Callaway Energy Center Seismic Probabilistic Risk Assessment in Response to 50.54(F) Letter with Regard to NTTF 2.1 Seismic – Supplemental Information

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1.0 Introduction

The purpose of this document is to provide supplemental information to the Callaway Energy Center S-PRA 2.1 Submittal. Following Fact and Observation (F&O) closure for the S-PRA model, model refinements and sensitivities have been performed to refine the CEC S-PRA model, and improve risk metric results based on the insights. The following subsections provide: (1) a description of the changes to the model which was documented and submitted as part of the 2.1 Submittal and the updated risk-metric results, (2) a description of the sensitivities performed on the S-PRA model to identify areas of future refinement and potential improvements to risk-metric results, and (3) the top model contributors after performing the changes as described in (1) and as assessed in (2).

2.0 Model Refinements

Following the CEC F&O Closure the following model changes have been made:

1. Incorporated an updated version of the Seismic PRA Relay Database (Revision 3).
2. Updated component mapping of fragility group SF-SB102X based upon plant-specific insights.
3. Updated mutually exclusive logic for relay groups
4. Updated component mapping for fragility group Relay_0.18DG base upon plant-specific insights.
5. Incorporated updated timing input for operator action to manually operator the turbine-driven pump (OP-XHE-FO-TDPMNL). Performed detailed seismic HRA for bin SH2.
6. Incorporated fragility parameter updates for fragility groups SF-EEG01X (CCW HXs), SF-IE-S3 (VSLOCA), SF-RL0XX (Main Control Panels RL01 – RL006 and RL013 – RL026), SF-ABTNX (N2 Tanks TKA02 – TKA05), and SF-XPB05 (AEPS Transformer).

2.1 Update to Seismic PRA Relay Database

Following the F&O Closure, a cutset review meeting was held to identify potential areas of refinement for the S-PRA model. Based on this review, Callaway reached out to a supporting vendor to determine if any conservative component mapping was being applied for various fragility groups. Based on this review, it was determined that an older revision of the S-PRA relay database (Revision 2) was still being credited in the S-PRA model. Revision 3 of the S-PRA relay database incorporates refinements to various relay mapping.

2.2 Updated Component Mapping for Fragility Group SF-SB012X

Based on review of the S-PRA model it was determined that fragility group SF-SB102X was mapped to failing reactor trip, but loss of the cabinet is expected to cause a reactor trip. The cabinet failure is therefore screened from failing the reactor trip function. Removal of this mapping removes fragility group SF-SB102X from the model.

2.3 Update of Mutually Exclusive Logic

Following the model update to reflect the latest S-PRA relay database, mutually exclusive logic was reviewed to ensure that all fragility groups were appropriately populating through the model, and were not being excluded based on mutually exclusive logic. Four (4) fragility groups were determined to be impacted by the mutually exclusive logic:

- Fragility group Relay_0.72 – This relay group fails basic events BB-MOV-OO-V8000A and BB-MOV-CC-V8000A which are identified as mutually exclusive events in the internal events model.
- Fragility group Relay_0.81 – This relay group fails basic events BB-MOV-OO-V8000B and BB-MOV-CC-V8000B which are identified as mutually exclusive events in the internal events model.
- Fragility group SF-BBRSV – This fragility group fails multiple basic events which impact multiple identified mutually exclusive combinations in the internal events model:
  - BB-PRV-CC-V455A and BB-MOV-OC-V455A
  - BB-PRV-CC-V456A and BB-PRV-OC-V456A
  - BB-MOV-OO-V8000B and BB-MOV-CC-V8000B
  - BB-MOV-OO-V8000A and BB-MOV-CC-V8000A
- Fragility group SF-FR-HEAF-A27 – This fragility group fails basic events SA-SIS-TM-TRAINA and SA-SIS-TM-TRAINB which are identified as mutually exclusive events in the internal events model.

To correct the issues with the mutually exclusive logic, logic was added to ensure that mutually exclusive combinations can only propagated as mutually exclusive in the internal events model.

2.4 Updated Component Mapping for Fragility Group Relay_0.18DG

Based on insights from review of the components mapped to fragility group Relay_0.18DG, it was determined that Relay_0.18DG was incorrectly failing NB0111 and NB0211. When the operators go to reset the relay and start the EDGs, they ensure that the EDG output breakers are open or open them manually. If the EDGs fail to start, the act of resetting the relays now allows AEPS to be loaded on the bus. Based on this justification, the component mapping between fragility group Relay_0.18DG and NB0111 and NB0211 were removed.

2.5 Update of Operator Action OP-XHE-FO-TDPMNL

Timing updates were provided for operator action to manually operator the turbine-driven pump. The timing updates and updated HRA analysis for OP-XHE-FO-TDPMNL were put through the EPRI HRA screening criteria. Detailed HRA was performed to refine bin 2 (SH2). Based on the extended Tdelay of 7 hours, the SH2 detailed analysis was determined to be applicable to bin 3 (SH3). The resultant HFE updates were determined from this process.

HFE	Bin	S-PRA Specific Action	HEP	Description
OP-XHE-FO-TDPMNL	1	SH1-OP-XHE-FO-TDPMNL	8.02E-03	FAILURE TO OPERATE TDAFP IAW EC SUPPL. G'LINE, ATTACH. R (SEISMIC)
OP-XHE-FO-TDPMNL	2	SH2-OP-XHE-FO-TDPMNL	1.25E-02	FAILURE TO OPERATE TDAFP IAW EC SUPPL. G'LINE, ATTACH. R (SEISMIC)
OP-XHE-FO-TDPMNL	3	SH3-OP-XHE-FO-TDPMNL	1.25E-02	FAILURE TO OPERATE TDAFP IAW EC SUPPL. G'LINE, ATTACH. R (SEISMIC)
OP-XHE-FO-TDPMNL	4	SH4-OP-XHE-FO-TDPMNL	1.00E+00	FAILURE TO OPERATE TDAFP IAW EC SUPPL. G'LINE, ATTACH. R (SEISMIC)

SH2-OP-XHE-FO-TDPMNL, FAILURE TO OPERATE TDAFP IAW EC SUPPL.G'LINE, ATTACH. R (SEISMIC)

Plant	Data File	File Size	File Date	Record Date
	OP-XHE-FO-TDPMNL.hra	1175552	6/6/2019	6/6/2019
	Name			**Date**
Analyst	**Rachel Christian, Westinghouse**			**6/6/2019**
Reviewer				**6/6/2019**

HEP Summary					
	P_1	P_2	P_{cog}	P_{exe}	**Total HEP**
Method	CBDTM	HCR/ORE	Maximum	THERP	
HEP	3.02E-03	0.00E+00	3.02E-03	9.50E-03	1.25E-02
Distribution Type	Beta		**Variance**	1.41E-04	

RAW	FV	Risk Significant
		N/A

Identification and Definition
Action is being performed to mitigate a seismic-induced initiating event 1. Initial Conditions: Steady state full power operation. 2. Initiating Event: Complete loss of both AC and DC power 3. Accident Sequence (Preceding Functional Failures and Successes): Reactor trip - successful SBO AC and DC failure 4. Preceding Operator Errors and Successes: None - Nothing is available due to complete loss of AC and DC Operators alert emergency response center about condition. 5. Success Criteria: R.3 CLOSE AFP Turb Mech Trip/Throt Hv Using The Manual Handwheel: R4. CHECK At Least One Of The Following - OPEN ABHV0005, TDAFP Stm Sply From MS Loop 2 R5. Slowly Crack OPEN, AFP Turb Mech Trip/Throt Hv, To Start Spinning AFW Pump Turbine: R7. Slowly RAISE TDAFP To 3850 RPM R8. STABILIZE TDAFP Speed - AT 3850 RPM R9. CHECK Auxiliary Feedwater Flowrate Indication - AVAILABLE - It is not available since there is a complete loss of both AC and DC power R9 RNO - INSTALL Local Flowrate Monitoring using Attachment UU, Local Monitoring Auxiliary Feedwater Flow Rates 6. Consequence of Failure: SG dryout

Cues and Indications	
Initial Cue	Loss of AC and DC power
Recovery Cue	
Cue Comments	
Degree of Clarity	Clarity of Cues and Indications are modeled explicitly in CBDTM

Procedures	
Cognitive Procedure	EC SUPP GUIDE (EMERGENCY COORDINATOR SUPPLEMENTAL GUIDELINE) Revision: 21
Cognitive Step Number	6
Cognitive Instruction	Step 6 RNO

	Attachment R, Starting TDAFP On Loss of AC and DC Power
Execution Procedure	Execution: Not Selected
Execution Instruction	
Job Performance Measure	JPM: Not Selected
Notes	
Seismic: The same procedures are used to mitigate initiating events, regardless of whether they occur as an internal event or are seismically induced. Note that additional workload and distractions posed by the earthquake, for example damage assessment walkdowns, are addressed in the Cognitive Unrecovered assessment of pcb Failure of Attention due to workload.	

Training	
Classroom Training	0.5 per year
Simulator Training	0.5 per year

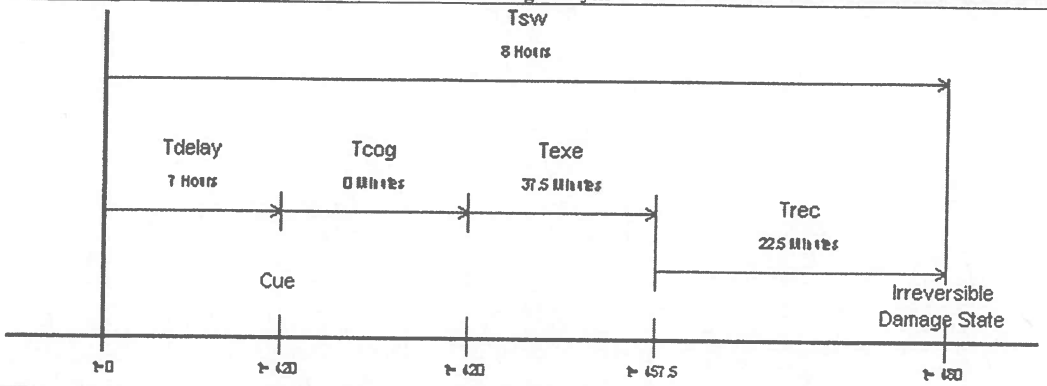
Crew Member	Included	Total Available	Required for Execution	Notes
Shift Manager	No	1	0	
Shift Supervisor	No	1	0	
STA	No	1	0	
Reactor operators	Yes	2	1	
Plant operators	Yes	2	2	
Mechanics	Yes	2	2	
Electricians	Yes	2	2	
I&C Technicians	Yes	2	0	
Health Physics Technicians	Yes	2	0	
Chemistry Technicians	Yes	1	0	
Notes				
Manpower required is equivalent whether the action is implemented in response to an internal initiating event or a seismically-induced event. Note that manpower needed for additional workload and distractions posed by the earthquake, for example damage assessment walkdowns, are addressed in the Cognitive Unrecovered assessment.				

Analyst Notes
SPRA Detailed HRA

Assumptions
The TDAFP is running and is not stopped due to loss of DC power. The TDAFP has been supplying the SG for 8 to 12 hours after the reactor trip and loss of all AC power. The heat load on the SG is considerably less than at reactor trip. The use of 50 minutes stated in the Supplementary Guide within reactor trip is considered to be extremely conservative for this HFE. It is assumed that the operator will be aware of the depletion of the batteries at least an hour before it happens. Therefore it is assumed the batteries deplete in 8 hours and the operators will take action to prepare for this at least an hour before it happens.

Operator Interview Insights
This guideline is entered based on directions from the Emergency Coordinator. Location of equipment required is clearly marked in the TSC. Step 6 provides several options of restoring injection. The PRA assumption is that the operators will choose to align the TDAFW. In addition to completing attachment R the operators will also need to obtain SG level indication following attachment U since there is a complete loss of both AC and DC. The Control Room Staff would more likely stay in ECA-0.0 (parent procedure) The Control Room Staff would more likely try to reset the TDAFP in parallel and implement loss of DC power The Control Room Staff would more likely start the Non-Safety Aux Feed Pump. The Foldout Page for ECA-0.0 directs operators to use Attachment A, ALTERNATE LOW PRESSURE FEEDWATER and use FSGs. Equipment used is clearly marked and locations provided. (top drawer of TSC Cabinet). Easy to find and use. Operations Training department has conducted training on this several times No insights specific to seismic. This action has not been reviewed by an operator for seismic considerations.

Timing Analysis



T_{sw}	8 Hours
T_{delay}	7 Hours
T_{cog}	0 Minutes
T_{exe}	37.5 Minutes
Time available for cognition and recovery	22.5 Minutes
Time available for recovery	22.5 Minutes
SPAR-H Available time (cognitive)	22.5 Minutes
SPAR-H Available time (execution) ratio	1.60 Minutes
EPRI Minimum level of dependence for recovery	MD

Notes

Tsw = 8 hours for battery depletion

Tdelay = 7 hours before the operators start to take action to compensate for the battery depletion. Seismic approach to increase Tdelay by 2 minutes account for additional distractions and confusion following the earthquake is not directly applicable for this action based on long Tdelay.

Tcog = 0 hours due to the long time before the battery depletion. The operators will be aware that the batteries are depleting and will not need any other indications. Seismic approach to increase Tcog by 25% to account for additional distractions and confusion following the earthquake is not directly applicable for this action based on long Tdelay. Note also that adjustment of Cognitive Unrecovered pcb further degrades the action reliability due to additional distractions and workload.

Texe = 30 minutes to perform all of the local actions + 7.5 minutes for seismic (25% increase to account for additional distractions and confusion following the earthquake)

Cognitive Analysis

Pc Failure Mechanism	**Branch**	**HEP**
Pca: Availability of Information	a	0.00E+00
Pcb: Failure of Attention	h	0.00E+00
Pcc: Misread/miscommunicate data	a	0.00E+00
Pcd: Information misleading	a	0.00E+00
Pce: Skip a step in procedure	g	6.00E-03
Pcf: Misinterpret Instructions	a	0.00E+00
Pcg: Misinterpret decision logic	l	0.00E+00
Pch: Deliberate violation	a	0.00E+00
Initial Pc(without recovery credited)		6.00E-03

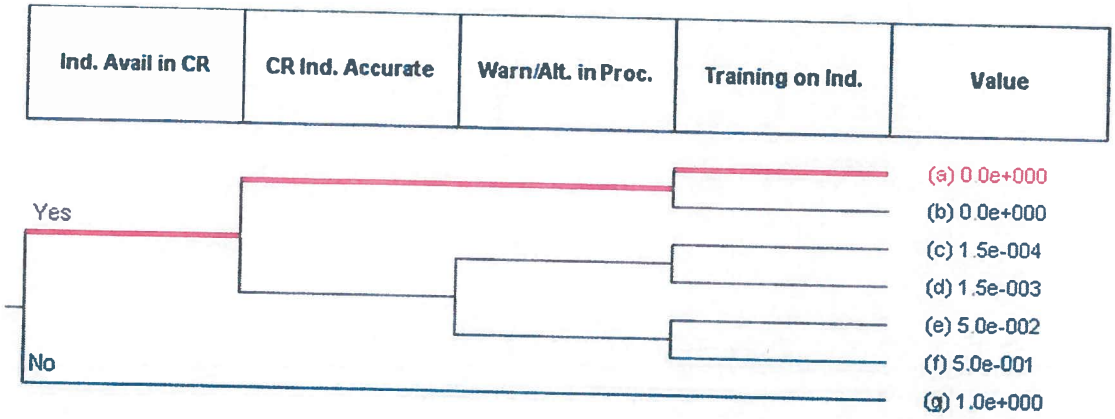
Notes

Accessibility during a seismic event should be confirmed via an operator pathway walkdown.

Pca: Availability of Information

Notes/Assumptions: Assumed that there is reasonable analogue instrumentation alternative to the alarm in the event of spurious alarms due to relay chatter.

Internal events response applicable to S-PRA.

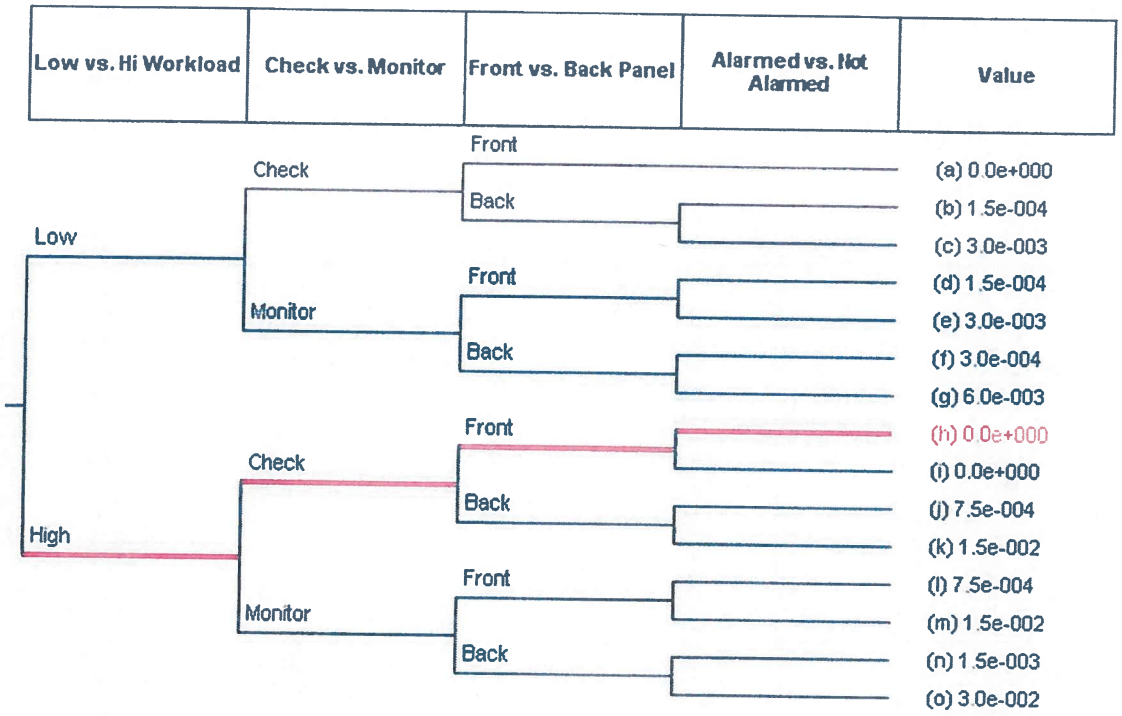


Pcb: Failure of Attention

Notes/Assumptions: Workload is set to high for all actions occurring prior to the damage assessment walkdowns (assumed to be eight hours following the earthquake).

Assumed that there is reasonable analogue instrumentation alternative to the alarm in the event of spurious alarms due to relay chatter.

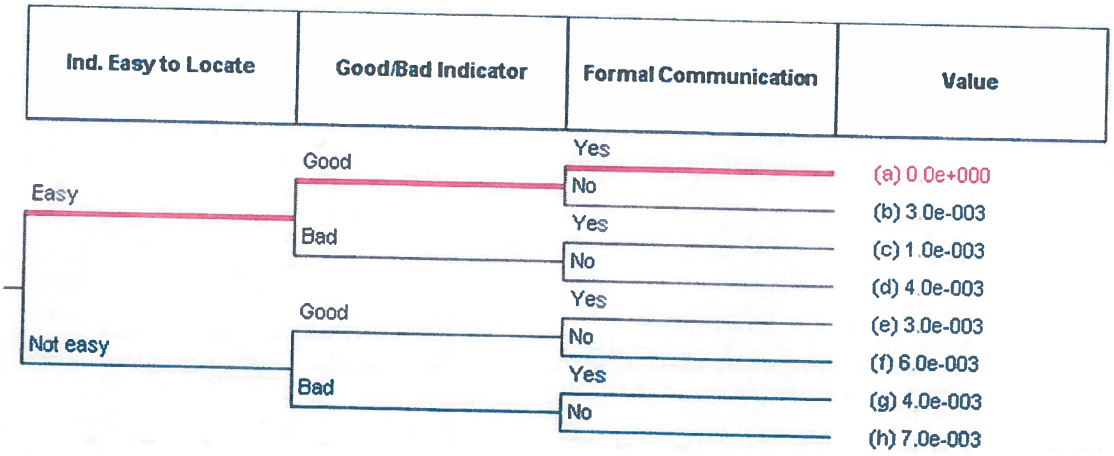
All other responses based on Internal Events.



Pcc: Misread/miscommunicate data

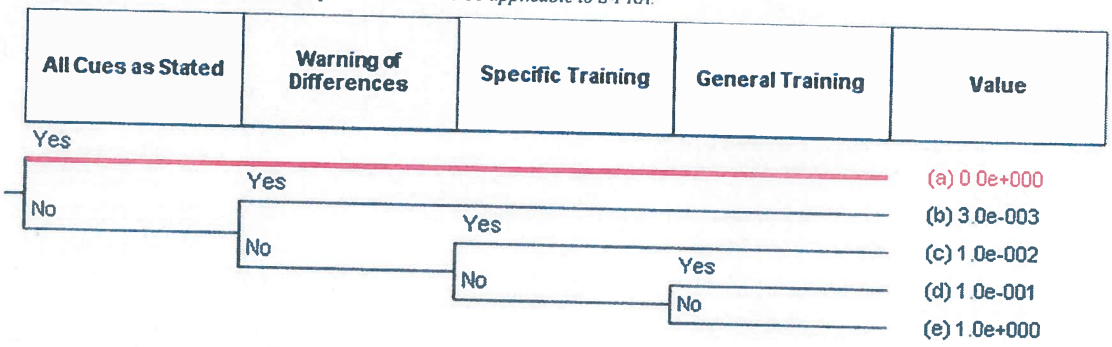
Notes/Assumptions: The CEC seismic HRA used the 'yes' branch for Formal Communications for SH2 where mitigation using conventional procedures and protocol is expected.

Internal events response applicable to S-PRA.



Pcd: Information misleading

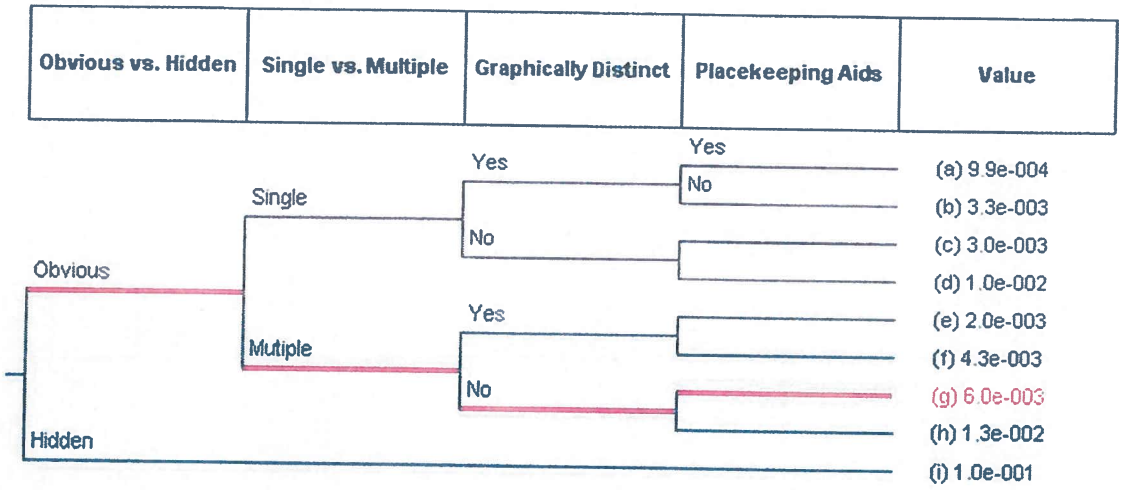
Notes/Assumptions: Internal events response assumed to be applicable to S-PRA.



Pce: Skip a step in procedure

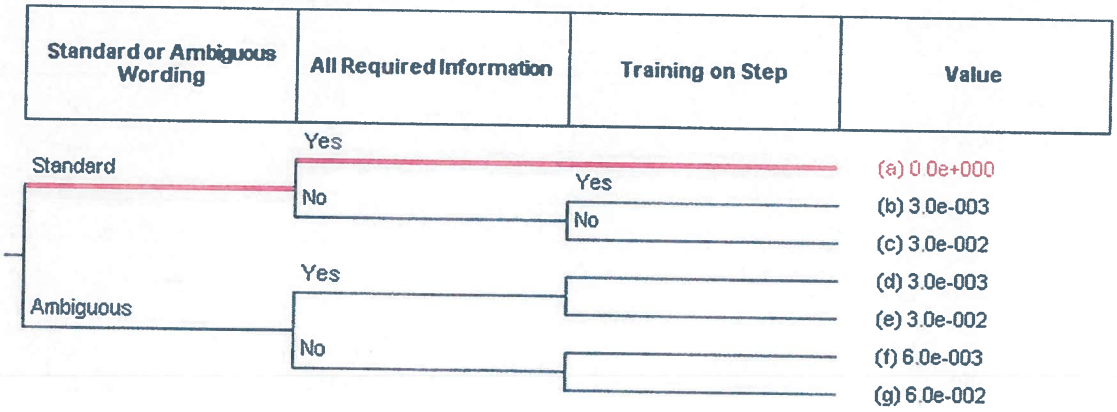
Notes/Assumptions: The CEC S-PRA seismic HRA selects "multiple" for all seismic HFEs. While the EOPs would be given priority, some additional procedure implementation is anticipated following an earthquake, for example the seismic response procedure.

All other responses based on Internal Events.



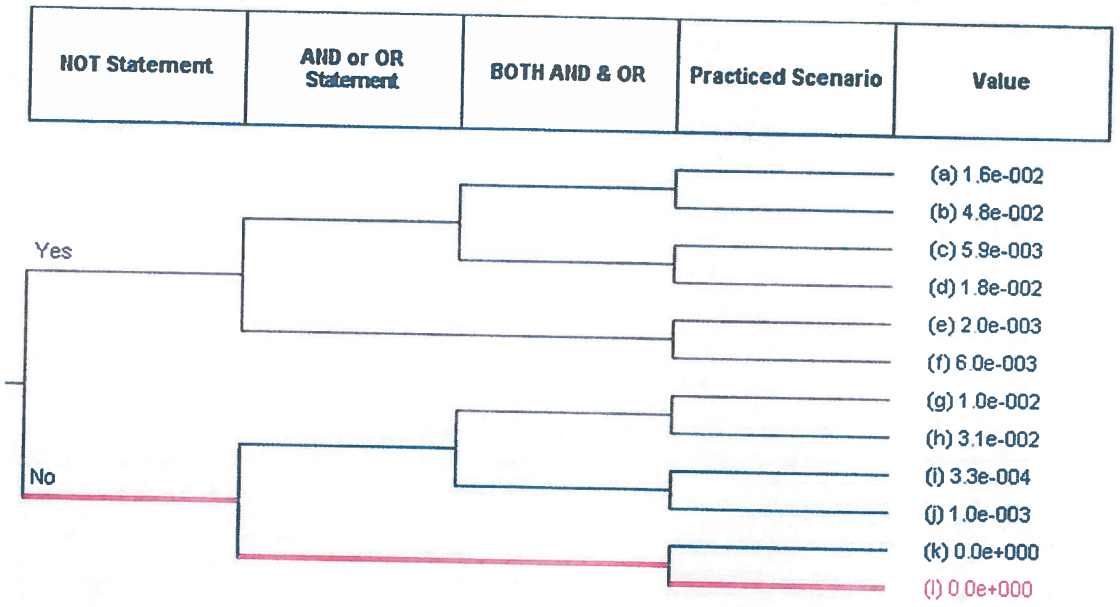
Pcf: Misinterpret Instructions

Notes/Assumptions: Internal events response applicable to S-PRA.



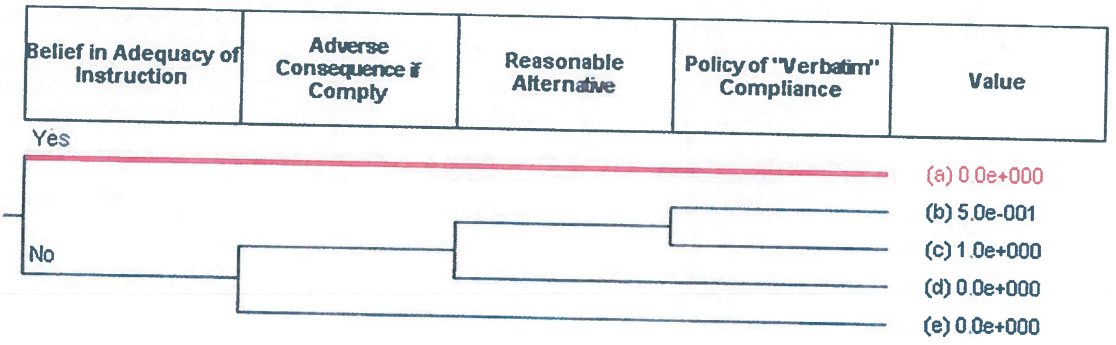
Pcg: Misinterpret decision logic

Notes/Assumptions: Internal events response applicable to S-PRA.



Pch: Deliberate violation

Notes/Assumptions: Internal events response applicable to S-PRA.



Cognitive Recovery											
	Initial HEP	Self Review	Extra Crew	STA Review	Shift Change	ERF Review	Recovery Matrix	Dependency Level	Multiply HEP by	Override Value	Final Value
Pca	n/a	-	-	-	-	-			1.00E+00		0.0
Pcb	n/a	-	-	-	-	-			1.00E+00		0.0
Pcc	n/a	-	-	-	-	-			1.00E+00		0.0
Pcd	n/a	-	-	-	-	-			1.00E+00		0.0
Pce	6.00E-03	X	-	-	-	-		HD	5.03E-01		3.02E-03
Pcf	n/a	-	-	-	-	-			1.00E+00		0.0
Pcg	n/a	-	-	-	-	-			1.00E+00		0.0
Pch	n/a	-	-	-	-	-			1.00E+00		0.0
Final Pc (with recovery credited)											3.02E-03
Notes											
Additional distractions created by response to the earthquake (for example the damage assessment walkdowns) would limit time and resources available for these cognitive recoveries. Self-review DF increased to High.											

Sigma Table				
Plant Type	Response Type	LB	Sigma	UB
BWR	CP1	0.4	0.7	1
	CP2	0.2	0.58	0.96
	CP3	0.59	0.75	0.91
PWR	CP1	0.26	0.57	0.88
	CP2	0.07	0.38	0.69
	CP3		0.77	
Sigma:	5.70E-01			
HEP:	0.00E+00			
Notes/Assumptions				

Execution Performance Shaping Factors		
Environment	Lighting	Emergency
	Heat/Humidity	Normal
	Radiation	Non Radiation Area
	Atmosphere	Normal
Special Requirements	Tools	Required
Special Requirements	Tools	Adequate
Special Requirements	Tools	Available
Complexity of Response	Execution	Simple
Equipment Accessibility (Cognitive)	Main Control Room	Accessible
Equipment Accessibility (Execution)	Local Actions	Accessible

Stress	
High	
Plant Response As Expected:	Yes
Workload:	High
Performance Shaping Factors:	Negative
Notes	
Post-earthquake workload and stress expected to be high, performance shaping factors expected to be negative.	

Execution Unrecovered							
Procedure		Comment					
Step No.	Instruction / Comment	Error Type	THERP		HEP	Stress Factor	Override
			Table	Item			
Attachment R Step 4	Check at least one of the following open: ABHV0005 or ABHV0006	EOM	20-7	1	1.3E-3	High	
		EOC	20-13	2	3.80E-03		
	Location:	AFW pump room			Total Step HEP		2.55E-02
Attachment R Step 8	Stabilize TDARP to 2850 RPM	EOM	20-7	1	1.3E-3	High	
		EOC	20-13	1	1.30E-03		
	Location:				Total Step HEP		1.30E-02
Attachment R Step 9 RNO	Install local flowrate monitoring using Attachment U, local monitoring steam generator wide range levels.	EOM	20-7	1	1.3E-3	High	
		EOC	20-13	2	3.80E-03		
	Location:				Total Step HEP		2.55E-02
Attachment R Step 10 RNO	Locally operate valves as directed by the control room/TSC.	EOM	20-7	1	1.3E-3	High	
	Location:					Total Step HEP	6.50E-03

Execution Recovered							
Critical Step No.	Recovery Step No.	Action	HEP (Crit)	HEP (Rec)	Dep.	Cond. HEP (Rec)	Total for Step
Attachment R Step 4		Check at least one of the following open: ABHV0005 or ABHV0006	2.55E-02				3.78E-03
	Attachment R Step 10 RNO	Locally operate valves as directed by the control room/TSC.		6.50E-03	MD	1.48E-01	
Attachment R Step 8		Stabilize TDARP to 2850 RPM	1.30E-02				1.93E-03
	Attachment R Step 10 RNO	Locally operate valves as directed by the control room/TSC.		6.50E-03	MD	1.48E-01	
Attachment R Step 9 RNO		Install local flowrate monitoring using Attachment U, local monitoring steam generator wide range levels.	2.55E-02				3.78E-03
	Attachment R Step 10 RNO	Locally operate valves as directed by the control room/TSC.		6.50E-03	MD	1.48E-01	
Total Unrecovered:			6.40E-02	**Total Recovered:**			9.50E-03

2.6 Fragility Parameter Updates

The following parameters for the specified fragility groups have been updated. Note the previous value used in the F&O Closure reviewed S-PRA model are also shown.

	Fragility	PGA_min (HCPLF)	β_c	β_r	β_u	PGA_med	Failure Mode
F&O Closure Model	SF-EEG01X	0.25	0.40	0.24	0.32	0.63	Anchorage
Updated Parameters	SF-EEG01X	0.45	0.40	0.24	0.32	1.14	Anchorage

	Fragility	PGA_min (HCPLF)	β_c	β_r	β_u	PGA_med	Failure Mode
F&O Closure Model	SF-IE-S3	0.2	0.32	0.24	0.4	0.51	Bending
Updated Parameters	SF-IE-S3	0.87	0.45	0.24	0.38	2.48	Bending

	Fragility	PGA_min (HCPLF)	β_c	β_r	β_u	PGA_med	Failure Mode
F&O Closure Model	SF-RL0XX	0.22	0.40	0.24	0.32	0.63	Anchorage
Updated Parameters	SF-RL0XX	0.31	0.45	0.24	0.38	0.88	Anchorage

	Fragility	PGA_min (HCPLF)	β_c	β_r	β_u	PGA_med	Failure Mode
F&O Closure Model	SF-ABTNX	0.25	0.45	0.24	0.38	0.56	Anchorage
Updated Parameters	SF-ABTNX	1.63	0.35	0.24	0.26	3.71	Anchorage

	Fragility	PGA_min (HCPLF)	β_c	β_r	β_u	PGA_med	Failure Mode
F&O Closure Model	SF-XPB05	0.47	0.40	0.24	0.32	1.19	Anchorage
Updated Parameters	SF-XPB05	0.37	0.35	0.24	0.26	0.83	Anchorage

3.0 Model Sensitivities

Following the F&O Closure, the following sensitivities have been performed to identify potential areas of model refinement:

1. Fragility Groups SF-AB-SURROG and SF-AXB-MV sub-grouping.

3.1 Fragility Groups SF-AB-SURROG and SF-AXB-MV Sub-Grouping

The full correlation assumption has the possibility to introduce conservatisms for seismic failures of SSCs which are represented by large surrogate fragility groups that are likely not correlated since the SSCs are located on different elevations. There are two surrogate fragility groups for components in the Auxiliary Building; one group (SF-AB-SURROG) is assigned to all SC-I check valves in the Auxiliary Building and the other (SF-AXB-MV) is assigned to all SC-I MOVs in the Auxiliary Building. These fragility groups SF-AB-SURROG and SF-AXB-MV were identified for a dedicated sensitivity to understand which components in these large fragility groups are risk significant and to determine if any additional refinement of these groups or specific components in these groups could be performed. Since the components in both of these fragility groups span multiple elevations of the Auxiliary Building, this sensitivity separated components into sub-groups based on the major elevations of the Auxiliary Building (i.e., 1974, 2000, 2026, and 2047). The following table documents the fragility sub-groups by elevation and the associated components. Note that the original fragility parameters calculated for the surrogate groups were applied across all associated sub-groups.

Fragility Group	Component	MappedBE
SF-AB-SURROG-1974	ALV0003	AL-CKV-CC-ALV003
SF-AB-SURROG-1974	BG8481A	BG-CKV-CC-8481A
SF-AB-SURROG-1974	BG8481B	BG-CKV-CC-8481B
SF-AB-SURROG-1974	BG8497	BG-CKV-CC-8497
SF-AB-SURROG-1974	BG8546A	BG-CKV-CC-V8546A
SF-AB-SURROG-1974	BG8546A	BG-CKV-OO-V8546A
SF-AB-SURROG-1974	BG8546B	BG-CKV-CC-V8546B
SF-AB-SURROG-1974	BG8546B	BG-CKV-OO-V8546B
SF-AB-SURROG-1974	BGV0589	BG-CKV-CC-V589
SF-AB-SURROG-1974	BGV0590	BG-CKV-CC-V590
SF-AB-SURROG-1974	BGV0591	BG-CKV-CC-V591
SF-AB-SURROG-1974	BGV0591	BG-CKV-OO-V591
SF-AB-SURROG-1974	BGV0605	BG-CKV-CC-V605
SF-AB-SURROG-1974	BGV0606	BG-CKV-CC-V606
SF-AB-SURROG-1974	BGV0645	BG-CKV-CC-V645
SF-AB-SURROG-1974	EJ8958A	EJ-CKV-CC-V8958A
SF-AB-SURROG-1974	EJ8958B	EJ-CKV-CC-V8958B
SF-AB-SURROG-1974	EJ8969B	EJ-CKV-CC-V8969B
SF-AB-SURROG-1974	EM8922A	EM-CKV-CC-V8922A
SF-AB-SURROG-1974	EM8922A	EM-CKV-IL-V8922A
SF-AB-SURROG-1974	EM8922A	EM-CKV-OO-V8922A
SF-AB-SURROG-1974	EM8922B	EM-CKV-CC-V8922B
SF-AB-SURROG-1974	EM8922B	EM-CKV-IL-V8922B
SF-AB-SURROG-1974	EM8922B	EM-CKV-OO-V8922B

Fragility Group	Component	MappedBE
SF-AB-SURROG-1974	EM8926A	EM-CKV-CC-V8926A
SF-AB-SURROG-1974	EM8926A	EM-CKV-OO-V8926A
SF-AB-SURROG-1974	EM8926B	EM-CKV-CC-V8926B
SF-AB-SURROG-1974	EM8926B	EM-CKV-OO-V8926B
SF-AB-SURROG-1974	EMV0005	EM-CKV-CC-V005
SF-AB-SURROG-1974	EMV0007	EM-CKV-CC-V007
SF-AB-SURROG-2000	AEV0124	AE-CKV-CC-AEV124
SF-AB-SURROG-2000	AEV0125	AE-CKV-CC-AEV125
SF-AB-SURROG-2000	AEV0126	AE-CKV-CC-AEV126
SF-AB-SURROG-2000	AEV0127	AE-CKV-CC-AEV127
SF-AB-SURROG-2000	ALFV0030	AL-ARC-CC-ALFV30
SF-AB-SURROG-2000	ALFV0042	AL-ARC-CC-ALFV42
SF-AB-SURROG-2000	ALV0001	AL-CKV-CC-ALV001
SF-AB-SURROG-2000	ALV0002	AL-CKV-CC-ALV002
SF-AB-SURROG-2000	ALV0006	AL-CKV-CC-ALV006
SF-AB-SURROG-2000	ALV0009	AL-CKV-CC-ALV009
SF-AB-SURROG-2000	ALV0012	AL-CKV-CC-ALV012
SF-AB-SURROG-2000	ALV0015	AL-CKV-CC-ALV015
SF-AB-SURROG-2000	ALV0033	AL-CKV-CC-ALV033
SF-AB-SURROG-2000	ALV0036	AL-CKV-CC-ALV036
SF-AB-SURROG-2000	ALV0045	AL-CKV-CC-ALV045
SF-AB-SURROG-2000	ALV0048	AL-CKV-CC-ALV048
SF-AB-SURROG-2000	ALV0053	AL-CKV-CC-ALV053
SF-AB-SURROG-2000	ALV0054	AL-CKV-CC-ALV054
SF-AB-SURROG-2000	ALV0057	AL-CKV-CC-ALV057
SF-AB-SURROG-2000	ALV0062	AL-CKV-CC-ALV062
SF-AB-SURROG-2000	ALV0067	AL-CKV-CC-ALV067
SF-AB-SURROG-2000	ALV0072	AL-CKV-CC-ALV072
SF-AB-SURROG-2000	ALV0148	AL-CKV-CC-ALV148
SF-AB-SURROG-2000	ALV0149	AL-CKV-CC-ALV149
SF-AB-SURROG-2000	ALV0150	AL-CKV-CC-ALV150
SF-AB-SURROG-2000	ALV0151	AL-CKV-CC-ALV151
SF-AB-SURROG-2000	ALV0152	AL-CKV-CC-ALV152
SF-AB-SURROG-2000	ALV0153	AL-CKV-CC-ALV153
SF-AB-SURROG-2000	ALV0154	AL-CKV-CC-ALV154
SF-AB-SURROG-2000	ALV0155	AL-CKV-CC-ALV155
SF-AB-SURROG-2000	BG8440	BG-CKV-OO-V8440
SF-AB-SURROG-2000	EJ8730A	EJ-CKV-CC-V8730A
SF-AB-SURROG-2000	EJ8730B	EJ-CKV-CC-V8730B
SF-AB-SURROG-2000	EJ8969A	EJ-CKV-CC-V8969A
SF-AB-SURROG-2026	EGV0003	EG-CKV-CC-V003
SF-AB-SURROG-2026	EGV0003	EG-CKV-OO-V003
SF-AB-SURROG-2026	EGV0007	EG-CKV-CC-V007

Fragility Group	Component	MappedBE
SF-AB-SURROG-2026	EGV0007	EG-CKV-OO-V007
SF-AB-SURROG-2026	EGV0012	EG-CKV-CC-V012
SF-AB-SURROG-2026	EGV0012	EG-CKV-OO-V012
SF-AB-SURROG-2026	EGV0016	EG-CKV-CC-V016
SF-AB-SURROG-2026	EGV0016	EG-CKV-OO-V016
SF-AB-SURROG-2026	EGV0036	EG-CKV-CC-V036
SF-AB-SURROG-2026	EGV0061	EG-CKV-CC-V061
SF-AB-SURROG-2026	EGV0130	EG-CKV-CC-V130
SF-AB-SURROG-2026	EGV0131	EG-CKV-CC-V131
SF-AB-SURROG-2026	FCV0001	FC-CKV-CC-FCV001
SF-AB-SURROG-2026	FCV0002	FC-CKV-CC-FCV002
SF-AB-SURROG-2026	FCV0024	FC-CKV-CC-FCV024
SF-AB-SURROG-2026	FCV0025	FC-CKV-CC-FCV025
SF-AB-SURROG-2047	ABV0345	AB-CKV-CC-PRV1IA
SF-AB-SURROG-2047	ABV0346	AB-CKV-CC-PRV1N2
SF-AB-SURROG-2047	ABV0347	AB-CKV-CC-PRV2IA
SF-AB-SURROG-2047	ABV0348	AB-CKV-CC-PRV2N2
SF-AB-SURROG-2047	ABV0349	AB-CKV-CC-PRV3IA
SF-AB-SURROG-2047	ABV0350	AB-CKV-CC-PRV3N2
SF-AB-SURROG-2047	ABV0351	AB-CKV-CC-PRV4IA
SF-AB-SURROG-2047	ABV0352	AB-CKV-CC-PRV4N2
SF-AXB-MV-1974	ALHV0030	AL-MOV-CC-ALHV30
SF-AXB-MV-1974	ALHV0031	AL-MOV-CC-ALHV31
SF-AXB-MV-1974	ALHV0032	AL-MOV-CC-ALHV32
SF-AXB-MV-1974	ALHV0033	AL-MOV-CC-ALHV33
SF-AXB-MV-1974	ALHV0034	AL-MOV-OC-ALHV34
SF-AXB-MV-1974	ALHV0035	AL-MOV-OC-ALHV35
SF-AXB-MV-1974	ALHV0036	AL-MOV-OC-ALHV36
SF-AXB-MV-1974	BGFCV0121	BG-AOV-OC-FCV121
SF-AXB-MV-1974	BGFCV0124	BG-AOV-OC-FCV124
SF-AXB-MV-1974	BGHV8110	BG-MOV-OO-HV8110
SF-AXB-MV-1974	BGHV8111	BG-MOV-OO-HV8111
SF-AXB-MV-1974	BGHV8357A	BG-MOV-CC-8357A
SF-AXB-MV-1974	BGHV8357B	BG-MOV-CC-8357B
SF-AXB-MV-1974	BNHV8806A	BN-MOV-OO-V8806A
SF-AXB-MV-1974	BNHV8806B	BN-MOV-OO-V8806B
SF-AXB-MV-1974	BNHV8812A	BN-MOV-OO-V8812A
SF-AXB-MV-1974	BNHV8812B	BN-MOV-OO-V8812B
SF-AXB-MV-1974	BNHV8813	BN-LSW-OO-8813
SF-AXB-MV-1974	BNHV8813	BN-LSW-OO-88131
SF-AXB-MV-1974	BNHV8813	BN-LSW-OO-HV8813
SF-AXB-MV-1974	BNHV8813	BN-MOV-OO-HV8813
SF-AXB-MV-1974	BNLCV0112D	BN-MOV-CC-V112D

Fragility Group	Component	MappedBE
SF-AXB-MV-1974	BNLCV0112D	BN-MOV-OO-V112D
SF-AXB-MV-1974	BNLCV0112E	BN-MOV-CC-V112E
SF-AXB-MV-1974	BNLCV0112E	BN-MOV-OO-V112E
SF-AXB-MV-1974	EJFCV0610	EJ-MOV-OC-FCV610
SF-AXB-MV-1974	EJFCV0611	EJ-MOV-OC-FCV611
SF-AXB-MV-1974	EJHV8804B	EJ-MOV-CC-V8804B
SF-AXB-MV-1974	EJHV8811A	EJ-MOV-CC-V8811A
SF-AXB-MV-1974	EJHV8811B	EJ-MOV-CC-V8811B
SF-AXB-MV-1974	EMHV8803A	EM-MOV-CC-V8803A
SF-AXB-MV-1974	EMHV8803A	EM-MOV-PG-V8803A
SF-AXB-MV-1974	EMHV8803B	EM-MOV-CC-V8803B
SF-AXB-MV-1974	EMHV8803B	EM-MOV-PG-V8803B
SF-AXB-MV-1974	EMHV8807A	EM-MOV-CC-V8807A
SF-AXB-MV-1974	EMHV8807B	EM-MOV-CC-V8807B
SF-AXB-MV-1974	EMHV8814A	EM-LSW-OO-V8814A
SF-AXB-MV-1974	EMHV8814A	EM-MOV-OO-V8814A
SF-AXB-MV-1974	EMHV8814B	EM-LSW-OO-V8814B
SF-AXB-MV-1974	EMHV8814B	EM-MOV-OO-V8814B
SF-AXB-MV-1974	EMV0041	EM-XVM-PG-V041
SF-AXB-MV-1974	EMV0042	EM-XVM-PG-V042
SF-AXB-MV-1974	EMV0244	EM-XVM-PG-V244
SF-AXB-MV-1974	EMV0245	EM-XVM-PG-V245
SF-AXB-MV-2000	ALHV0005	AL-MOV-OC-ALHV05
SF-AXB-MV-2000	ALHV0006	AL-AOV-OC-ALHV06
SF-AXB-MV-2000	ALHV0007	AL-MOV-OC-ALHV07
SF-AXB-MV-2000	ALHV0008	AL-AOV-OC-ALHV08
SF-AXB-MV-2000	ALHV0009	AL-MOV-OC-ALHV09
SF-AXB-MV-2000	ALHV0010	AL-AOV-OC-ALHV10
SF-AXB-MV-2000	ALHV0011	AL-MOV-OC-ALHV11
SF-AXB-MV-2000	ALHV0012	AL-AOV-OC-ALHV12
SF-AXB-MV-2000	BGHV8105	BG-MOV-OO-HV8105
SF-AXB-MV-2000	BGHV8106	BG-MOV-OO-HV8106
SF-AXB-MV-2000	BGLCV0112B	BG-MOV-OO-112B
SF-AXB-MV-2000	BGLCV0112C	BG-MOV-OO-112C
SF-AXB-MV-2000	EGHV069A	EG-AOV-OO-HV69A
SF-AXB-MV-2000	EGHV069B	EG-AOV-OO-HV69B
SF-AXB-MV-2000	EGHV070A	EG-AOV-OO-HV70A
SF-AXB-MV-2000	EGHV070B	EG-AOV-OO-HV70B
SF-AXB-MV-2000	EJFCV0618	EJ-AOV-CO-FCV618
SF-AXB-MV-2000	EJFCV0619	EJ-AOV-CO-FCV619
SF-AXB-MV-2000	EJHCV0606	EJ-AOV-OC-HCV606
SF-AXB-MV-2000	EJHCV0607	EJ-AOV-OC-HCV607
SF-AXB-MV-2000	EJHV8716A	EJ-MOV-OC-V8716A

Fragility Group	Component	MappedBE
SF-AXB-MV-2000	EJHV8716A	EJ-MOV-OO-V8716A
SF-AXB-MV-2000	EJHV8716B	EJ-MOV-OC-V8716B
SF-AXB-MV-2000	EJHV8716B	EJ-MOV-OO-V8716B
SF-AXB-MV-2000	EJHV8804A	EJ-MOV-CC-V8804A
SF-AXB-MV-2000	EJHV8809A	EJ-MOV-OC-V8809A
SF-AXB-MV-2000	EJHV8809B	EJ-MOV-OC-V8809B
SF-AXB-MV-2000	EJHV8840	EJ-MOV-FH-HV8840
SF-AXB-MV-2000	EJHV8840	EJ-MOV-IR-HV8840
SF-AXB-MV-2000	EJHV8840	EJ-MOV-SO-HV8840
SF-AXB-MV-2000	EMHV8801A	EM-MOV-CC-V8801A
SF-AXB-MV-2000	EMHV8801A	EM-MOV-PG-V8801A
SF-AXB-MV-2000	EMHV8801B	EM-MOV-CC-V8801B
SF-AXB-MV-2000	EMHV8801B	EM-MOV-PG-V8801B
SF-AXB-MV-2000	EMHV8802A	EM-MOV-FH-8802A
SF-AXB-MV-2000	EMHV8802A	EM-MOV-IR-8802A
SF-AXB-MV-2000	EMHV8802A	EM-MOV-SO-8802A
SF-AXB-MV-2000	EMHV8802B	EM-MOV-FH-8802B
SF-AXB-MV-2000	EMHV8802B	EM-MOV-IR-8802B
SF-AXB-MV-2000	EMHV8802B	EM-MOV-SO-8802B
SF-AXB-MV-2000	EMHV8835	EM-MOV-OC-HV8835
SF-AXB-MV-2026	EGHV0015	EG-MOV-CC-HV15
SF-AXB-MV-2026	EGHV0015	EG-MOV-OO-HV15
SF-AXB-MV-2026	EGHV0016	EG-MOV-CC-HV16
SF-AXB-MV-2026	EGHV0016	EG-MOV-OO-HV16
SF-AXB-MV-2026	EGHV0054	EG-MOV-CC-HV54

The fragility ranking tool was ran on both the CDF and LERF results of the sensitivity model. The results were compared to the original model for reasonableness and are shown in the tables below. Note that the fragility sub-groups SF-AXBMV-2000, SF-AXB-MV-1974, and SF-AB-SURROG-2000 are showing up as risk significant contributors; suggesting that the components in these elevation groups can be targeted for refinements to help gain additional seismic margin. Note that a review of the quantification results shows that with the addition of these sub-groups, the S-PRA CDF and S-PRA LERF risk metric results start to increase. This is attributed to the additional number of cutsets being generated.

Fragility Group Sub-Grouping Sensitivity CDF Results								
Scenario	**Hazard Range**	**HRA Bin**	**Earthquake Frequency**	**Truncation**	**ACUBE Cutsets**	**ACUBE CCDP**	**ACUBE CDF**	**% CDF**
%G01	0.1g to 0.2g	1	8.02E-04	1.00E-10	1000	9.29E-05	7.45E-08	0.18%
%G02	0.2g to 0.3g	2	1.80E-04	5.00E-09	1000	3.61E-03	6.50E-07	1.6%
%G03	0.3g to 0.4g	2	6.48E-05	5.00E-09	1000	4.71E-02	3.05E-06	7.3%
%G04	0.4g to 0.45g	2	1.67E-05	5.00E-09	1000	2.00E-01	3.35E-06	8.0%
%G05	0.45g to 0.5g	2	1.16E-05	1.00E-08	1000	3.82E-01	4.43E-06	10.6%
%G06	0.5g to 0.55g	3	8.13E-06	5.00E-08	1000	7.05E-01	5.73E-06	13.7%
%G07	0.55g to 0.6g	3	5.87E-06	2.00E-07	1000	7.41E-01	4.35E-06	10.4%
%G08	0.6g to 0.7g	4	7.60E-06	5.00E-07	1000	9.34E-01	7.10E-06	17.0%
%G09	0.7g to 0.8g	4	4.45E-06	5.00E-07	1000	9.63E-01	4.28E-06	10.3%
%G10	> 0.8g	4	8.85E-06	2.00E-06	1000	9.85E-01	8.71E-06	20.9%
						Total SCDF	**4.17E-05**	
						Total SCDF (w/ PAF)	**3.75E-05**	

Fragility Group Sub-Grouping Sensitivity LERF Results								
Scenario	**Hazard**	**HRA Bin**	**Earthquake Frequency**	**Truncation**	**ACUBE Cutsets**	**ACUBE CLERP**	**ACUBE LERF**	**% LERF**
%G01	0.1g to 0.2g	1	8.02E-04	1.00E-10	7100	8.0E-07	6.39E-10	0.02%
%G02	0.2g to 0.5g	2	2.73E-04	1.00E-09	7100	5.5E-05	1.49E-08	0.40%
%G03	0.5g to 0.6g	3	1.40E-05	1.00E-09	7100	9.4E-03	1.31E-07	3.53%
%G04	0.6g to 0.8g	4	1.21E-05	2.00E-09	7100	3.5E-02	4.28E-07	11.50%
%G05	0.8g to 1g	4	4.49E-06	5.00E-09	7100	1.4E-01	6.35E-07	17.06%
%G06	1g to 1.2g	4	1.89E-06	1.20E-08	7100	3.5E-01	6.56E-07	17.63%
%G07	1.2g to 1.4g	4	1.01E-06	4.00E-08	7100	6.0E-01	6.08E-07	16.33%
%G08	1.4g to 1.6g	4	5.68E-07	6.00E-08	7100	7.4E-01	4.22E-07	11.35%
%G09	1.6g to 2g	4	5.29E-07	2.00E-07	7100	8.9E-01	4.70E-07	12.63%
%G10	> 2g	4	3.63E-07	2.00E-07	7100	9.8E-01	3.55E-07	9.55%
						Total SLERF	**3.72E-06**	
						Total SLERF (w/ PAF)	**3.35E-06**	

Fragility Group Sub-Grouping Sensitivity CDF Fragility Ranking		
Fragility Group	**Description**	**Percent Reduction**
SF-IE-T1	Seismic induced loss of offsite power	70.1%
SF-NN0X	Seismic Induced Failure of 120 VAC Distribution Panels NN01, NN02, NN03 and NN04	4.3%
Relay_0.18DG	Relay Fragility Group	4.0%
SF-AXB-MV-2000	Seismic Induced Failure of the Aux Building Motor Operated Valves - Elevation 2000	3.3%
SF-AXB-MV-1974	Seismic Induced Failure of the Aux Building Motor Operated Valves - Elevation 1974	3.0%
SF-NSCI	Seismic Induced failure of Non-SC-I SSCs	2.9%
SF-RL0XX	Seismic Induced Failure of the Main Control Room Board(s)	2.7%
SF-AB-SURROG-2000	Auxiliary Building Surrogate Element for Check Valves - Elevation 2000	2.5%
SF-NSSSSIT	Seismic Induced Failure of the Accumulator Safety Injection Tanks	2.0%
SF-SCI-PMP	Seismic Induced Failure of the Class I Safety Pumps	1.9%
SF-FR-YDXFR	Seismic rupture of the yard transformer housings, oil leakage, and subsequent ignition	1.7%
SF-IE-SW	Seismic Induced failure of service water (NSCI)	1.6%
SF-AB-SURROG-2026	Auxiliary Building Surrogate Element for Check Valves - Elevation 2026	1.5%
SF-SB0XX-2	Seismic Induced Failure of RP Cabinet SB037, SB038, SB041, SB042	1.5%
SF-IE-S3	Seismic induced very small break LOCA	<0.1%
SF-SB102X	Seismic Failure of W Cabinet for reactor trip switchgear train A/B	<0.1%
Relay_0.33	Relay Fragility Group	<0.1%

4.0 Updated Model Results

Following all the changes described in Section 2.0, the current S-PRA CDF and LERF risk metric results, and the CDF and LERF fragility rankings are shown below. Note that the risk metric evolution (from peer review, to F&O Closure) are also shown.

	SCDF	SLERF	% Difference (SCDF)	% Difference (SLERF)
Peer Review Model	1.14E-04	5.33E-06	-	-
F&O Closure Model	4.86E-05	3.41E-06	57.4% (Decrease)	36.0% (Decrease)
Model Refinements (Post F&O Closure)	3.56E-05	3.35E-06	26.8% (Decrease)	1.8% (Decrease)

Model Refinements (Post F&O Closure) CDF Results

Scenario	Hazard Range	HRA Bin	Earthquake Frequency	Truncation	ACUBE Cutsets	ACUBE CCDP	ACUBE CDF	% CDF
%G01	0.1g to 0.2g	1	8.02E-04	1.00E-10	1000	5.60E-05	4.49E-08	0.11%
%G02	0.2g to 0.3g	2	1.80E-04	5.00E-09	1000	3.13E-03	5.63E-07	1.42%
%G03	0.3g to 0.4g	2	6.48E-05	5.00E-09	1000	4.02E-02	2.61E-06	6.59%
%G04	0.4g to 0.45g	2	1.67E-05	5.00E-09	1000	1.70E-01	2.83E-06	7.16%
%G05	0.45g to 0.5g	2	1.16E-05	1.00E-08	1000	3.32E-01	3.85E-06	9.74%
%G06	0.5g to 0.55g	3	8.13E-06	5.00E-08	1000	6.72E-01	5.46E-06	13.83%
%G07	0.55g to 0.6g	3	5.87E-06	2.00E-07	1000	6.95E-01	4.08E-06	10.32%
%G08	0.6g to 0.7g	4	7.60E-06	5.00E-07	1000	9.33E-01	7.09E-06	17.94%
%G09	0.7g to 0.8g	4	4.45E-06	5.00E-07	1000	9.63E-01	4.28E-06	10.84%
%G10	> 0.8g	4	8.85E-06	2.00E-06	1000	9.85E-01	8.71E-06	22.05%
						Total SCDF	**3.95E-05**	
						Total SCDF (w/ PAF)	**3.56E-05**	

Model Refinements (Post F&O Closure)LERF Results								
Scenario	Hazard Range	HRA Bin	Earthquake Frequency	Truncation	ACUBE Cutsets	ACUBE CLERP	ACUBE LERF	% LERF
%G01	0.1g to 0.2g	1	8.02E-04	1.00E-10	7100	7.97E-07	6.39E-10	0.02%
%G02	0.2g to 0.5g	2	2.73E-04	1.00E-09	7100	5.47E-05	1.49E-08	0.40%
%G03	0.5g to 0.6g	3	1.40E-05	1.00E-09	7100	9.38E-03	1.31E-07	3.53%
%G04	0.6g to 0.8g	4	1.21E-05	2.00E-09	7100	3.54E-02	4.28E-07	11.50%
%G05	0.8g to 1g	4	4.49E-06	5.00E-09	7100	1.41E-01	6.35E-07	17.06%
%G06	1g to 1.2g	4	1.89E-06	1.20E-08	7100	3.47E-01	6.56E-07	17.63%
%G07	1.2g to 1.4g	4	1.01E-06	4.00E-08	7100	6.02E-01	6.08E-07	16.33%
%G08	1.4g to 1.6g	4	5.68E-07	6.00E-08	7100	7.44E-01	4.22E-07	11.35%
%G09	1.6g to 2g	4	5.29E-07	2.00E-07	7100	8.89E-01	4.70E-07	12.63%
%G10	> 2g	4	3.63E-07	2.00E-07	7100	9.79E-01	3.55E-07	9.55%
						Total SLERF	**3.72E-06**	
						Total SLERF (w/ PAF)	**3.35E-06**	

CDF Fragility Ranking		
Fragility Group	Description	Percent Reduction
SF-IE-T1	Seismic induced loss of offsite power	69.3%
SF-NN0X	Seismic Induced Failure of 120 VAC Distribution Panels NN01, NN02, NN03 and NN04	4.8%
Relay_0.18DG	Relay Fragility Group	4.3%
SF-AXB-MV	Seismic Induced Failure of the Aux Building Motor Operated Valves	3.8%
SF-RL0XX	Seismic Induced Failure of the Main Control Room Board(s)	2.8%
SF-AB SURROG	Auxiliary Building Surrogate Element for Check Valves	2.8%
SF-NSCI	Seismic Induced failure of Non-SC-I SSCs	2.3%
SF-NSSSSI1	Seismic Induced Failure of the Accumulator Safety Injection Tanks	2.3%
SF-SCI-PMP	Seismic Induced Failure of the Class I Safety Pumps	2.3%
SF-SB0XX-2	Seismic Induced Failure of RP Cabinet SB037, SB038, SB041, SB042	1.8%
SF-FR-YDXFR	Seismic rupture of the yard transformer housings, oil leakage, and subsequent ignition	1.5%
SF-IE-SW	Seismic Induced failure of service water (NSCI)	1.5%
SF-NK02	Seismic Induced Failure of 125 V DC Bus NK02	1.5%
SF-ALHV220	Seismic Induced Failure of ALH0V220 – Air Operated Suction Valve from HCST to TDAFW Pumps	1.5%
SF-NGXC-1	Seismic Induced Failure of the MCC NG05E and NG06E	1.0%
SF-IE-S3	Seismic induced very small break LOCA	<0.1%
SF-SB102X	Seismic Failure of W Cabinet for reactor trip switchgear train A/B	<0.1%
Relay_0.33	Relay Fragility Group	<0.1%

LERF Fragility Ranking		
Fragility Group	**Description**	**Percent Reduction**
SF-SOIL	Seismic Induced Soil Failure	19.4%
SF-NSSG	Seismic Induced Failure of the Steam Generator Supports	19.4%
SF-RB-PEN	Seismic Induced Failure of the Reactor Building Containment Penetrations	13.5%
SF-IE-T1	Seismic induced loss of offsite power	8.3%
SF-F-AB-2047-F	Seismic Induced Flooding from Fire protection piping in Aux Building 2047' level	6.7%
SF-CC	Seismic Induced Failure of the Communications Corridor	2.7%
SF-RB	Seismic Induced Failure of the Reactor Building	1.6%
SF-NN0X	Seismic Induced Failure of 120 VAC Distribution Panels NN01, NN02, NN03 and NN04	1.1%
SF-SB0XX-1	Seismic Induced Failure of RP Cabinet SB029A/B/C/D, SB032A/B/C/D	0.8%
SF-SB0XX-2	Seismic Induced Failure of 120 VAC Distribution Panels NN01, NN02, NN03, and NN04.	0.5%
Relay_0.18DG	Relay Fragility Group	0.5%
SF-IE-S3	Seismic induced very small break LOCA	<0.1%

Fragility Ranking Color Key
Identified as risk-significant contributor in MOR, remains top contributor.
Identified as non-risk significant contributor in MOR, remains non-significant contributor.
Identified as risk-significant contributor in MOR, dropped below 2% threshold.
Not identified as risk-significant contributor in MOR, now showing as risk significant.