UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
1600 EAST LAMAR BOULEVARD
ARLINGTON, TEXAS 76011-4511

June 26, 2023

EA-23-055

Phil Hansett, Site Vice President
Entergy Operations, Inc.
5485 U.S. Highway 61N
St. Francisville, LA 70775

SUBJECT: RIVER BEND STATION – NRC INSPECTION REPORT 05000458/2023090 AND PRELIMINARY WHITE FINDING

Dear Phil Hansett:

This letter refers to an inspection conducted from September 19, 2022, to June 8, 2023, by the U.S. Nuclear Regulatory Commission (NRC) at the River Bend Station. The purpose of the inspection was to evaluate the circumstances surrounding the failure of the High Pressure Core Spray (HPCS) transformer feeder during an operability test of the Division III diesel generator on September 19, 2022. On June 8, 2023, a final exit briefing was conducted with Bruce Chenard, General Manager Plant Operations, and other members of your staff. The results of the inspection are documented in the enclosed report.

The enclosed report discusses a preliminary White finding (i.e., “a finding with low-to-moderate safety significance that may require additional NRC inspections”), with an associated apparent violation. As described in the enclosed report, NRC inspectors reviewed documents and interviewed site personnel to determine whether the HPCS transformer feeder failure was the result of insufficient testing or maintenance. The finding was assessed based on the best available information, using the applicable significance determination process (SDP). The final resolution of this finding will be conveyed in separate correspondence.

The finding has an associated apparent violation which is being considered for escalated enforcement action in accordance with the NRC Enforcement Policy, which can be found at http://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html. The apparent violation involves the failure to adequately inspect the HPCS transformer feeder in accordance with site maintenance procedures required by Technical Specification 5.4.1.a.

In accordance with NRC Inspection Manual Chapter 0609, we intend to complete our evaluation using the best available information and issue our final significance determination and enforcement decision, in writing, within 90 days from the date of this letter. The significance determination process encourages an open dialogue between your staff and the NRC; however, the dialogue should not impact the timeliness of our final determination.

Before we make a final decision on this matter, we are providing you with an opportunity to either (1) attend a Regulatory Conference where you can present to the NRC your perspective on the facts and assumptions the NRC used to arrive at the finding and assess its significance, or (2) submit your position on the finding to the NRC in writing. If you request a Regulatory

Conference, it should be held within 40 days of the receipt of this letter, and we encourage you to submit supporting documentation at least one week prior to the conference in an effort to make the conference more efficient and effective. The focus of the Regulatory Conference is to discuss the significance of the finding and not necessarily the root cause(s) or corrective action(s) associated with the finding. If a Regulatory Conference is held, it will be open for public observation. If you decide to submit only a written response, such submittal should be sent to the NRC within 40 days of your receipt of this letter.

If you decline to request a Regulatory Conference or to submit a written response, you relinquish your right to appeal the final SDP determination, in that by not doing either, you fail to meet the appeal requirements stated in the Prerequisite and Limitation sections of Attachment 2 of NRC Inspection Manual Chapter 0609.

If you choose to send a written response, it should be clearly marked as a "Response to Apparent Violation in NRC Inspection Report 05000458/2023090; EA-23-055" and should include: (1) the reason for the apparent violation or, if contested, the basis for disputing the apparent violation; (2) the corrective steps that have been taken and the results achieved; (3) the corrective steps that will be taken; and (4) the date when full compliance will be achieved. Your response may reference or include previously docketed correspondence if the correspondence adequately addresses the required response.

Additionally, your written response should be sent to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with a copy to the Director, Division of Operating Reactor Safety, U.S. Nuclear Regulatory Commission, Region IV, 1600 East Lamar Blvd., Arlington, Texas 76011-4511, and the NRC Resident Inspector at the River Bend Nuclear Station, and emailed to R4Enforcement@nrc.gov, within 40 days of the date of this letter. If an adequate response is not received within the time specified or an extension of time has not been granted by the NRC, the NRC will proceed with its enforcement decision or schedule a Regulatory Conference.

Please contact Jeff Josey at 817-200-1148 within 10 days from the issue date of this letter to notify the NRC of your intentions. If we have not heard from you within 10 days, we will continue with our significance determination and enforcement decision.

Because the NRC has not made a final determination in this matter, a Notice of Violation is not being issued at this time. In addition, please be advised that the number and characterization of the apparent violations described in the enclosed inspection report may change as a result of further NRC review.

In accordance with 10 CFR 2.390 of the NRC's "Agency Rules of Practice and Procedure," a copy of this letter, its enclosure, and your response, if you choose to provide one, will be made available electronically for public inspection in the NRC Public Document Room and from the NRC's Agencywide Documents Access and Management System (ADAMS), accessible from the NRC website at http://www.nrc.gov/reading-rm/adams.html.

If you have any questions concerning this matter, please contact Jeff Josey of my staff at 817-200-1148.

Sincerely,

Signed by Lantz, Ryan
on 06/26/23

Ryan E. Lantz, Director
Division of Operating Reactor Safety

Docket No. 05000458
License No. NPF-47

Enclosure:
NRC Inspection Report 05000458/2023090
w/Attachment: Detailed Risk Evaluation

cc w/ encl: Distribution via LISTSERV

RIVER BEND STATION – NRC INSPECTION REPORT 05000458/2023090 AND
PRELIMINARY WHITE FINDING - DATED JUNE 26, 2023

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ADAMS ACCESSION NUMBER: **ML23165A102**

☒SUNSI Review: By: ACR	ADAMS: ☒ Yes ☐ No	☐ Non-Publicly Available ☒ Publicly Available	☒ Non-Sensitive ☐ Sensitive	Keyword: NRC-002

OFFICE	ES:ACES	SPE:PBC	C:PBC	SRA:DORS	TL:ACES	RC:ORA
NAME	ARoberts	JRollins	JJosey	RDeese	JKramer	DCylkowski
SIGNATURE	/RA/ E	/RA/ E	/RA/E	/RA/ E	/RA/ E	/RA/ E
DATE	06/15/23	06/16/23	06/16/23	06/15/23	06/15/23	06/20/23
OFFICE	NRR	OE	D:DORS			
NAME	RFelts	JPeralta	RLantz			
SIGNATURE	/RA/ E	/RA/ E	/RA/ E			
DATE	06/20/23	06/22/23	06/26/23			

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U.S. NUCLEAR REGULATORY COMMISSION
Inspection Report

Docket Number:	05000458
License Number:	NPF-47
Report Number:	05000458/2023090
Enterprise Identifier:	I-2023-090-0007
Licensee:	Entergy Operations, Inc.
Facility:	River Bend Station
Location:	St. Francisville, LA
Inspection Dates:	September 19, 2022, to June 8, 2023
Inspectors:	R. Deese, Senior Reactor Analyst R. Kumana, Senior Resident Inspector J. Rollins, Senior Project Engineer W. Schaup, Inspection Programs & Assessment Team Leader C. Wynar, Senior Resident Inspector M. Chisolm, Reactor Inspector
Approved By:	Jeffrey E. Josey, Chief Projects Branch C Division of Operating Reactor Safety

Enclosure

SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring the licensee's performance by conducting an event follow-up inspection at River Bend Station, in accordance with the Reactor Oversight Process. The Reactor Oversight Process is the NRC's program for overseeing the safe operation of commercial nuclear power reactors. Refer to https://www.nrc.gov/reactors/operating/oversight.html for more information.

List of Findings and Violations

Failure to Adequately Inspect High Pressure Core Spray (HPCS) Transformer Wiring Resulting in Transformer Failure and Inoperability of HPCS system.			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Preliminary White AV 05000458/2023090-01 Open EA-23-055	[H.12] - Avoid Complacency	71153
The NRC identified a finding of preliminary low to moderate (white) safety significance and an associated apparent violation of Technical Specification 5.4.1.a for the failure to adequately inspect HPCS transformer wiring in accordance with site maintenance procedures. Specifically, while inspecting the HPCS transformer on June 21, 2022, the licensee failed to identify improperly stored spare conductors laid across the transformer cores which, on September 19, 2022, caused a phase-to-phase fault and subsequent transformer failure resulting in the inoperability of the HPCS system.			

Additional Tracking Items

Type	Issue Number	Title	Report Section	Status
LER	05000458/2022-04-00	LER 2022-04-00 for River Bend Station, Unit 1, High Pressure Core Spray Inoperable due to Transformer Failure	71153	Closed

INSPECTION SCOPES

Inspections were conducted using the appropriate portions of the inspection procedures (IPs) in effect at the beginning of the inspection unless otherwise noted. Currently approved IPs with their attached revision histories are located on the public website at http://www.nrc.gov/reading-rm/doc-collections/insp-manual/inspection-procedure/index.html. Samples were declared complete when the IP requirements most appropriate to the inspection activity were met consistent with Inspection Manual Chapter (IMC) 2515, "Light-Water Reactor Inspection Program - Operations Phase." The inspectors reviewed selected procedures and records, observed activities, and interviewed personnel to assess licensee performance and compliance with Commission rules and regulations, license conditions, site procedures, and standards.

OTHER ACTIVITIES – BASELINE

71153 - Follow Up of Events and Notices of Enforcement Discretion

Event Report (IP section 03.02) (1 Sample)

The inspectors evaluated the following licensee event report (LER):

(1) LER 05000458/2022-04-00, High Pressure Core Spray Inoperable due to Transformer Failure (ADAMS Accession No. ML22321A306).

The inspection conclusions associated with this LER are documented in this report under the inspection results section (05000458/2023090-01). This LER is closed.

INSPECTION RESULTS

<table>
<tr><td colspan="4">Failure to Adequately Inspect High Pressure Core Spray (HPCS) Transformer Wiring Resulting in Transformer Failure and Inoperability of HPCS system.</td></tr>
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<tr><td>Mitigating Systems</td><td>Preliminary White
AV 05000458/2023090-01
Open
EA-23-055</td><td>[H.12] - Avoid Complacency</td><td>71153</td></tr>
<tr><td colspan="4">The NRC identified a finding of preliminary white safety significance and an associated apparent violation of Technical Specification 5.4.1.a for the failure to adequately inspect HPCS transformer wiring in accordance with site maintenance procedures. Specifically, while inspecting the HPCS transformer on June 21, 2022, the licensee failed to identify improperly stored spare conductors laid across the transformer cores which, on September 19, 2022, caused a phase-to-phase fault and subsequent transformer failure resulting in the inoperability of the HPCS system.</td></tr>
<tr><td colspan="4">Description: On September 19, 2022, the licensee was conducting surveillance test STP-309-0203, Division III Diesel Generator Operability Test. Approximately 5 seconds after starting the diesel, multiple control room alarms and annunciators were received in the main control room for division III equipment along with a fire alarm for the HPCS switchgear room. Operators secured the division III diesel generator and placed it in maintenance mode. Operators in the field identified that the HPCS transformer feeder (E22-S003) was visibly damaged. The HPCS transformer feeder powers various division III auxiliary loads required to</td></tr>
</table>

support the HPCS system. With the failure of the transformer, operators declared the HPCS system and standby service water pump SWP-P2C inoperable.

The licensee performed an apparent cause analysis of the event and determined the apparent cause was improperly stored spare conductors laid across the transformer cores caused a phase-to-phase fault resulting in the failure of the transformer. Additionally, the licensee had a failure analysis performed that supported the apparent cause from the licensee's causal analysis.

Inspectors reviewed the event and determined that the licensee failed to adequately perform work order 53003640 "E22-S003 – Clean, Test, E22-S003 Transformer." Specifically, section 4.1 "Clean and Inspect," subsection 4.1.1.6, requires, in part, that the licensee inspect the interior of the transformer enclosure for signs of rodent intrusion (droppings, debris, and abraded cable/wire insulation) AND note any signs of intrusion in comments. If cables are found damaged, the work order requires the licensee to initiate necessary corrective actions to identify and correct the problem. Subsection 4.1.1.10 states "INSPECT all wiring for signs for degradation, cracked insulation AND overheating." Additionally, subsection 4.1.1.13 requires the licensee to "Inspect for loose nuts, bolts, set screws or other fasteners."

Due to an inadequately performed inspection, the licensee failed to identify spare conductors housed inside the transformer cabinet or note the condition of their associated jacket insulation. The licensee's apparent cause analysis identifies these spare conductors as causing the faulted condition and subsequent failure of the HPCS transformer. The inspectors determined that the transformer cabinet is designed to support inspection of internal components and wiring. No spatial challenges or internal component impediments were identified during review of documentation that would prevent identification of the spare conductors. The failure of the licensee to identify these spare conductors, assess the health of their insulation, and take appropriate corrective action allowed for a latent error to remain uncorrected until component failure.

Corrective Actions: The licensee entered the condition into its corrective action program and evaluated a replacement transformer under engineering change EC 93841. The replacement transformer was installed as a temporary modification under work order 00586001 and is currently being evaluated for acceptance as a permanent modification.

Corrective Action References: CR-RBS-2022-05422, EC 93841, and CR-RBS-2023-04821

Performance Assessment:

Performance Deficiency: The failure to properly inspect all wiring for signs of degradation, cracked insulation, and overheating, and inspect for loose nuts, bolts, set screws, or fasteners was a performance deficiency.

Screening: The inspectors determined the performance deficiency was more than minor because it was associated with the Equipment Performance attribute of the Mitigating Systems cornerstone and adversely affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the failure to adequately inspect the HPCS transformer adversely affected the mitigating systems cornerstone objective because it resulted in the inoperability of systems that mitigate the effects of initiating events and prevent core damage.

Significance: The inspectors assessed the significance of the finding using IMC 0609 Appendix A, “The Significance Determination Process (SDP) for Findings At-Power.” The degraded condition represents a loss of the probabilistic risk assessment function of a single train technical specification system for greater than its technical specification allowed outage time and therefore screening instructs performance of a detailed risk evaluation. A detailed risk evaluation was performed and concluded that the increase in core damage frequency resulting from the HPCS transformer failure was estimated to be 6.6E-6/year (White).

Cross-Cutting Aspect: H.12 - Avoid Complacency: Individuals recognize and plan for the possibility of mistakes, latent issues, and inherent risk, even while expecting successful outcomes. Individuals implement appropriate error reduction tools. Specifically, licensee personnel failed to use all information available, assumed that there were no latent conditions, and did not use error reduction techniques to ensure that all areas of the transformer were inspected and that the failed cables were properly secured.

Enforcement:

Violation: Technical Specification 5.4.1.a, requires, in part, that written procedures shall be established, implemented, and maintained covering the activities recommended in Regulatory Guide 1.33, revision 2, Appendix A. Regulatory Guide 1.33, revision 2, Appendix A, section 9.a, requires, in part, that maintenance that can affect the performance of safety-related equipment should be properly preplanned and performed in accordance with written procedures, or documented instructions appropriate to the circumstances.

The licensee established Work Order 53003640 to clean, inspect, and test HPCS transformer E22-S003. Work Order 53003640 step 4.1.10 requires, in part, to inspect all wiring for signs of degradation, cracked insulation and overheating, and step 4.1.13 requires, in part, to inspect for loose nuts, bolts, set screws or other fasteners.

Contrary to the above, on June 21, 2022, the licensee failed to implement procedures recommended by Regulatory Guide 1.33, revision 2, Appendix A. Specifically, when performing a cleaning and inspection of HPCS Transformer E22-S003, the licensee failed to adequately perform Work Order 53003640 step 4.1.10 to inspect all wiring for signs of degradation, cracked insulation and overheating, and step 4.1.13 to inspect for loose nuts, bolts, set screws or other fasteners. As a result, the transformer failed, causing the HPCS system and standby service water pump SWP-P2C to be inoperable.

Enforcement Action: This violation is being treated as an apparent violation pending a final significance (enforcement) determination.

EXIT MEETINGS AND DEBRIEFS

The inspectors verified no proprietary information was retained or documented in this report.

- On June 8, 2023, the inspectors presented the inspection results to Bruce Chenard, General Manager Plant Operations, and other members of the licensee staff.

DOCUMENTS REVIEWED

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
71153	Corrective Action Documents	CR-RBS-2022-5422		
71153	Drawings	244A9094	Neutral Grounding Resistor Drawing	06/02/1981
71153	Drawings	828E537AA	HPCS Power Supply System	
71153	Engineering Evaluations	E-222-E22-S002	480 VAC Standby Motor Control Center Load Tabulation including Cable Verification	
71153	Engineering Evaluations	G13.18.3.6*019	HPCS (Division III) Diesel Generator Loading	
71153	Miscellaneous	3.221.418.000.001	HPCS Transformer Installation instructions	11/28/1979
71153	Miscellaneous	SDC-203	High Pressure Core Spray System Design Criteria	Rev 5 11/22/2011
71153	Miscellaneous	SDC-303	Safety Related 480V Electrical Distribution System Design Criteria	Rev 1 06/30/2003
71153	Miscellaneous	SDC-309/405	High Pressure Core Spray Diesel Generator Division III, Diesel Generator Building Ventilation system design criteria	Rev 3 11/20/2004
71153	Miscellaneous	VTD-G080-1312	General Electric Ventilated Dry-Type Transformers	11/08/1995
71153	Self-Assessments	CR-RBS-2023-0412	HPCS Inoperable due to Transformer Feeder Malfunction Root Cause Evaluation	03/13/2023
71153	Work Orders	53003640	E22-S003 Clean Test E22-S003 Transformer	
71153	Work Orders	586001	FIN Troubleshoot E22-S003 Failure	

River Bend Station (River Bend)
High Pressure Core Spray Transformer
Detailed Risk Evaluation

Conclusion: The increase in core damage frequency (CDF) resulting from the licensee's failure to properly clean and inspect the Division III 480v transformer, which caused the high pressure core spray (HPCS) transformer to fail, was estimated to be 6.6E-6/year (White).

Influential Assumption:

The exposure time was 40 days. Inspectors concluded that the HPCS transformer E22-S003 failed upon starting of the HPCS diesel generator (DG) for a surveillance run. When the diesel generator was started, HPCS DG room ventilation fan, 1HVP-FN3A, started as designed. This large load, which is powered through the HPCS transformer, was assumed to have drawn a large starting current. This large current draw created heating of the transformer and the improperly located, loose spare cable such that the insulation on the spare cable was degraded to the point that the electrical shorting event occurred, resulting in the failure of the transformer. The inspectors assumed that the next start after the last successful surveillance run 28 days earlier would have resulted in failure of the transformer. The licensee replaced the transformer 12 days later. Using the "t + repair time" method, the analyst used an exposure time of 40 days.

Model Modifications:

- The HPCS transformer was not modeled in the SPAR model for River Bend. The analyst created a basic event for the transformer using template event ZT-TFM-FC, "Transformer Fails to Operate," from the SPAR template event library. The analyst placed this basic event under fault trees HCS-SS, "HPCS Support Systems," and SSW P2C, "Standby Service Water Pump Train 2C Is Unavailable," to represent the impact on the plant for the loss of the HPCS transformer.

- Because River Bend has developed Diverse and Flexible Coping (FLEX) Strategies, the analyst incorporated use of these FLEX strategies into the model. The analyst changed the basic event FLX-XHE-XM-ELAP, "Operators Fail to Declare ELAP when Beneficial," from a failure probability of 1.0 to 1.0E-2 to reflect nominal probabilistic success for the decision to employ these strategies. For the FLEX equipment failures, the analyst noted that the River Bend SPAR model used failure data for the FLEX equipment that was typical of installed permanent equipment at the plant. After a review of the dominant sequences using these failure data, the analyst noted that only one sequence (the 31st most dominant sequence) included use of the FLEX strategies. From that review and judging that any change of FLEX failure data to the higher industry observed failure rate data would have a minimal impact on the results, the analyst did not alter the FLEX failure rate data.

Internal Events:

The River Bend SPAR model, version 8.80, with the previously mentioned modifications, on SAPHIRE, version 8.2.8, was used to complete this evaluation. In the Event and Condition Assessment module of SAPHIRE, the analyst set the basic event created for the HPCS transformer to TRUE for an exposure time of 40 days. This input yielded 31 core damage sequences that contributed at least one percent to the total estimate in the increase in CDF. From this group of sequences, the analyst eliminated internal flooding

sequences FLI-AB-141_03FP-G sequence 2-104-25, FLI-AB-95_07SWC-M sequence 2-096, and FLI-AB-70_05SW-L sequence 2-096. These sequences assume HPCS would be lost during these flood events, so failure of the HPCS transformer would result in no increase in CDF because HPCS would still not be available. The analyst adjusted the sequence's input to the increase in CDF to zero.

The analyst incorporated the change described above to the results from the Event and Condition Assessment module, which resulted in an estimate on the increase in CDF from internal events from the performance deficiency of 3.01E-6/year.

External Events:

Fire Events: The analyst noted that the licensee had a peer reviewed fire PRA model which they used to attain various risk-informed license amendments. The analyst considered this model to be the best source of information for estimating the increase in CDF from fire events. The licensee provided the top 100 cutsets and top 22 fire sequences to the analyst from their fire PRA model where the HPCS transformer was non-functional for fire sequences. The table below lists the top 22 fire scenarios and their associated increase in CDF.

Fire Scenario	Increase in CDF
Transformer Yard 1 Burnout	4.10E-7
Load Center NJS-LDC1AB Fire	2.83E-7
Auxiliary Building West / Elevation 70 feet Burnout	2.37E-7
Load Center EJS*LDC2B Fire	2.06E-7
Load Center EJS*LDC2A Fire	2.01E-7
Auxiliary Building Walkway / Reactor Water Cleanup Pumps Burnout	1.75E-7
Turbine Building South of 8-Line / Elevation 67 feet 6 inches Burnout	1.68E-7
ENB Inverter and Battery 1A Room Burnout	1.38E-7
Turbine Building North of 8-Line / Elevation 67 feet 6 inches Burnout	1.35E-7
Turbine Building Air Removal Equip Room / Elevation 95' Burnout	1.26E-7
Turbine Building Generator and Exciter / Elevation 123 feet 6 inches Burnout	1.19E-7
Cable Chase I - Transient Burnout	1.17E-7
Auxiliary Building West / Elevation 95 feet Burnout	1.12E-7
Radwaste Building / Elevation 166 feet Burnout	9.88E-8
Air Compressor Canopy Full Burnout	9.65E-8
Bus C71-S001A Fire	9.58E-8
Turbine Building Off-Gas Area / Elevation 123 feet 6 inches Burnout	8.82E-8
Turbine Building Clean and Dirty Lube Oil Tank Burnout	7.91E-8
Service Water Cooling Switchgear Building Burnout	7.82E-8
Normal Switchgear Building Room 1B Full Burnout	7.30E-8

Fuel Building All Areas Burnout	7.29E-8
Normal Switchgear Building Motor Control Center, Switchgear and Heating, Ventilation, and Air Conditioning Burnout	6.79E-8
TOTAL	3.18E-6

The analyst noted that these values included a plant availability factor of 8.98E-1 which the licensee added to make the values represent at-power risk. To make the value more representative of the 40-day exposure time in which the plant was always at full power, the analyst divided this table's results by the plant availability factor to revise the estimate to the estimate in the increase in CDF for these top 22 scenarios to 3.54E-6/year. The analyst used this estimate even though there were additional less significant fire scenarios that would increase risk further.

Seismic Events: The analyst used the SPAR model to evaluate the performance deficiency for the increase in CDF due to seismic events. The analyst removed cutsets which contained the failure of the Division III battery because its failure would render HPCS non-functional before the transformer would fail. This method estimated the increase in CDF from seismic events to be 5.62E-8/year. Results are in the table below:

Seismic Range	Increase in CDF
Earthquake 0.1g to 0.3g	1.36E-9/year
Earthquake 0.3g to 0.5g	3.40E-9/year
Earthquake 0.5g to 1.0g	4.20E-8/year
Earthquake 1.0g to 1.5g	9.25E-9/year
Earthquake greater than 1.5g	2.69E-10/year

Total Estimate of CDF Increase from Internal and External Events: The inputs to determine the total increase in CDF are contained in the table below:

Input	Value
Internal Events	3.01E-6/year
Fire Events	3.54E-6/year
Seismic Events	5.62E-8/year
Total	6.61E-6/year

The total estimate in the increase of CDF is estimated to be 6.6E-6/year, or of low to moderate safety significance (White).

Large Early Release Frequency (LERF): The analyst evaluated the increase in large early release frequency using Inspection Manual Chapter 0609, Appendix H, "Containment Integrity Significance Determination Process." The unavailability of the HPCS transformer was treated as a Type A finding in Appendix H because it can influence likelihood of accidents leading to core damage as well as being a contributor to LERF. The analyst screened out all sequences except station blackout and high reactor coolant system pressure sequences per Table 6.1, Phase 1 Screening – Type A Findings at Full Power by eliminating all sequences with the success depressurization top event. For the station blackout and high reactor coolant system pressure

sequences, the analyst applied the applicable assessment factors from Table 6.2, Phase 2 Assessment Factors – Type A Findings at Power. This resulted in an increase in LERF from internal events of 3.4E-7/year. The analyst noted this estimate was comparable to the internal events estimate for the increase in CDF relative to the NRC's significance thresholds and opted to use CDF as the risk metric for significance determination.

Sensitivities: The analyst estimated the increase in CDF for changes to key assumptions made in the evaluation.

- 13-day exposure time: The analyst postulated a 13-day exposure time, which would reflect the transformer failure being treated as a failure of continuously running equipment (24 hours plus 12 days repair time) and estimated the increase in CDF as 2.1E-6/year. This sensitivity gives confidence that the estimate was not of very low safety significance (Green).

- Inclusion of all potential fire scenarios: The licensee provided the top 22 fire scenarios which had an increase in CDF from the HPCS transformer failure of 3.54E-6/year. More fire scenarios (scenarios 23 and on) would be included if a more accurate estimate were made. To support a timely analysis, the analyst just used the top 22 scenarios. Information from the license in the top 100 cutsets indicated that the increase in CDF from all fire scenarios could be as high as 6.93E-6/year, which would make the total increase in CDF from all events equal to 9.9E-6/year. This sensitivity gives confidence the estimate was not of substantial safety significance (Yellow). The analyst reserved the rights to perform further refinement of the contribution of fire events to the total estimate of the increase in CDF.

- Consideration of common cause: The analyst did not model the HPCS transformer as part of a common cause group, despite the possibility of other large dry 4160v/480v transformers in the plant having the same condition leading to the possibility of their failure. Had this common cause vulnerability been modeled, the quantitative estimate for the increase in CDF would have been higher. The analyst reserved the rights to perform this modeling.

- Use of licensee-suggested model enhancements: After discussing the sequences with the licensee, the analyst performed sequence-specific adjustments to several of the sequences produced from the SPAR model to reflect actual plant and operator response. The analyst reviewed sequence 59-12 for grid-related LOOPs, plant-centered LOOPs, switchyard-centered LOOPs, and weather-related LOOPs. This sequence progresses with a failure of the emergency diesel generators upon a LOOP leading to a station blackout. Additionally, high pressure injection to the reactor vessel is lost when feedwater is lost due to the LOOP, reactor core isolation cooling (RCIC) is lost due to probabilistic failures, and HPCS is lost due to the performance deficiency. Offsite power and diesel generators are not recovered within 30 minutes, leading to core damage. The analyst ran a change set on the four LOOP sequences with the HPCS transformer faulted and the RCIC failure-to-run basic event set to 2.58E-2 (which represents RCIC failing to run for 4 hours) to eliminate the counting of failures of RCIC to run for hours 5 to 24 since this sequence results in core damage in the first few hours. Additionally for loss of main feedwater sequence 13, the analyst credited the availability of the control rod drive pumps after 6 hours as an adequate injection source and therefore used a 6-hour mission time for RCIC failures to run (4.07E-2). The consideration of these

changes lowered the estimate of the increase in CDF from internal events to 2.6E-6/year.

Uncertainties: The analyst performed an uncertainties analysis using the Monte Carlo method with 5000 runs on the internal events estimate in SAPHIRE. The distribution of results was tight around the point estimate with 80 percent of the results in the range of 1.0E-6 to 1.0E-5. The shape of the distribution of the results contained 19 percent less than 1.0E-6 and 1 percent greater than 1E-5, making the distribution skewed low. Because of this skew in the internal events results, the analyst judged that inclusion of the increase in CDF from fire events would not appreciably alter the large majority of the results falling within the 1.0E-6 to 1.0E-5 range.