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SUBJECT: Responds to 881123 GL 88-20,Individual Plant Exam For Severe Accident Vulnerabilities.

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November 11, 1993

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Ladies/Gentlemen:

Docket 50-305
Operating License DPR-43
Kewaunee Nuclear Power Plant
Response to Generic Letter 88-20, Individual Plant Examination

References:
1) NRC Generic Letter 88-20, Individual Plant Examination for Severe Accident Vulnerabilities - 10 CFR 50.54(f), dated November 23, 1988
2) Letter from C. R. Steinhardt (WPSC) to NRC Document Control Desk dated November 1, 1989
3) Letter from C. R. Steinhardt (WPSC) to NRC Document Control Desk dated October 14, 1991
4) Letter from C. R. Steinhardt (WPSC) to NRC Document Control Desk dated December 1, 1992
5) NUREG-1275, Vol. 9, "Operating Experience Feedback Report - Pressure Locking and Thermal Binding of Gate Valves" dated March, 1993

Generic Letter 88-20 (reference 1) requested that all licensees perform Individual Plant Examinations (IPEs). Wisconsin Public Service Corporation (WPSC) submitted the response to Generic Letter 88-20 for the Kewaunee Nuclear Power Plant (KNPP) in letters dated November 1, 1989, October 14, 1991, and December 1, 1992 (references 2, 3, and 4). Reference 4 provided the WPSC IPE Summary Report for the KNPP. Tables 1.4-1 and 6-1 of the IPE Summary Report list plant improvements that were made, or will be made, as a result of the IPE. One of these improvements is to "modify the normal position of two motor operated valves located on the low pressure safety injection (SI) line from open to closed."

Since then, the NRC issued NUREG-1275, Vol. 9 (reference 5), which states that certain valves are susceptible to pressure locking and thermal binding. The valves mentioned above, designated SI-302A and SI-302B in the plant, are among the valves that WPSC engineering staff has determined may be subject to this phenomenon.

A011 1/1

Each of these valves are isolated from the reactor coolant system (RCS) by two check valves. Leakage past these valves would cause the line downstream of SI-302A or SI-302B to pressurize to near RCS pressure (2235 psig), while the upstream side would stay at near atmospheric pressure. This large differential pressure could cause the valve disc to move slightly off its seat, allowing high pressure fluid to enter the valve bonnet. This would cause the bonnet to pressurize as well, as shown in Figure 1 of Attachment 1. If a large break loss of coolant accident (LOCA) were then to occur, the fluid on the downstream side would rapidly depressurize, causing the high pressure fluid in the bonnet to press tightly against both seats, as shown in Figure 2 of Attachment 1. When the valve receives a signal to open as part of the automatic SI signal in response to the LOCA, the valve operator may not be capable of producing enough thrust to dislodge the discs from both seats. Because a LOCA would have the same effect on both lines, this is a potential common mode failure, resulting in the inability to get low pressure SI flow into the reactor vessel.

Therefore, WPSC has decided that the normal position of the valves should remain as open. Since the Kewaunee IPE assumed that the valves were closed during normal operations, it was necessary to make a change in the IPE. There are two competing effects of this change. First, the overall core melt frequency decreases by 2E-6 due to the fact that SI-302A and SI-302B do not have to open in the event of a LOCA. Second, the frequency of containment bypass increases by 2E-8, due to fact that SI-302A and SI-302B are open and therefore must be closed manually to mitigate an interfacing system LOCA (ISL).

Table 1 shows the revised total core melt results (Table 3.4.4-1 in the original submittal). Only the small LOCA, medium LOCA, large LOCA and interfacing system LOCA events are affected by the change. Table 2 shows the sequences that changed, i.e., changes to Table 3.4.4-4 of the original submittal. Note that four new ISL sequences appear, only two of which are non-zero. Figure 3 shows the revised event tree for the ISL and Table 3 describes the four new top events. In this revised event tree, operator actions are necessary to isolate an ISL due to leakage of the check valves down stream of SI-302A or SI-302B. This operator action is proceduralized in the Emergency Operating Procedures.

The new ISL sequences are bounded by the steam generator tube rupture (SGR) event. This can be done because no credit is taken in the SGR for fission product scrubbing by the secondary water in the steam generator, i.e. it is assumed to be dry. The ISL is in reality less severe than the SGR because of fission product retention in the auxiliary building. Since the ISL frequency is two orders of magnitude less than the SGR frequency, this conservatism is of little consequence.

The changes to the Level 2 sequences (Table 3.5.5-1) are presented in Table 4. The results of this change are a 2E-8 increase in the containment bypass frequency (Release Category T) and a 2E-6 decrease in the success with accident management frequency (Release Category A). The revised release category table (Table 4.3-6) is shown in Table 5.

SI-302A and SI-302B are only used in a LOCA situation. Therefore, this change has no effect on the internal flooding results.

Several other plant changes were recommended in the IPE. These changes have all been completed.

In conclusion, WPSC has determined that valves SI-302A and SI-302B should remain normally open because of the possibility of pressure locking in the event of a large break LOCA. Therefore, the commitment to close SI-302A and SI-302B during normal power operations is hereby rescinded. If there are any questions regarding this letter, please contact a member of my staff.

Sincerely,

Clark Steinhardt

C. R. Steinhardt
Senior Vice President - Nuclear Power

EDC/cjt

Attach.

cc - US NRC Region III
US NRC Senior Resident Inspector

Subscribed and Sworn to
Before Me This 11th Day
of November 1993

Jeanne M. Ferris
Notary Public, State of Wisconsin

My Commission Expires:
June 18, 1995

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ATTACHMENT 1

Letter from C. A. Schrock (WPSC)

To

Document Control Desk

Dated

November 11, 1993

Figure 1
Figure 2
Figure 3

Table 1
Table 2
Table 3
Table 4
Table 5

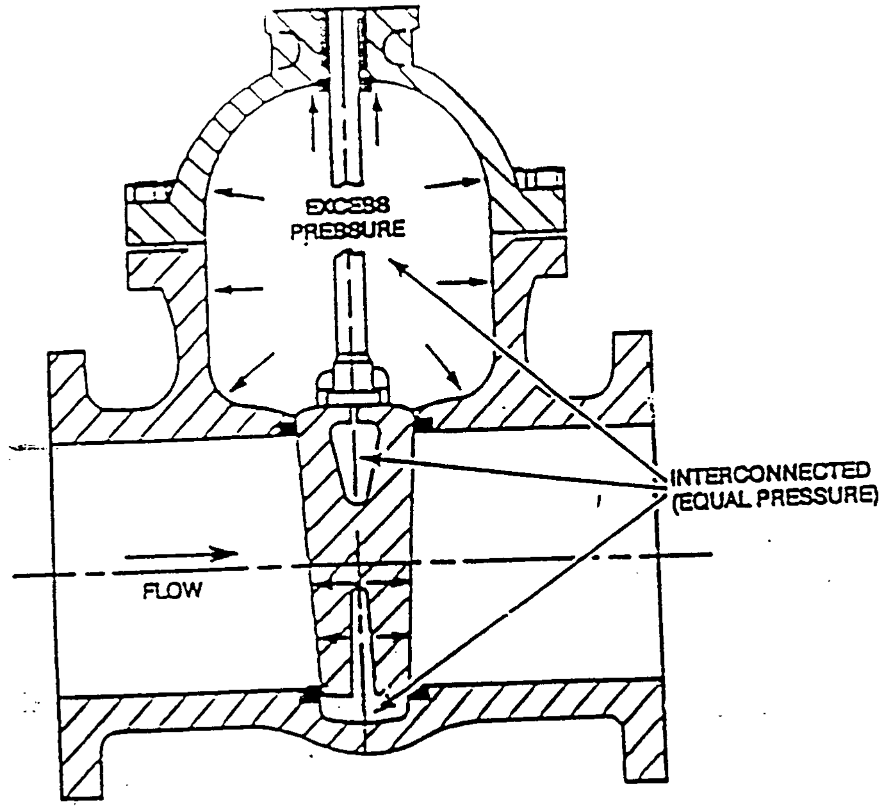


Figure 1.Flexible wedge gate valve

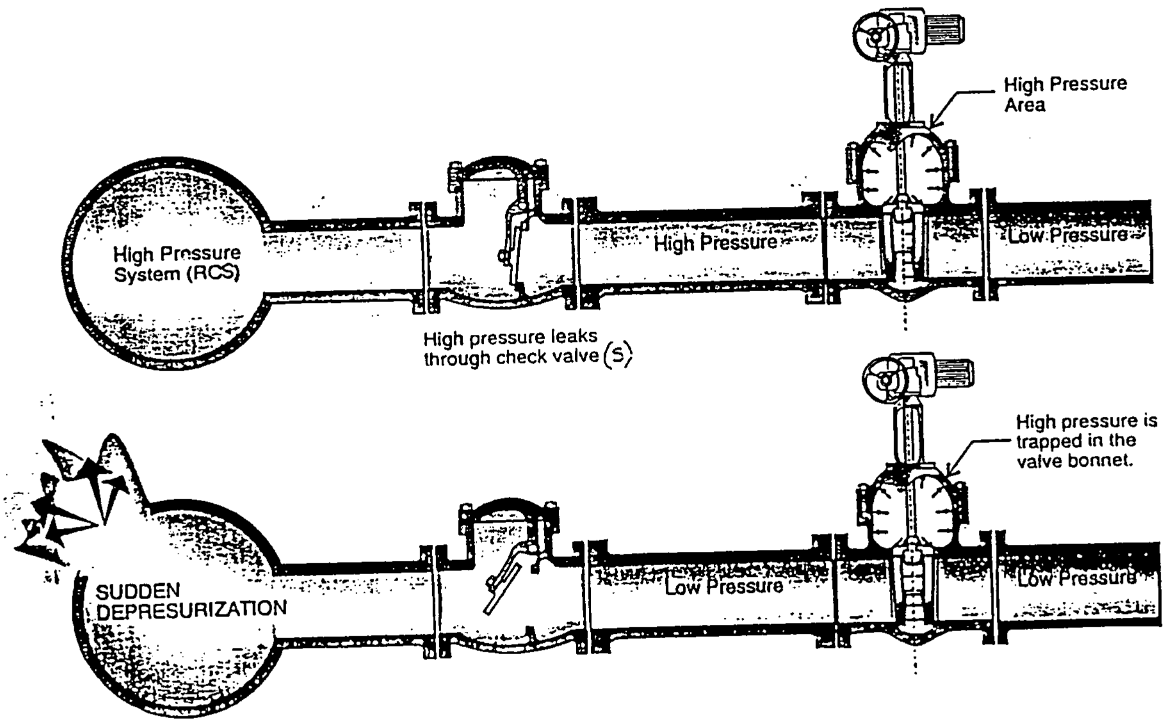
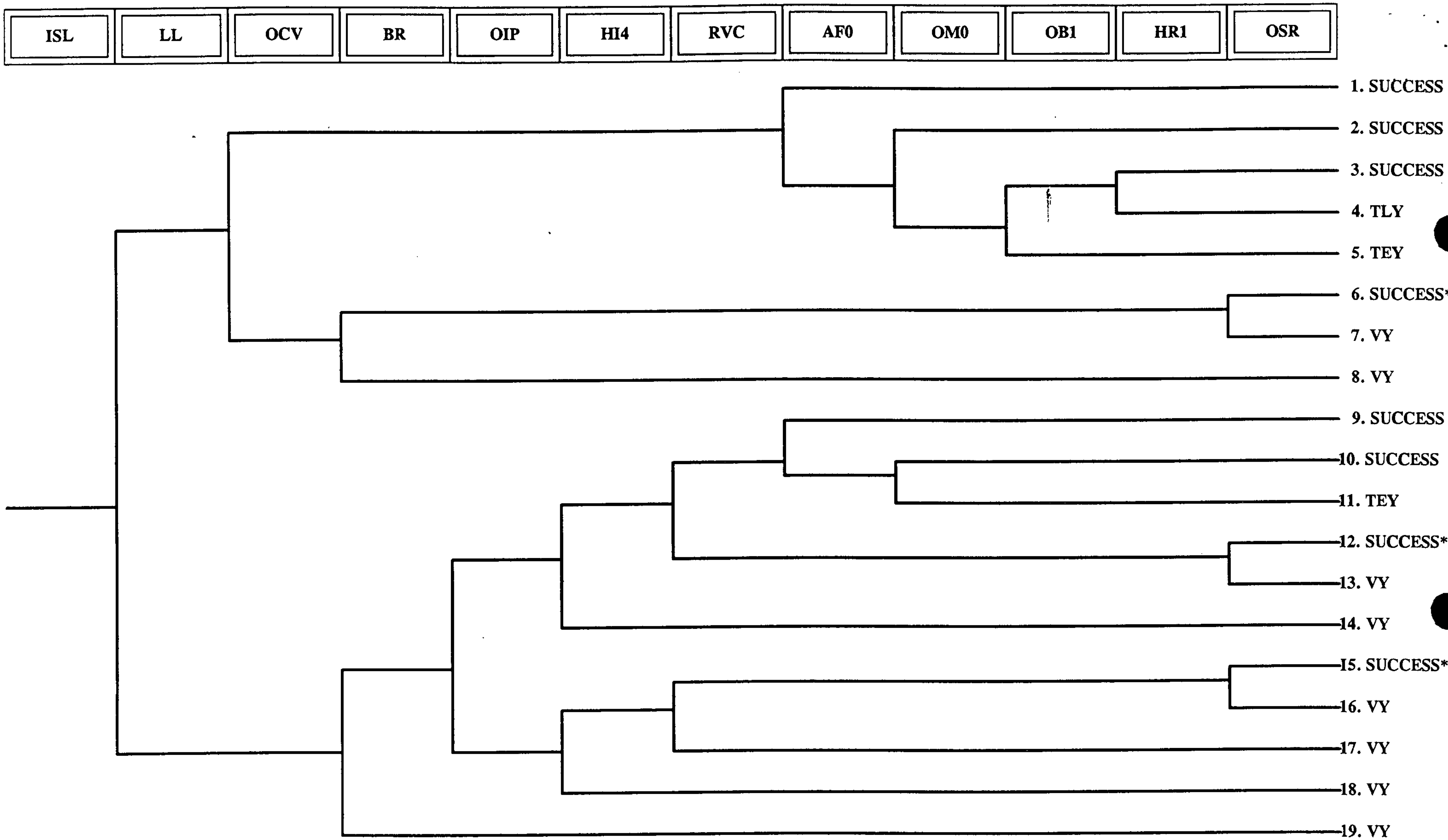


Figure 2.Pressure Locking resulting from a LOCA

FIGURE 3

INTERFACING SYSTEMS LOCA EVENT TREE



*Success in this case refers to core melt being delayed.

TABLE 1 TOTAL CORE MELT RESULTS

TOTAL CORE MELT FREQUENCY = 6.451E-05
NUMBER OF INITIATORS = 16
NUMBER OF CUTSETS = 3492

INITIATING EVENTS	IMPORTANCE IMPORTANCE	NUMBER OF CUTSETS	INITIATOR CM FREQUENCY	INITIATING EVENT FREQUENCY
STATION BLACKOUT	40.91	516	2.6400E-05	4.3500E-04
SMALL LOCA	19.32	455	1.2500E-05	5.1200E-03
MEDIUM LOCA	11.77	295	7.5900E-06	2.3600E-03
SG TUBE RUPTURE	8.20	418	5.2900E-06	6.4100E-03
LOSS OF OFFSITE POWER	6.96	658	4.4900E-06	4.3600E-02
TRANSIENTS WITH MFW	4.24	291	2.7400E-06	3.0000E+00
LOSS OF INSTRUMENT AIR	3.22	36	2.0800E-06	1.0000E+00
LARGE LOCA	2.86	216	1.8400E-06	5.0000E-04
TRANSIENTS WITHOUT MFW	.71	343	4.5900E-07	1.4000E-01
LOSS OF SERVICE WATER	.65	58	4.2200E-07	1.0000E+00
VESSEL FAILURE	.47	1	3.0000E-07	3.0000E-07
LOSS OF ONE VITAL DC BUS	.33	61	2.1100E-07	1.0000E+00
STEAM LINE BREAK	.16	56	1.0000E-07	2.5000E-03
ATWS WITHOUT MFW	.11	33	6.8500E-08	3.8400E-06
INTERFACING SYSTEM LOCA	.06	13	3.8500E-08	8.0600E-05
LOSS OF COMPONENT COOLING	.04	42	2.8300E-08	1.0000E+00

. TABLE 2 CHANGES TO TABLE 3.4.4-4

OLD NUMBER	OLD SEQUENCE PROBABILITY	NEW SEQUENCE PROBABILITY	OLD PERCENT CONTRIB	NEW PERCENT CONTRIB	SEQUENCE DESCRIPTION	SEQUENCE IDENIIFIER
12	1.17E-06	6.45E-09	1.77	.01	SMALL LOCA INITIATING EVENT OCCURS	IEV-SLO
					HIGH PRESSURE INJECTION FAILS	SYS-HI2
					LOW PRESSURE INJECTION FAILS	SYS-LI2
15	5.36E-07	2.87E-09	.81	.00	MEDIUM LOCA INITIATING EVENT OCCURS	IEV-MLO
					HIGH PRESSURE INJECTION FAILS	SYS-HI0
					LOW PRESSURE INJECTION FAILS	SYS-LI2
16	4.57E-07	3.59E-07	.69	.56	LARGE LOCA INITIATING EVENT OCCURS	IEV-LLO
					LOW PRESSURE INJECTION FAILS	SYS-LI1
18	3.62E-07	3.63E-07	.55	.56	SMALL LOCA INITIATING EVENT OCCURS	IEV-SLO
					HIGH PRESSURE INJECTION FAILS	SYS-HI2
					LOW PRESSURE RECIRCULATION FAILS	SYS-LR1
37	1.67E-08	1.74E-08	.03	.03	SMALL LOCA INITIATING EVENT OCCURS	IEV-SLO
					HIGH PRESSURE INJECTION FAILS	SYS-HI2
					COOLDOWN AND DEPRESSURIZATION FOR ACC AND LI2 FAILS	SYS-OP2
41	1.33E-08	1.39E-08	.02	.02	MEDIUM LOCA INITIATING EVENT OCCURS	IEV-MLO
					HIGH PRESSURE INJECTION FAILS	SYS-HI0
					COOLDOWN AND DEPRESSURIZATION FAILS	SYS-OP1
44	7.40E-09	7.13E-09	.01	.01	INTERFACING SYSTEMS LOCA INITIATING EVENT OCCURS	IEV-ISL
					ISL AT RHR PUMP SUCTION	LL-SUCT
					RHR PIPE FAILS	BR-PIPE
46	3.73E-09	3.63E-09	.01	.01	INTERFACING SYSTEMS LOCA INITIATING EVENT OCCURS	IEV-ISL
					ISL AT RHR PUMP SUCTION	LL-SUCT
					HIGH PRESSURE INJECTION FAILS	SYS-HI4
50	1.56E-09	1.52E-09	.01	.00	INTERFACING SYSTEMS LOCA INITIATING EVENT OCCURS	IEV-ISL
					ISL AT RHR PUMP SUCTION	LL-SUCT
					RHR RELIEF VALVES FAIL TO CLOSE	SYS-RVC
					OPERATOR FAILS TO THROTTLE SI FLOW	SYS-OSR
56	6.83E-10	6.63E-10	.00	.00	INTERFACING SYSTEMS LOCA INITIATING EVENT OCCURS	IEV-ISL
					ISL AT RHR PUMP SUCTION	LL-SUCT
					OPERATOR FAILS TO ISOLATE RHR PUMPS	SYS-OIP
					OPERATOR FAILS TO THROTTLE SI FLOW	SYS-OSR
57	6.58E-10	6.40E-10	.00	.00	INTERFACING SYSTEMS LOCA INITIATING EVENT OCCURS	IEV-ISL
					ISL AT RHR PUMP SUCTION	LL-SUCT
					OPERATOR FAILS TO ISOLATE RHR PUMPS	SYS-OIP
					RHR RELIEF VALVES FAIL TO CLOSE	SYS-RVC
N/A	N/A	2.16E-08	N/A	.03	INTERFACING SYSTEMS LOCA INITIATING EVENT OCCURS	IEV-ISL
					OPERATOR FAILS TO ISOLATE ISL WITH SI-302B	SYS-OCV
					OPERATOR FAILS TO THROTTLE SI FLOW	SYS-OSR

TABLE 2 CHANGES TO TABLE 3.4.4-4

OLD NUMBER	OLD SEQUENCE PROBABILITY	NEW SEQUENCE PROBABILITY	OLD PERCENT CONTRIB	NEW PERCENT CONTRIB	SEQUENCE DESCRIPTION	SEQUENCE IDENTIFIER
N/A	N/A	3.25E-09	N/A	.01	INTERFACING SYSTEMS LOCA INITIATING EVENT OCCURS	IEV-ISL
					OPERATOR FAILS TO ISOLATE ISL WITH SI-302B	SYS-OCV
					RHR PIPE FAILS	BR-PIPE
N/A	N/A	0.00E+00	N/A	.00	INTERFACING SYSTEMS LOCA INITIATING EVENT OCCURS	IEV-ISL
					AFW SYSTEM FAILS	SYS-AFO
					MFW SYSTEM FAILS	SYS-OMO
					HIGH PRESSURE RECIRCULATION FAILS	SYS-HR1
N/A	N/A	0.00E+00	N/A	.00	INTERFACING SYSTEMS LOCA INITIATING EVENT OCCURS	IEV-ISL
					AFW SYSTEM FAILS	SYS-AFO
					MFW SYSTEM FAILS	SYS-OMO
					BLEED AND FEED FAILS	SYS-OB1

TABLE 3

SUCCESS CRITERIA FOR INTERFACING SYSTEMS LOCA

Top Event	Description	System Success Criteria	Necessary Operator Actions	Mission Time (hrs)
LL -	LOCA LOCATION	Interfacing Systems LOCA is at the discharge, rather than the suction, of the RHR pumps.	None	None
OCV -	OPERATOR ACTION - CLOSE RHR DISCHARGE VALVES	1 of 1 RHR pump discharge valve closed.	Operator closes RHR pump discharge valve on affected loop.	None
OB1 -	OPERATOR ACTION - BLEED AND FEED	1 of 2 high pressure SI trains delivering flow to 1 of 2 RCS cold legs, 1 of 2 pressurizer PORVs open (bleed and feed initiated prior to secondary dryout - assume 30 minutes).	Manually open PORVs and block valves, start SI pumps (see FR-H.1).	Run for 24 hours
HR1 -	HIGH PRESSURE RECIRCULATION	1 of 2 SI/RHR trains delivering flow from the containment sump to 1 of 2 RCS cold legs, sump valve on operable recirc train open.	Manually align high pressure containment sump recirculation on low RWST level (may include restart of RHR pump), align CCW cooling to RHR Hx, confirm operation of system.	20.5 hours

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TABLE 4
LIST OF LEVEL 2 SEQUENCES

SEQ#	EVENT SEQUENCE	LP RECIRC	FAN COOLERS	SPRAYS	CONT. ISOL.	TIME	RCS PRESS	FRE-QUENCY
LLO-1	SYS-ACC	A	A	A	A	E	L	1.00E-07
LLO-2	SYS-LI1	F	A	F	A	E	L	3.58E-07 X
LLO-3	SYS-LI1	F	F	F	A	E	L	6.52E-10 X
LLO-4	SYS-LR1	F	A	A	A	E	L	4.90E-09
LLO-5	SYS-LR1	F	A	F	A	E	L	1.35E-06
LLO-6	SYS-LR1	F	F	F	A	E	L	3.06E-08
MLO-1	SYS-HI0 SYS-OP1	A	A	A	A	E	H	1.13E-08
MLO-2	SYS-HI0 SYS-OP1	F	F	F	A	E	H	1.99E-09
MLO-3	SYS-HI0 SYS-OP1	A	A	F	A	E	H	6.06E-10 N
MLO-2	SYS-HI0 SYS-OPI	F	F	F	A	E	H	1.99E-09
MLO-6	SYS-HI0 SYS-LR1	F	A	F	A	L	L	1.22E-08
MLO-7	SYS-HI0 SYS-LR1	F	F	F	A	L	L	1.47E-07
MLO-8	SYS-HR0 SYS-LR2	F	A	A	A	L	L	8.09E-10 X
MLO-9	SYS-HR0 SYS-LR2	F	A	F	A	L	L	7.42E-06
MLO-10	SYS-HR0 SYS-LR2	F	A	F	F	L	L	1.57E-09
MLO-11	SYS-HR0 SYS-LR2	F	F	F	A	L	L	2.97E-09
SLO-1	SYS-HI2 SYS-OP2	A	A	A	A	E	H	1.20E-08
SLO-2	SYS-HI2 SYS-OP2	F	F	F	A	E	H	4.72E-09

TABLE 4
LIST OF LEVEL 2 SEQUENCES

SEQ#	EVENT SEQUENCE	LP RECIRC	FAN COOLERS	SPRAYS	CONT. ISOL.	TIME	RCS PRESS	FRE-QUENCY
SLO-3	SYS-HI2 SYS-LI2	F	A	F	A	E	L	6.45E-09 X
SLO-4	SYS-HI2 SYS-OP2	A	A	F	A	E	H	6.82E-10 N
SLO-6	SYS-HI2 SYS-LR1	F	A	F	A	L	L	4.46E-08 X
SLO-7	SYS-HI2 SYS-LR1	F	F	F	A	L	L	3.18E-07
SLO-8	SYS-ES1 SYS-HR1 SYS-LR2	F	A	A	A	L	L	8.77E-10 X
SLO-9	SYS-ES1 SYS-HR1 SYS-LR2	F	A	F	A	L	L	1.21E-05
SLO-10	SYS-ES1 SYS-HR1 SYS-LR2	F	A	F	F	L	L	3.52E-09
SLO-11	SYS-ES1 SYS-HR1 SYS-LR2	F	F	F	A	L	L	5.85E-09
SGR-1	SYS-AF1 SYS-OM1	F*	N/A	F*	B	L	H	6.02E-07
SGR-2	SYS-ISO SYS-EC3	F*	N/A	F*	B	L	H	1.19E-07
SGR-3	SYS-HI1 SYS-OS1 SYS-SSV	F*	N/A	F*	B	L	H	1.93E-07
SGR-4	SYS-OS1 SYS-SSV SYS-EC4	F*	N/A	F*	B	L	H	4.31E-06
SGR-5	SYS-OS1 SYS-OS2	F*	N/A	F*	B	L	H	5.96E-08
VEF-1		A	A	A	A	E	H	3.00E-07
VEF-2		A	A	F	A	E	H	1.45E-09

TABLE 4
LIST OF LEVEL 2 SEQUENCES

SEQ#	EVENT SEQUENCE	LP RECIRC	FAN COOLERS	SPRAYS	CONT. ISOL.	TIME	RCS PRESS	FRE-QUENCY
VEF-3		A	F	A	A	E	H	1.79E-10
VEF-4		F	A	A	A	E	H	1.26E-10
VEF-5		F	A	F	A	E	H	6.37E-10
ISL-1	LL-SUCT BR-PIPE	N/A	N/A	N/A	B	E	L	7.13E-09 X
ISL-2	SYS-OCV SYS-OSR	N/A	N/A	N/A	B	E	L	2.16E-08 N
TRA-1	SYS-AF3 SYS-OM2 SYS-OB2	A	A	A	A	E	H	2.02E-06
TRA-2	SYS-AF3 SYS-OM2 SYS-OB2	A	A	A	F	E	H	1.78E-10
TRA-3	SYS-AF3 SYS-OM2 SYS-OB2	A	A	F	A	E	H	1.15E-08 X
TRA-4	SYS-AF3 SYS-OM2 SYS-OB2	A	F	A	A	E	H	1.03E-09
TRA-5	SYS-AF3 SYS-OM2 SYS-OB2	F	A	A	A	E	H	7.31E-10
TRA-6	SYS-AF3 SYS-OM2 SYS-OB2	F	A	F	A	E	H	4.26E-09 X
TRA-7	SYS-AF3 SYS-OM2 SYS-OB2	F	F	F	A	E	H	6.74E-07
TRA-8	SYS-AF3 SYS-OM2 SYS-HR1	A	A	A	A	L	L	4.40E-09
TRA-9	SYS-AF3 SYS-OM2 SYS-HR1	F	A	F	A	L	L	9.23E-09

TABLE 4
LIST OF LEVEL 2 SEQUENCES

SEQ#	EVENT SEQUENCE	LP RECIRC	FAN COOLERS	SPRAYS	CONT. ISOL.	TIME	RCS PRESS	FRE-QUENCY
TRA-10	SYS-AF3 SYS-OM2 SYS-HR1	F	F	F	A	L	L	2.37E-10
TRA-11	SYS-CHG SYS-CCW	F	A	F	A	L	H	3.21E-08
TRA-12	SYS-CHG SYS-CCW	F	F	F	A	L	H	2.35E-09
TRA-13	SYS-AF3 SYS-OM2 SYS-OB2	A	F	F	A	E	H	4.71E-10 N
TRS-1	SYS-AF3 SYS-OB2	A	A	A	A	E	H	2.20E-07
TRS-2	SYS-AF3 SYS-OB2	A	A	F	A	E	H	6.99E-09 X
TRS-4	SYS-AF3 SYS-OB2	F	A	F	A	E	H	1.01E-10 X
TRS-5	SYS-AF3 SYS-OB2	F	F	F	A	E	H	3.06E-08
TRS-6	SYS-AF3 SYS-HR1	A	A	A	A	L	L	7.62E-08
TRS-7	SYS-AF3 SYS-HR1	A	A	F	A	L	L	1.05E-08
TRS-8	SYS-AF3 SYS-HR1	F	A	F	A	L	L	1.14E-07
SLB-1	PWR-LOW SYS-IS1 SYS-HI3	A	A	A	A	E	H	2.90E-08 X
SLB-3	PWR-LOW SYS-IS1 SYS-HI3	F	A	F	A	E	H	1.78E-08
SLB-4	PWR-LOW SYS-IS1 SYS-HI3	F	F	F	A	E	H	1.76E-09

TABLE 4
LIST OF LEVEL 2 SEQUENCES

SEQ#	EVENT SEQUENCE	LP RECIRC	FAN COOLERS	SPRAYS	CONT. ISOL.	TIME	RCS PRESS	FRE-QUENCY
SLB-5	SYS-HI3 SYS-AF1 SYS-OM1	F	A	F	A	E	H	6.79E-10
SLB-6	SYS-HI3 SYS-AF1 SYS-OM1	F	F	F	A	E	H	2.39E-08
SLB-7	SYS-AF1 SYS-OM1 SYS-OB4	A	A	A	A	E	H	2.71E-08
LSP-1	SYS-AF3 SYS-OB5	A	A	A	A	E	H	1.83E-06
LSP-2	SYS-AF3 SYS-OB5	A	A	F	A	E	H	8.66E-08
LSP-3	SYS-AF3 SYS-OB5	A	F	A	A	E	H	3.87E-09
LSP-4	SYS-AF3 SYS-OB5	A	F	F	A	E	H	5.63E-08 N
LSP-5	SYS-AF3 SYS-OB5	F	A	F	A	E	H	2.67E-07
LSP-6	SYS-AF3 SYS-OB5	F	F	F	A	E	H	9.07E-09 X
LSP-7	SYS-AF3 SYS-HR1	A	A	A	A	L	L	3.49E-07
LSP-8	SYS-AF3 SYS-HR1	A	A	F	A	L	L	3.22E-08
LSP-9	SYS-AF3 SYS-HR1	F	A	F	A	L	L	6.55E-07
LSP-10	SYS-CHG SYS-CCW	F	A	F	A	L	H	1.23E-06
LSP-11	SYS-CHG SYS-CCW	F	F	F	A	L	H	4.39E-09
SBO-1	SYS-AF2 AC2-24	A	A	A	A	E	H	1.25E-05

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TABLE 4
LIST OF LEVEL 2 SEQUENCES

SEQ#	EVENT SEQUENCE	LP RECIRC	FAN COOLERS	SPRAYS	CONT. ISOL.	TIME	RCS PRESS	FRE-QUENCY
SBO-2	SYS-AF2 AC2-24	A	A	A	F	E	H	4.39E-09
SBO-3	SYS-AF2 AC2-24	A	A	F	A	E	H	9.50E-08 X
SBO-4	SYS-AF2 AC2-24	A	F	A	A	E	H	8.01E-09
SBO-5	SYS-AF2 AC2-24	F	A	A	A	E	H	5.11E-09 X
SBO-6	SYS-AF2 AC2-24	F	A	F	A	E	H	3.26E-08 X
SBO-7	SYS-AF2 AC2-24	F	F	F	A	E	H	6.60E-10
SBO-8	SYS-CHB SYS-AF2 CCV-2	A	A	A	A	E	H	1.79E-07
SBO-9	SYS-CHB SYS-ORI	A	A	A	A	L	H	1.54E-07 X
SBO-10	SYS-CHB SYS-ORI	A	A	F	A	L	H	1.01E-08 N
SBO-11	SYS-CHB SYS-ORI	F	A	F	A	L	H	1.13E-10 X
SBO-12	SYS-CHB SYS-ORI	F	F	F	A	L	H	2.94E-09
SBO-13	SYS-CHB SYS-HR1	A	A	A	A	L	H	1.01E-07
SBO-14	SYS-CHB SYS-HR1	A	A	F	A	L	H	1.56E-08
SBO-15	SYS-CHB SYS-HR1	F	A	F	A	L	H	1.60E-07
SBO-16	SYS-OCD AC9-24	A	A	A	A	L	H	4.91E-08
SBO-17	SYS-CHB SYS-OCD CCV-9	A	A	A	A	L	H	1.51E-08

TABLE 4
LIST OF LEVEL 2 SEQUENCES

SEQ#	EVENT SEQUENCE	LP RECIRC	FAN COOLERS	SPRAYS	CONT. ISOL.	TIME	RCS PRESS	FRE-QUENCY
SBO-18	AC11-24	A	A	A	A	L	H	4.35E-06
SBO-19	AC11-24	A	A	A	F	L	H	1.80E-09
SBO-20	AC11-24	A	A	F	A	L	H	3.46E-08 X
SBO-21	AC11-24	A	F	A	A	L	H	2.86E-09
SBO-22	AC11-24	F	A	A	A	L	H	1.89E-09 X
SBO-23	AC11-24	F	A	F	A	L	H	1.19E-08 X
SBO-24	AC11-24	F	F	F	A	L	H	2.71E-10
SBO-25	SYS-CHB CCV-11	A	A	A	A	L	H	4.01E-06
SBO-26	SYS-CHB CCV-11	A	A	A	F	L	H	8.47E-10
SBO-27	SYS-CHB CCV-11	A	A	F	A	L	H	2.38E-08
SBO-28	SYS-CHB CCV-11	A	F	A	A	L	H	1.90E-09
SBO-29	SYS-CHB CCV-11	F	A	A	A	L	H	1.25E-09 X
SBO-30	ACX-24	F*	F*	F*	A	L	H	4.35E-06
SBO-31	ACX-24	F*	F*	F*	F	L	H	1.80E-09
AWS-1	AFM-RODS SYS-PPR	A	A	A	A	E	H	7.10E-09
AWS-2	AFM-BREAKER SYS-AFG	A	A	A	A	E	H	1.24E-08
AWS-3	AFM-BREAKER SYS-PPR	A	A	A	A	E	H	4.40E-08
SWS-1	SYS-AF6	F*	F*	F*	A	E	H	4.21E-07
CCS-1	SYS-CHG	F*	A	F*	A	L	H	1.27E-08
CCS-2	SYS-AF3 SYS-OM2	F*	A	F*	A	E	H	1.56E-08

TABLE 4
LIST OF LEVEL 2 SEQUENCES

SEQ#	EVENT SEQUENCE	LP RECIRC	FAN COOLERS	SPRAYS	CONT. ISOL.	TIME	RCS PRESS	FRE-QUENCY
TDC-1	SYS-AF4 SYS-OM4 SYS-OB3	A	A	A	A	E	H	1.18E-07
TDC-2	SYS-AF4 SYS-OM4 SYS-OB3	A	A	F	A	E	H	4.53E-09
TDC-3	SYS-AF4 SYS-OM4 SYS-OB3	A	F	A	A	E	H	2.56E-10
TDC-4	SYS-AF4 SYS-OM4 SYS-OB3	F	A	F	A	E	H	2.01E-09
TDC-5	SYS-AF4 SYS-OM4 SYS-OB3	F	F	F	A	E	H	9.28E-08
INA-1	SYS-AF5 SYS-OM3	A	A	A	A	E	H	7.41E-10
INA-2	SYS-AF5 SYS-OM3	F	F	F	A	E	H	2.08E-06
INA-3	SYS-AF5 SYS-OM3	F	F	F	F	E	H	6.79E-10

F* Containment safeguards function unavailable due to the nature of the core melt sequence.
X Changed from original submittal.
N New sequences due to the change.

The following sequences from the original submittal were elimimated:
SLO-4
SLO-5
TRS-3
SLB-2
LSP-4
SBO-10

TABLE 5

KEWAUNEE NUCLEAR PLANT
AIRBORNE RELEASE CATEGORIES AND PROBABILITIES

Release Category	Definition	Frequency	Conditional Probability[1,2]
S	No containment failure (leakage only, successful maintenance of containment integrity; containment not bypassed; isolation successful)	2.87×10^{-5}	0.45
T	Containment bypassed with noble gases and more than 10% of volatiles released	5.32×10^{-6}	0.08
G	Containment failure prior to vessel failure with noble gases and up to 10% of the volatiles released (containment isolation impaired)	1.48×10^{-8}	2.30×10^{-4}
A	No containment failure within 48 hr mission time, but failure could eventually occur without accident management action; noble gases and less than 0.01% volatiles released	3.03×10^{-5}	0.47

NOTES:

1. Conditional probability of release category given core damage.
2. Core damage frequency for Level 2 = 6.4×10^{-5}/yr.