC	COOLDOWN (PRIMARY & SECONDARY)
98	SSC1	COOLDOWN (PRIMARY & SECONDARY)
99	SSCR	SECONDARY SIDE COOLING RECOVERED



	<b>Event Tree</b>	<b>Initiator</b>	<b>Description</b>
1	ISL-HPI	IE-ISL-HPI	Vogtle SI cold leg discharge ISLOCA
2	ISL-LPI	IE-ISL-LPI	Vogtle RHR discharge ISLOCA
3	ISL-RHR	IE-ISL-RHR	Vogtle RHR suction ISLOCA
4	LLOCA	IE-LLOCA	Vogtle large loss-of-coolant accident
5	LOACA	IE-LOACA	Vogtle loss of vital ac 1AA02 bus
6	LOACCW	IE-LOACCW	Vogtle loss of auxiliary component cooling water
7	LOCHS	IE-LOCHS	Vogtle loss of condenser heat sink
8	LODCA	IE-LODCA	Vogtle loss of vital dc 1AD1 bus
9	LODCB	IE-LODCB	Vogtle loss of vital dc 1BD1 bus
10	LOMFW	IE-LOMFW	Vogtle loss of main feedwater
11	LONSW	IE-LONSW	Vogtle loss of nuclear service cooling water
12	LOOPGR	IE-LOOPGR	Vogtle loss of offsite power (Grid related)
13	LOOPPC	IE-LOOPPC	Vogtle loss of offsite power (Plant Centered)
14	LOOPSC	IE-LOOPSC	Vogtle loss of offsite power (Switchyard centered)
15	LOOPWR	IE-LOOPWR	Vogtle loss of offsite power (Weather related)
16	MLOCA	IE-MLOCA	Vogtle medium loss-of-coolant accident
17	RXVRUPT	IE-XLOCA	Vogtle reactor vessel rupture
18	SGTR	IE-SGTR	Vogtle steam generator tube rupture
19	SLOCA	IE-SLOCA	Vogtle small loss-of-coolant accident
20	TRANS	IE-TRANS	Vogtle general transient



			<b>SGTR</b>	<b>LSSB and C-SGTR</b>	<b>Comment on LSSB</b>			
	IEV frequency		2.07E-03	1.0E-03	Rare event, not expected to occur during plan			
	CCDP		7.23E-05	1.45E-04	2 times the CCDP of SGTR due to less favora			
	p(csgtr)			0.02	From Table 2.4-1			
	CDF		1.50E-07	3.E-09				
	<b>C-SGTR in SSB Event Tree</b>							
	IE-LSSB	RPS	C-SGTR SSB	CCDP of LSSB	End State			
					No C-SGTR			
		Success			OK			
	Occurs	~1	C-SGTR		CD with C-SGTR			
	1.00E-03		0.02	1.45E-04	3.E-09			
		Fails			Transfer to ATWS ET			
		small						

ATWS C-SGTR Models

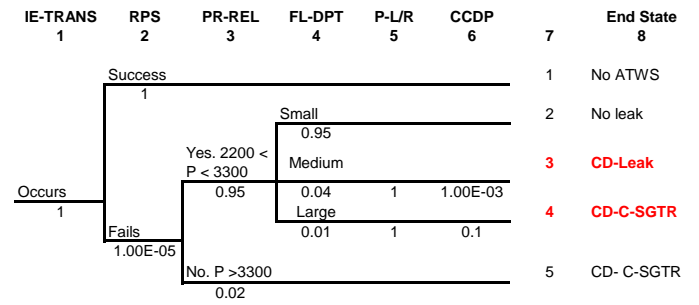
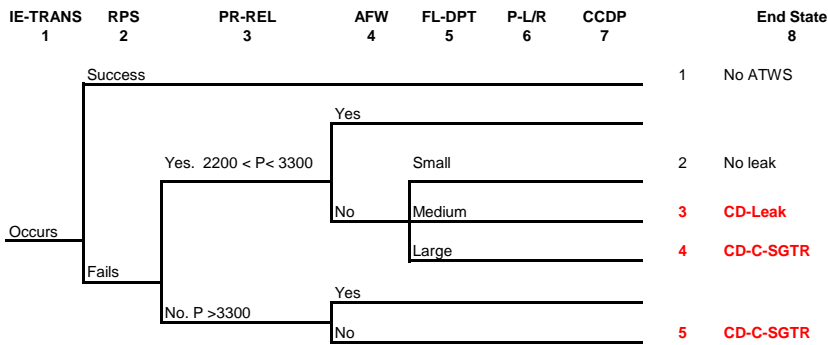


Figure 3-1. ATWS Event Tree Top Events to Address Type-II C-SGTR

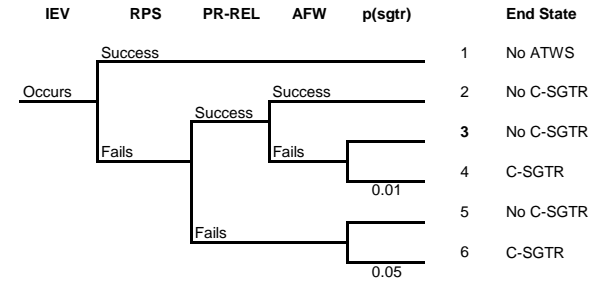
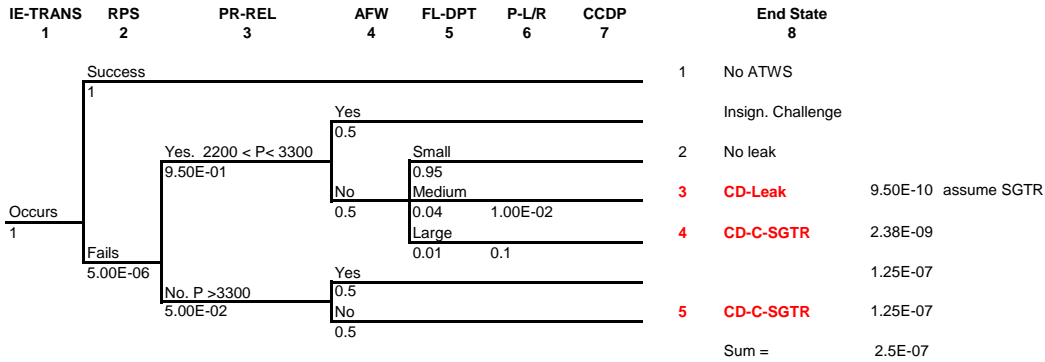
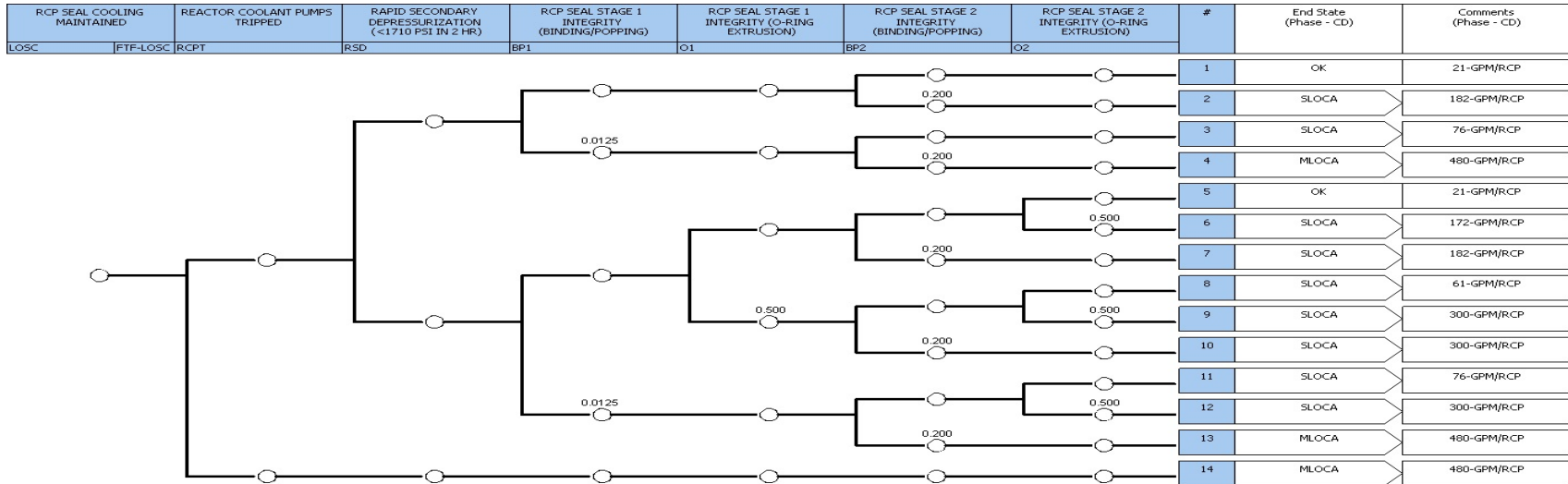


Figure 3-2. ATWS Event Tree Top Events to Address Type-II C-SGTR – Example Quantification

- 5 FL-DPT This node represents the probability of getting a "small", or a "medium", or a "large" flaw depth, given a flaw is originated since the last refueling outage. Any flaws of depth 40% or less are assumed identified and their tubes are plugged, if they have occurred before the last outage.
- 6 P-L/R This node represents the probability of leak or C-SGTR given that a flaw with depth specified in the FL-DPT node exists.
- 7 CCDP This is the CCDP assigned to the sequence defined so far with Node 1 through 6 in the event tree. This CCDP represents the additional failures needed to reach core damage end state, given that the sequence in question has progressed to the point defined by Nodes 1 through 6.

### RCP Seal LOCA Model in SPAR



LOSC  
 RCPT  
 RCS PRESS  
 RSD

RCP SEAL COOLING MAINTAINED  
 REACTOR COOLANT PUMPS TRIPPED  
 RCS PRESSURE LIMITED  
 RAPID SECONDARY DEPRESSURIZATION (<1710 PSI IN 2 HR)

480 gpm/pump seal LOCA occurs if LOSP and RCPT OR if LOSC and BP1 and BP2. Then, loop seal clearing occurs.

Table 2.3-1. Probability that a Detected Flaw Belongs to a Bin Size

		Flaw Length						Total			
		0 to 1 cm	1 to 2 cm	2 to 3 cm	3 to 4 cm	4 to 5 cm	5 to 6 cm				
Flaw Depth %/100	0 to 0.1	2.74E-03	4.62E-02	2.23E-02	5.38E-03	1.04E-03	1.80E-04	7.78E-02			
	0.1 to 0.2	1.86E-02	3.14E-01	1.52E-01	3.66E-02	7.08E-03	1.23E-03	5.30E-01			
	0.2 to 0.3	9.59E-03	1.62E-01	7.81E-02	1.89E-02	3.64E-03	6.31E-04	2.73E-01			
	0.3 to 0.4	3.09E-03	5.21E-02	2.52E-02	6.07E-03	1.17E-03	2.03E-04	8.78E-02	8.78E-02		
	0.4 to 0.5	8.47E-04	1.43E-02	6.90E-03	1.66E-03	3.22E-04	5.57E-05	2.41E-02	2.41E-02		
	0.5 to 0.6	2.14E-04	3.61E-03	1.74E-03	4.21E-04	8.13E-05	1.41E-05	6.08E-03	6.08E-03		
	0.6 to 0.7	5.14E-05	8.67E-04	4.19E-04	1.01E-04	1.95E-05	3.38E-06	1.46E-03	1.46E-03	5.43E-04	
	0.7 to 0.8	1.19E-05	2.01E-04	9.73E-05	2.35E-05	4.54E-06	7.86E-07	3.39E-04	3.39E-04	1.26E-04	
	0.8 to 0.9	2.71E-06	4.57E-05	2.21E-05	5.32E-06	1.03E-06	1.78E-07	7.70E-05	7.70E-05	2.86E-05	
	0.9 to 1.0	small									
<b>Total</b>		3.51E-02	5.93E-01	2.87E-01	6.92E-02	1.34E-02	2.32E-03	1.00E+00	1.00E+00	1.20E-01	6.98E-04