



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
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June 17, 2025

Ms. Kym A. Harshaw  
Acting President, Chief Executive  
Officer, and Chief Nuclear Officer  
STP Nuclear Operating Company  
P.O. Box 289  
Wadsworth, TX 77483

SUBJECT: TRANSMITTAL OF FINAL SOUTH TEXAS PROJECT, UNIT 1, ACCIDENT  
SEQUENCE PRECURSOR REPORT (LICENSEE EVENT REPORT  
498-2024-006)

Dear Ms. Harshaw:

By letter dated December 23, 2024, STP Nuclear Operating Company (the licensee) submitted licensee event report (LER) 498-2024-006, "Condition Prohibited by Technical Specifications and Potential Loss of Safety Function Due to Inoperable Pressurizer Power Operated Relief Valve" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML24358A097) to the U.S. Nuclear Regulatory Commission (NRC) staff pursuant to Title 10 of the *Code of Federal Regulations* Section 50.73 for South Texas Project, Unit 1 (STP). As part of the accident sequence precursor (ASP) program, the NRC staff reviewed the event to identify potential precursors and to determine the probability of the event leading to a core damage state.

The preliminary ASP report was transmitted to STP Nuclear Operating Company (the licensee) on January 24, 2025, to allow for a 30-day review period. The licensee provided comments on February 13, 2025. The purpose of these comments was to communicate to the NRC that the 138 kilovolt STP Offsite power source for the engineered safety feature (ESF) buses via the emergency transformer, which is available for emergency response and use in the probabilistic risk assessment, but is not credited for technical specifications compliance, remained available to power an ESF bus during the event in question. STP has procedures and training in place for its use. This power source was detailed in an attached drawing in the licensee's response. This information was not mentioned in the Preliminary ASP Analysis. The final ASP report is provided in an enclosure to this letter.

K. Harshaw

- 2 -

If you have any questions, please contact me at contact me at 301-415-3719 or via email at [Thomas.Byrd@nrc.gov](mailto:Thomas.Byrd@nrc.gov).

Sincerely,

*/RA/*

Thomas J. Byrd, Project Manager  
Plant Licensing Branch IV  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 50-498

Enclosure:  
Unit 1 LER 498-2024-006

cc: Listserv

## **ENCLOSURE**

Final ASP Analysis – Precursor

South Texas Project, Unit 1

LER 498-2024-006

“Condition Prohibited by Technical Specifications and Potential Loss of Safety Function Due to

Inoperable Pressurizer Power-Operated Relief Valve”

# Final ASP Analysis – Precursor

Accident Sequence Precursor Program – Office of Nuclear Regulatory Research		
<b>South Texas Project, Unit 1</b>	Condition Prohibited by Technical Specifications and Potential Loss of Safety Function Due to Inoperable Pressurizer Power-Operated Relief Valve	
<b>Event Date:</b> 10/5/2024	<b>LERs:</b> <a href="#">498-2024-006</a> <b>IR:</b> TBD	<b>ΔCDP =</b> $3 \times 10^{-6}$
<b>Plant Type:</b>	Westinghouse Four-Loop Pressurized-Water Reactor (PWR) with Dry Ambient Pressure Containment	
<b>Plant Operating Mode (Reactor Power Level):</b>	Mode 3 (0% Reactor Power)	
<b>Analyst:</b> Christopher Hunter	<b>Reviewer:</b> Kyle Warns	<b>Completion Date:</b> 5/29/2025

## 1 EXECUTIVE SUMMARY

On October 5, 2024, pressurizer power-operated relief valve (PORV) ‘656A’ failed to open from the main control room (MCR) hand switch and auxiliary shutdown panel during performance of an operability test. Initial licensee troubleshooting identified a partially disengaged fastener that is used to connect a wire from the PORV solenoid to its power source. This degraded condition was determined to have resulted in inoperability of the valve following installation of a replacement solenoid valve in November 2021. PORV ‘656A’ was declared operable on November 4<sup>th</sup>, following corrective maintenance and successful post-maintenance testing. During the period when PORV ‘656A’ was unable to fulfil its safety function, PORV ‘655’ was also inoperable at various times to support testing and maintenance activities. In addition, a review of South Texas Project (STP) Unit 1 licensee event reports (LERs) revealed six “windowed” events (i.e., initiating events or degraded conditions that were concurrent with the PORV ‘656A’ failure).

An overall mean  $\Delta\text{CDP}$  of  $5.6 \times 10^{-7}$  for this degraded condition was calculated using a revised STP Unit 1 standardized plant analysis risk (SPAR) model. However, this SPAR model does not include all key hazards, most notably internal fires. Importance measures from the existing licensee probabilistic risk assessment (PRA) results in an estimated  $\Delta\text{CDP}$  of  $4.9 \times 10^{-7}$  from internal fires. This risk impact, along with those from the “windowed” events ( $\Delta\text{CDP} \sim 1.4 \times 10^{-6}$ ), indicate that the overall  $\Delta\text{CDP}$  would be in low  $10^{-6}$  range (i.e.,  $\sim 2.5 \times 10^{-6}$ ) and, therefore, the degraded condition associated with the failure of PORV ‘656A’ is a precursor.

## 2 EVENT DETAILS

### 2.1 Event Description

On October 5, 2024, pressurizer PORV ‘656A’ failed to open from the MCR hand switch and auxiliary shutdown panel during performance of an operability test. Initial licensee troubleshooting identified a partially disengaged fastener that is used to connect a wire from the PORV solenoid to its power source. This degraded condition was determined to have resulted in inoperability of the valve following installation of a replacement solenoid valve in November 2021. PORV ‘656A’ was declared operable on November 4<sup>th</sup>, following corrective maintenance and successful post-maintenance testing. During the period when PORV ‘656A’

was unable to fulfil its safety function, PORV '655' was also inoperable at various times to support testing and maintenance activities. See LER 498-2024-006, "Condition Prohibited by Technical Specifications and Potential Loss of Safety Function Due to Inoperable Pressurizer Power Operated Relief Valve," ([ML24358A097](#)) for additional information.

## 2.2 Causes

The licensee identified a loose electrical connection associated with the PORV valve solenoid to its power source. A subsequent causal analysis is being performed to determine if there were any additional causes of the PORV failure.

## 3 MODELING

### 3.1 SDP Results/Basis for ASP Analysis

The [ASP Program](#) uses Significance Determination Process results for degraded conditions when available (and applicable). Discussions with Region 4 staff indicated that no licensee performance deficiency associated with this degraded condition have been identified; however, the LER remains open. Therefore, an independent ASP analysis was performed to determine the risk significance of PORV '656A' failure. A search of STP LERs revealed six "windowed" events (i.e., initiating events or degraded conditions that were concurrent with the PORV '656A' failure). Evaluations of the risk impact of these windowed events is provided in [Section 4.5](#).

### 3.2 Analysis Type

A degraded condition analysis was performed using a test and limited use revision of the version 8.80 SPAR model for STP Project Unit 1 created on February 25, 2025. The following SPAR model changes were made to support this analysis:

- The pressurizer PORV success criteria for feed and bleed cooling was changed to 1 out of 2 valves based on a review of thermal-hydraulic calculations for STP.
- The manual and automatic functions of the pressurizer PORVs were separated with the applicable fault tree logic.
- The common-cause failure (CCF) events associated with the essential chilled water (ECH) chillers were modified to allow the manual adjustment to the various CCF combinations.
- Credit for other steam pathways in addition to the steam generator (SG) PORVs for decay heat removal (e.g., steam dumps and SG safety valves) were provided.
- The reactor coolant system pressure relief success criteria given an anticipated transient without scram were modified based on a review of thermal-hydraulic calculations for STP. Specifically, either both pressurizer PORVs or safety valves are required to operate to ensure that RCS pressure does not exceed 3200 psi.
- Corrections were made to the auxiliary feedwater (AFW) electrical room cooling fault tree.

This SPAR model includes the following hazards:

- Internal events,
- Seismic events, and
- High winds (including hurricanes and tornados).

Internal fire and flood scenarios are not included in the STP SPAR model. Internal floods, based on the results of the licensee PRA, are a minimal contributor to the overall risk at STP and, therefore, the risk impact of internal flood scenarios with these degraded conditions are not expected to be significant. The lack of internal fire hazards modeling is a key uncertainty for this analysis, which is evaluated in [Section 4.4](#).

### 3.3 SPAR Model Modifications

The existing STP SPAR model SBO-ELAP event tree has three transfers to the SBO-1 event tree given successful offsite power recovery. These transfers were changed to 'OK' end states because reactivity control and decay heat removal were successful and are not associated with a loss-of-coolant accident (LOCA), which is consistent with other initiating events in the STP SPAR model and SBO-ELAP event trees in other SPAR models.

### 3.4 Exposure Time

PORV '656A' was unable to perform its manual safety function from November 2021 through November 2024. Therefore, the exposure time was set to the maximum of 1 year in accordance with Volume 1 (internal events) of the Risk Assessment of Operational Events (or RASP) Handbook ([ML17348A149](#)). During this 1-year exposure time, PORV '655' was unavailable for approximately 36 hours to support various test and maintenance activities. Therefore, the following two exposure times were identified:

- Exposure Time 1—PORV '656A' failure to operate (manual function only) for approximately 8724 hours.
- Exposure Time 2—PORV '656A' failure to operate (manual function only) and PORV '655' unavailable (both manual and automatic functions) for approximately 36 hours.

### 3.5 Analysis Assumptions

The following modeling assumptions were determined to be significant for this analysis:

- Basic event PPR-PRV-CC-PCV656M (*PORV PCV-656 fails to open on demand (manual)*) was set to TRUE due to inability of PORV '656A' to be manually opened during Exposure Times 1 and 2.
- Basic events PPR-PRV-CC-PCV655M (*PORV PCV-655 fails to open on demand (manual)*) and PPR-PRV-CC-PCV655A (*PORV PCV-655 fails to open on demand (automatic)*) were set to 1.0 due to the inability to manually open PORV '655' during Exposure Time 2.

## 4 ANALYSIS RESULTS

### 4.1 Results<sup>1</sup>

The overall mean  $\Delta$ CDP for this analysis is calculated to be  $5.6 \times 10^{-7}$ , which is the sum of the two exposure times. The parameter uncertainty results for both exposure times of this analysis are provided below:

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<sup>1</sup> The  $\Delta$ CDPs presented in the following sections are point estimates unless otherwise noted.

**Table 1. Parameter Uncertainty Results for Exposure Times 1 and 2**

Exposure Time	5%	Median	Point Estimate	Mean	95%
1	$3.6 \times 10^{-8}$	$2.1 \times 10^{-7}$	$4.9 \times 10^{-7}$	$4.4 \times 10^{-7}$	$1.5 \times 10^{-6}$
2	$1.0 \times 10^{-8}$	$4.2 \times 10^{-8}$	$7.6 \times 10^{-8}$	$6.9 \times 10^{-8}$	$2.1 \times 10^{-7}$

The  $\Delta$ CDP for hazards included in the STP SPAR model is below the ASP Program threshold of  $1 \times 10^{-6}$  for degraded conditions. However, additional risk impacts estimated for internal fires ( $\Delta$ CDP =  $4.9 \times 10^{-7}$ ; see [Section 4.4](#) for additional information) and “windowed” events ( $\Delta$ CDP =  $1.4 \times 10^{-6}$ ; see [Section 4.5](#) for additional information) indicate that the overall  $\Delta$ CDP would be in low  $10^{-6}$  range ( $2.5 \times 10^{-6}$ ) and, therefore, the degraded condition associated with the failure of PORV ‘656A’ is a precursor.<sup>2</sup>

#### 4.2 Dominant Hazards

The dominant hazard for this analysis is high winds (including hurricanes and tornados) ( $\Delta$ CDP =  $3.3 \times 10^{-7}$ ), which contribute approximately 59 percent of the total  $\Delta$ CDP. Internal events contribute approximately 41 percent ( $2.3 \times 10^{-7}$ ) of the total  $\Delta$ CDP. Seismic hazards are minimal contributors for this analysis. The lack of internal fire scenarios in the SPAR model is a key uncertainty, which is considered qualitatively in [Section 4.4](#).

#### 4.3 Dominant Sequences

The dominant accident sequence is hurricane (bin 2) sequence 4-21 ( $\Delta$ CDP =  $2.8 \times 10^{-7}$ ), which contributes approximately 49 percent of the total  $\Delta$ CDP. The sequences that contribute at least 5 percent to the total  $\Delta$ CDP are provided in Table 2. The event tree with the dominant sequence is shown graphically in Figures A-1 and A-2 of [Appendix A](#).

**Table 2. Dominant Sequences**

Sequence	$\Delta$ CDP	%	Description
HCN-BIN-2 4-21	$2.8 \times 10^{-7}$	49.4%	Hurricane (bin 2) occurs that results in a LOOP initiating event; the reactor trips successfully; the emergency power system is successful; AFW fails; and feed and bleed cooling fails resulting in core damage.
PLOMFW 33	$9.3 \times 10^{-8}$	16.4%	Partial loss of main feedwater (MFW) initiating event occurs; the reactor trips successfully; AFW fails; and feed and bleed cooling fails resulting in core damage.
SGTR 9	$5.8 \times 10^{-8}$	10.3%	A SG tube rupture occurs, AFW or MFW is successful; high-pressure safety injection is successful; SG isolation is successful; secondary side cooldown fails; refueling water storage tank refill fails; and additional actions to restore decay heat removal fail resulting in core damage.

<sup>2</sup> When adding the contribution from the “windowed” events, the exposure time associated with the failure of PORV ‘656A’ must be adjusted to eliminate double counting. The total exposure time considered in evaluating the risk impact of the “windowed” events is approximately 49 days. Therefore, Exposure Time 1 associated with the failure of PORV ‘656A’ would decrease from 8724 hours to 7539 hours, which would result in a mean  $\Delta$ CDP of  $3.8 \times 10^{-7}$  for this exposure time. However, the overall  $\Delta$ CDP associated with the failure of PORV ‘656A’, including estimated from internal fires and the “windowed” events, remains in the low  $10^{-6}$  range.

#### 4.4 Key Uncertainties

A review of the analysis assumptions and results reveal the following key uncertainties:

- Lack of Internal Fire Modeling in the SPAR Model.** The STP SPAR model does not include internal fire scenarios. The risk impact from internal fires is likely to be dominated from scenarios that result in a loss of MFW and/or AFW or affect the availability of PORV '655'. A quantitative evaluation using the information in the STP's individual plant examination from external events (IPEEE) is not practical; however, the risk achievement worth (RAW) importance measure of 1.78 of pressurizer PORV '656A' from the existing licensee PRA results in an additional  $\Delta$ CDP of  $4.9 \times 10^{-7}$  from internal fire scenarios.<sup>3</sup> This risk estimate is bounding for Exposure Time 1 since the importance measure considers the manual and automatic functions of PORV '656A'; however, it is expected that the failure of the manual function to be the dominant risk contributor. In addition, the risk estimate for Exposure Time 2 is likely underestimated because the importance measures only consider a single failure (i.e., the importance measure for PORV '656A' was not calculated based on the additional failure of PORV '655'). The inclusion of internal fires results in the overall  $\Delta$ CDP to increase to  $1.1 \times 10^{-6}$ , which is the ASP Program threshold for degraded conditions.

#### 4.5 Windowed Events

A search of STP Unit 1 LERs identified the six windowed events/degraded conditions that occurred during the maximum 1-year exposure time of PORV '656A' (see [Figure 1](#)). Most of these events/degraded conditions were evaluated by previously completed ASP analyses. A brief description of these events/degraded conditions along with a reevaluation of the risk impacts associated with the concurrent unavailability of PORV '656A' are provided below.

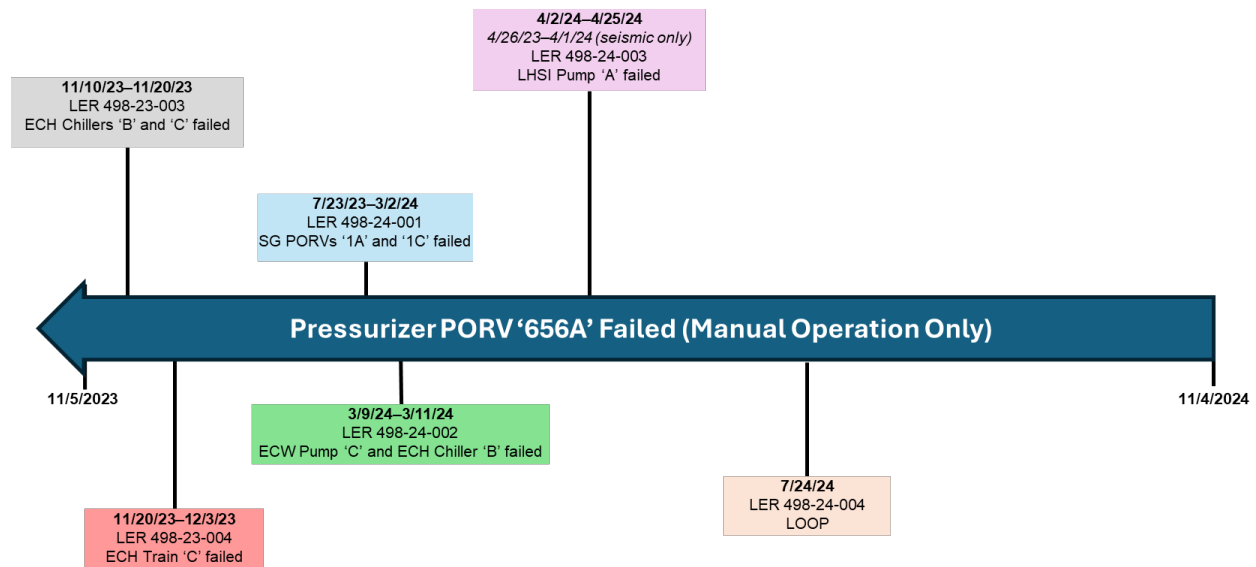


Figure 1: STP Unit 1 Windowed Events with PORV '656A' Failure

<sup>3</sup> The licensee fire PRA core damage frequency is  $6.3 \times 10^{-7}$  per year.

- LER 498-23-003. On November 10, 2023, essential chilled water (ECH) system train 'B' was declared inoperable due to the temperature exceeding limits. Approximately 8 hours later, the ECH train 'C' chiller was declared inoperable due to exceeding maximum compressor discharge pressure. ECH trains 'B' and 'C' were restored to service after successful repairs and post-maintenance testing were completed on November 11<sup>th</sup> and 20<sup>th</sup>, respectively. See LER 498-2023-003, "Two Essential Chilled Water Trains Inoperable Resulting in a Condition That Could Have Prevented Fulfillment of a Safety Function," ([ML24036A352](#)) for additional information.

An ASP evaluation was performed assuming three exposure times—(a.) ECH chiller 'B' was failed for approximately 8 hours, (b.) ECH chillers 'B' and 'C' were failed for approximately 24 hours, and (c.) ECH chiller 'C' was failed for approximately 9 days. The risk impact from the concurrent unavailabilities of the SG PORVs '1A' and '1C' (LER 498-24-001) and low-head safety injection (LHSI) pump '1A' (LER 498-24-003) are negligible and, are not evaluated further as part of the evaluation of these degraded conditions. This analysis resulted in an overall  $\Delta$ CDP of  $1.9 \times 10^{-7}$  from internal events, high winds (including hurricanes and tornadoes), and seismic events. Internal flooding and fires scenarios are not included in the South Texas SPAR model. The risk impact due to internal floods is likely to be minimal for this degraded condition because these scenarios are unlikely to result in a LOCA for which the ECH system is needed to support the emergency core cooling systems (ECCS). The potential for LOCAs due to internal fires is expected to be mostly limited to LOCAs resulting from failures of reactor coolant pump (RCP) seals and the pressurizer PORVs. The risk impact from losses of RCP seal cooling/injection are mitigated by the installation of the passive shutdown seals and PORVs failure are likely to be isolable using the block valves. A quantitative evaluation using the information in the IPEEE is not practical; however, the RAW importance measures of 12.3 for the ECH chillers from the existing licensee PRA result in an additional  $\Delta$ CDP of  $2.2 \times 10^{-7}$  from internal fires, which would not result in the overall risk impact to exceed the ASP Program threshold. Given these considerations, this degraded condition was determined to not be a precursor.

A subsequent reevaluation considering PORV '656A' was concurrently unavailable to be operated manually during the applicable exposure time results in the  $\Delta$ CDP increasing approximately 11 percent ( $2.1 \times 10^{-7}$ ) from internal events, high winds (including hurricanes and tornadoes), and seismic events. The RAW importance measure of 1.78 for PORV '656A' from the existing licensee fire PRA results in an additional  $\Delta$ CDP of  $1.4 \times 10^{-8}$  from internal fires. Although the risk impact from fires is likely underestimated because the available importance measures are limited to single failures, the overall risk of  $4.4 \times 10^{-7}$  from all hazards is very unlikely to increase to above the ASP Program threshold given the modest increases shown when evaluating the concurrent degraded conditions using the SPAR model. Therefore, this degraded condition is still not a precursor.

- LER 498-23-004. On November 11, 2023, a condition report identified ECH train 'C' expansion tank level lowering over the previous 3 months to the low-level alarm setpoint. On November 21<sup>st</sup>, ECH train 'C' was declared inoperable due to excessive chilled water leakage. A subsequent licensee engineering evaluation determined that due to the excessive chilled water leakage, ECH train 'C' was considered to have been inoperable from November 20<sup>th</sup> until December 3<sup>rd</sup> when ECH train 'C' leakage was corrected. See LER 498-2023-004, "Condition Prohibited by Technical Specifications Due to Inoperable Train of Essential Chilled Water," ([ML24036A352](#)) for additional information.

An ASP evaluation was performed assuming ECH train 'C' was unable to perform its safety function for approximately 14 days. The risk impact from the concurrent unavailabilities of the SG PORVs '1A' and '1C' (LER 498-24-001) and LHSI pump '1A' (LER 498-24-003) are negligible and, are not evaluated further as part of the evaluation of this degraded condition. This analysis resulted in an overall  $\Delta$ CDP of  $2.1 \times 10^{-7}$  from internal events, high winds (including hurricanes and tornadoes), and seismic events. Internal flooding and fires scenarios are not included in the South Texas SPAR model. The risk impact due to internal floods is likely to be minimal for this degraded condition because these scenarios are unlikely to result in a LOCA for which the ECH system is needed to support the ECCS. The potential for LOCAs due to internal fires is expected to be mostly limited to LOCAs resulting from failures of RCP seals and the pressurizer PORVs. The risk impact from losses of RCP seal cooling/injection are mitigated by the installation of the passive shutdown seals and PORVs failure are likely to be isolable using the block valves. A quantitative evaluation using the information in the IPEEE is not practical; however, the RAW importance measure of 12.3 for the ECH chiller from the existing licensee PRA results in an additional  $\Delta$ CDP of  $2.7 \times 10^{-7}$  from internal fires, which would not result in the overall risk impact to exceed the ASP Program threshold. Given these considerations, this degraded condition was determined to not be a precursor.

A subsequent reevaluation considering PORV '656A' was concurrently unavailable to be operated manually during the applicable exposure time results in the  $\Delta$ CDP increasing approximately 10 percent ( $2.3 \times 10^{-7}$ ) from internal events, high winds (including hurricanes and tornadoes), and seismic events. The RAW importance measure of 1.78 for PORV '656A' from the existing licensee fire PRA results in an additional  $\Delta$ CDP of  $1.9 \times 10^{-8}$  from internal fires. Although the risk impact from fires is likely underestimated because the available importance measures are limited to single failures, the overall risk of  $5.2 \times 10^{-7}$  from all hazards is very unlikely to increase to above the ASP Program threshold given the modest increases shown when evaluating the concurrent degraded conditions using the SPAR model. Therefore, this degraded condition is still not a precursor.

- LER 498-24-001. On January 22, 2024, steam generator (SG) PORV '1A' was declared inoperable due to its failure to operate in automatic or manual mode. On January 23<sup>rd</sup>, SG PORV '1C' was declared inoperable due to its failure to operate in manual mode (only). Repairs on SG PORV '1C' were successfully completed and the PORV was declared operable later that day. Unit 1 was restarted on January 30<sup>th</sup> and returned to full-power operation on January 31<sup>st</sup>. On March 1, 2024, the station entered a forced outage to replace a SG safety relief valve (SRV) spring. With the unit in Mode 4, after closing SG PORV '1C' earlier in the day, operators attempted to open SG PORV '1C', but the valve would not open. The operators observed that the demand signal did not change on the controller. A subsequent licensee investigation found the same fuse blown that resulted in the valve failure identified on January 23<sup>rd</sup>, and an intermittent electrical failure on one of the A/B solenoid coils. The licensee replaced the A/B solenoid and SG PORV '1C' was declared operable following post-maintenance testing on March 2<sup>nd</sup>. See LER 498-2024-001, "Two SG PORVs Inoperable Resulting in a Condition that Could Have Prevented Fulfillment of a Safety Function," ([ML24092A190](#)) for additional information.

An ASP analysis was completed for these degraded conditions and is documented in an ASP analysis report ([ML24183A224](#)). This analysis resulted in a  $\Delta$ CDP of  $2 \times 10^{-9}$  from

internal events, high winds (including hurricanes and tornadoes), and seismic events. The dominant scenario from the failed SG PORVs included in the SPAR model is a SGTR initiating event. Internal fire and flood scenarios are very unlikely to result in a SGTR. In addition, internal fire and floods are unlikely to result in similar scenarios for the smaller risk contributors, which include steam line break and seismically small LOCAs with concurrent losses of offsite power.

The concurrent failure of PORV '656A' would not affect the same scenarios and, therefore, the risk of these windowed events is only additive, with the failure of SG PORVs being a negligible contributor to the risk associated with the failure of pressurizer PORV '656A' (i.e., the overall risk of the concurrent degraded conditions will be approximately equal to the risk associated with the failure of PORV '656A' itself). Therefore, the degraded conditions associated with the failure of SG PORVs is still not a precursor.

- LER 498-24-002. On March 9, 2024, essential cooling water (ECW) train 'C' was declared inoperable due to a through-wall leak on ECW pump '1C' discharge vent line. On March 10<sup>th</sup>, ECH train 'B' was declared inoperable due to chilled water outlet temperature exceeding limits. ECH train 'B' temperature limits were restored in approximately 47 minutes. The ECW pump 'C' discharge vent line was repaired on March 11<sup>th</sup>. See LER 498-2024-002, "Two Essential Chilled Water Trains Inoperable Resulting in a Condition That Could Have Prevented Fulfillment of a Safety Function," ([ML24130A271](#)) for additional information.

An ASP evaluation was performed assuming two exposure times—(a.) ECW train 'C' was unable to fulfil its safety function for approximately 2 days and (b.) both ECW train 'C' and ECH chiller 'B' failed. The risk impact from the concurrent unavailability of LHSI pump '1A' (LER 498-24-003) is negligible and, is not evaluated further as part of the evaluation of these degraded conditions. This analysis resulted in an overall  $\Delta$ CDP of  $9.2 \times 10^{-8}$  from internal events, high winds (including hurricanes and tornadoes), and seismic events. Internal flooding and fires scenarios are not included in the South Texas SPAR model. The risk impact due to internal floods is likely to be minimal for this degraded condition because these scenarios are unlikely to result in a LOOP or LOCA for which the ECW system is needed to support the emergency diesel generators and ECCS. The potential for LOCAs due to internal fires is expected to be mostly limited to LOCAs resulting from failures of RCP seals and the pressurizer PORVs. The risk impact from losses of RCP seal cooling/injection are mitigated by the installation of the passive shutdown seals and PORVs failure are likely to be isolable using the block valves. A quantitative evaluation using the information in the IPEEE is not practical; however, the RAW importance measures of 16.1 and 12.3 for the ECW train and ECH chiller from the existing licensee fire PRA result in an additional  $\Delta$ CDP of  $5.4 \times 10^{-8}$  from internal fires, which would not result in the overall risk impact to exceed the ASP Program threshold. Given these considerations, this degraded condition was determined to not be a precursor.

A subsequent reevaluation considering PORV '656A' was concurrently unavailable to be operated manually during the applicable exposure time results in the  $\Delta$ CDP increasing approximately 3 percent ( $9.5 \times 10^{-8}$ ) from internal events, high winds (including hurricanes and tornadoes), and seismic events. The RAW importance measure of 1.78 for PORV '656A' from the existing licensee fire PRA results in an additional  $\Delta$ CDP of  $2.7 \times 10^{-9}$  from internal fires. Although the risk impact from fires is likely underestimated because the

available importance measures are limited to single failures, the overall risk of  $1.5 \times 10^{-7}$  from all hazards is very unlikely to increase to above the ASP Program threshold given the modest increases shown when evaluating the concurrent degraded conditions using the SPAR model. Therefore, this degraded condition is still not a precursor.

- LER 498-24-003. On April 21, 2024, LHSI pump '1A' failed to start from the MCR during a valve operability test. An inspection of the 4.16 kilovolt breaker identified an unrestrained washer in the breaker cubicle that prevented the breaker from closing. It was determined that the unrestrained washer adversely impacted the seismic qualification of the breaker and there was no reasonable assurance that LHSI pump '1A' breaker would have been able to perform its required safety-related function during a seismic event following breaker installation on April 4, 2023, until the breaker was replaced, and the pump was declared operable on April 25, 2024. In addition, the breaker would not have operated for any demand since it was last operated successfully on April 2, 2024. See LER 498-2024-003, "Condition Prohibited by Technical Specifications and Potential Loss of Safety Function Due to Inoperable LHSI Pump," ([ML24183A174](#)) for additional information.

An initial ASP evaluation was performed assuming LHSI pump '1A' would have failed to start during (a.) any demand for an exposure time of 24 days and (b.) any seismic event for the exposure time of 341 days. This analysis resulted in an overall  $\Delta$ CDP of  $2.6 \times 10^{-7}$  from internal events, high winds (including hurricanes and tornadoes), and seismic events. Internal flooding and fires scenarios are not included in the STP SPAR model. The risk impact due to these unmodeled hazards for exposure time 'b' is likely to be minimal because these scenarios are unlikely to result in a medium or large LOCAs, which are the dominant scenarios for this degraded condition. A quantitative evaluation using the information in the IPEEE is not practical; however, the RAW importance measure of 1.61 for LHSI pump '1A' from the existing licensee fire PRA results in an additional  $\Delta$ CDP of  $2.5 \times 10^{-8}$  from internal fires, which would not result in the overall risk impact to exceed the ASP Program threshold. Given these considerations, this degraded condition was determined to not be a precursor.

A subsequent reevaluation considering PORV '656A' was concurrently unavailable to be operated manually during the applicable exposure times results in the  $\Delta$ CDP increasing approximately 2 percent ( $2.7 \times 10^{-7}$ ) from internal events, high winds (including hurricanes and tornadoes), and seismic events. The RAW importance measure of 1.78 for PORV '656A' from the existing licensee fire PRA results in an additional  $\Delta$ CDP of  $3.2 \times 10^{-8}$  from internal fires. Although the risk impact from fires is likely underestimated because the available importance measures are limited to single failures, the overall risk of  $3.2 \times 10^{-7}$  from all hazards is very unlikely to increase to above the ASP Program threshold given the modest increases shown when evaluating the concurrent degraded conditions using the SPAR model. Therefore, this degraded condition is still not a precursor.

- LER 498-24-004. On July 24, 2024, a LOOP occurred, resulting in an automatic reactor trip and actuation of all three Unit 1 EDGs and all four AFW pumps. All three trains of essential safety feature buses were energized via the EDGs, and all equipment responded as expected without any complications except for SG PORV '1C'. Unit 2 experienced a partial LOOP and automatic actuation of EDG '22' and one of four AFW pumps. See LER 498-2024-004, "LOOP Resulting in Unit 1 Automatic Reactor Trip and Actuation of EDGs and AFW Pumps," ([ML24263A145](#)) and inspection report (IR) 05000498/2024050 "South Texas Project Electric Generating Station, Units 1 and 2 –

NRC Special Inspection Report 05000498/2024050 and 05000499/2024050 and Preliminary White Finding,” ([ML24320A137](#)) for additional information. The risk impact of the LOOP with the concurrent unavailability of PORV ‘656A’ is modeled explicitly in the final precursor analysis ([ML25086A198](#)). The mean conditional core damage probability (CCDP) of the LOOP and concurrent failure of PORV ‘656A’ is  $3.6 \times 10^{-6}$ . The mean CCDP of this event would have been  $3.0 \times 10^{-6}$  if PORV ‘656A’ was able to fulfil its full safety function. Note that the CCDP associated with this initiating event analysis was not added to the overall  $\Delta$ CDP of the degraded condition analysis documented in this report because different metrics are used and to prevent double counting.

Table 3 provides a summary of the ASP results from “windowed” events that contribute additional risk to the failure of PORV ‘656A’:<sup>4</sup>

**Table 3: Summary of ASP Results of “Windowed” Events**

LER	Impacted System(s)	Exposure Time	$\Delta$ CDP w/o PORV ‘656A’ Failure	$\Delta$ CDP w/ PORV ‘656A’ Failure
498-23-003	ECH	~10 days	$4.1 \times 10^{-7}$	$4.4 \times 10^{-7}$
498-23-004	ECH	~14 days	$4.8 \times 10^{-7}$	$5.2 \times 10^{-7}$
498-24-002	ECW; ECH	~2 days	$1.5 \times 10^{-7}$	$1.5 \times 10^{-7}$
498-24-003	LHSI	~24 days <sup>5</sup>	$2.8 \times 10^{-7}$	$3.2 \times 10^{-7}$
<b>Total =</b>				<b><math>1.4 \times 10^{-6}</math></b>

An estimated  $\Delta$ CDP of  $1.4 \times 10^{-6}$  (including internal fires) from these “windowed” events is estimated to be added to  $\Delta$ CDP for the failure of PORV ‘656A’.

<sup>4</sup> LER 498-24-001 is not listed in this table because the concurrent SG PORV failures provides a negligible risk impact to the failure of pressurizer PORV ‘656A’. An initiating event analysis was performed for LER 498-2024-004, which uses the CCDP risk metric. Therefore, this result was not added to the overall results of the degraded condition assessment of the failure of PORV ‘656A’, which uses the  $\Delta$ CDP risk metric.

<sup>5</sup> This exposure time is associated with LHSI pump ‘A’ failure for all hazards. The additional 341-day exposure time for seismic hazards (only) is a negligible risk contributor.

### Appendix A: Key Event Tree

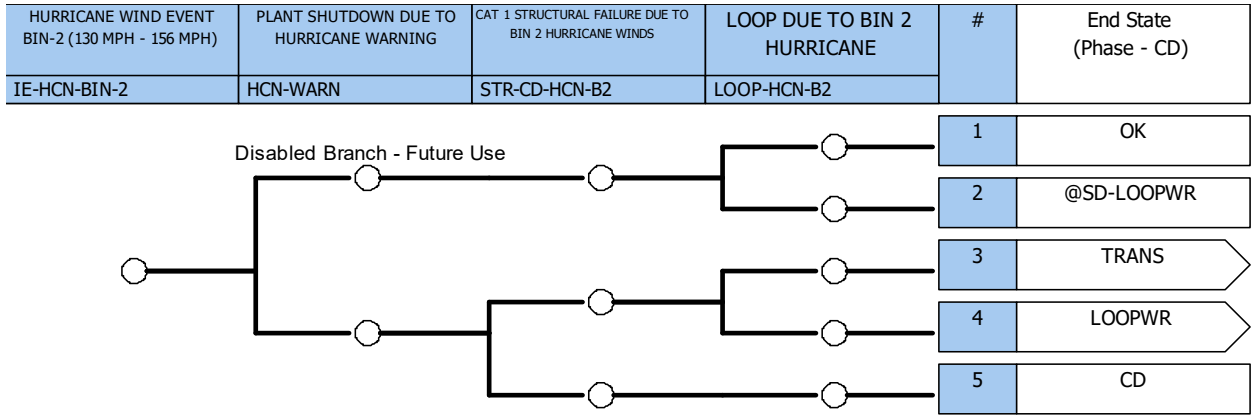


Figure A-1. Hurricane (Bin 2) Event Tree

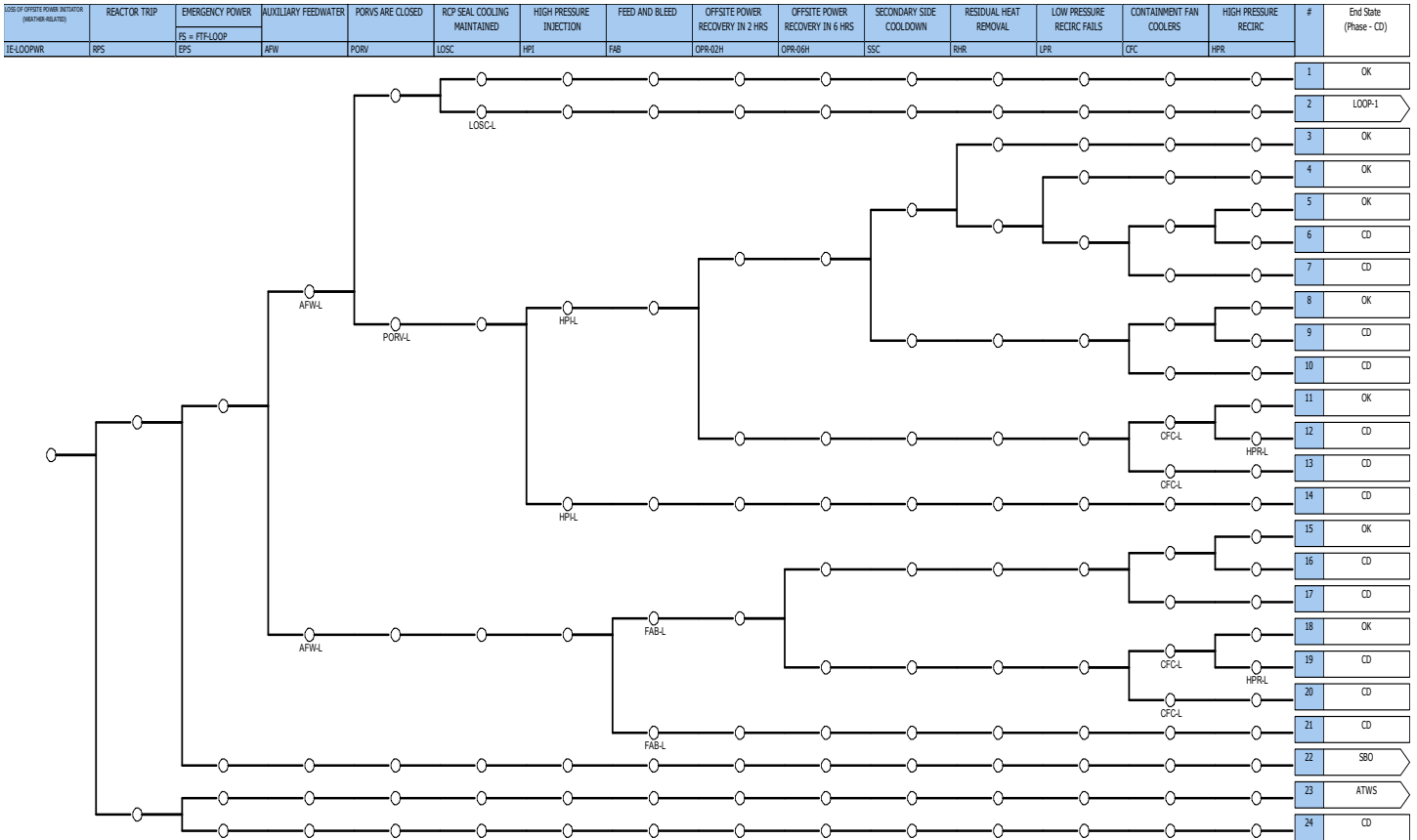


Figure A-1. Weather-Related LOOP Event Tree

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