UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
475 ALLENDALE RD, STE 102
KING OF PRUSSIA, PENNSYLVANIA 19406-1415

September 19, 2024

EA-24-088

David P. Rhoades
Senior Vice President
Constellation Energy Generation, LLC
President and Chief Nuclear Officer (CNO)
Constellation Nuclear
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: JAMES A. FITZPATRICK NUCLEAR POWER PLANT – FOLLOW-UP TO INSPECTION PROCEDURE 71153 REPORT 05000333/2024011 AND PRELIMINARY WHITE FINDING AND APPARENT VIOLATION

Dear David Rhoades:

On September 10, 2024, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at James A. FitzPatrick Nuclear Power Plant and discussed the results of this inspection with Alex Sterio, Site Vice President, and other members of your staff. The results of this inspection are documented in the enclosed report.

Section 71153 of the enclosed report documents a finding with an associated apparent violation that the NRC has preliminarily determined to be White with low-to-moderate safety significance. The finding involved failure to provide adequate qualitative or quantitative acceptance criteria in work instructions during maintenance activities on the 'B' emergency diesel generator. We assessed the significance of the finding using the Significance Determination Process (SDP) and readily available information. We are considering escalated enforcement for the apparent violation consistent with our Enforcement Policy, which can be found at http://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html. Because we have not made a final determination, no notice of violation is being issued at this time. Please be aware that further NRC review may prompt us to modify the number and characterization of the apparent violations.

We intend to issue our final significance determination and enforcement decision, in writing, within 90 days from the date of this letter. The NRC's SDP is designed to encourage an open dialogue between your staff and the NRC; however, neither the dialogue nor the written information you provide should affect the timeliness of our final determination.

Before we make a final decision, you may choose to communicate your position on the facts and assumptions used to arrive at the finding and assess its significance by either (1) attending

and presenting at a regulatory conference or (2) submitting your position in writing. The focus of a regulatory conference is to discuss the significance of the finding.

Written responses should reference the inspection report number and enforcement action number associated with this letter in the subject line. Responses related to this apparent violation should include: (a) the reason for the apparent violation or, if contested, the basis for disputing the violation; (b) the corrective steps that have been taken and the results achieved; (c) the corrective steps that will be taken; and (d) the date when full compliance will be achieved. Your response should be sent to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001 with a copy to the Regional Administrator, Region I, and a copy to the NRC Resident Inspector at James A. FitzPatrick Nuclear Power Plant. Your response may reference or include previously docketed correspondences.

If you request a regulatory conference, it should be held within 40 days of your receipt of this letter. Please provide information you would like us to consider or discuss with you at least 10 days prior to any scheduled conference. If you choose to attend a regulatory conference, it will be open for public observation. If you decide to submit only a written response, it should be sent to the NRC within 40 days of your receipt of this letter. If you choose not to request a regulatory conference or to submit a written response, you will not be allowed to appeal the NRC's final significance determination.

Please contact Erin Carfang at 610-337-5120, by phone or other means, within ten days from the issue date of this letter to notify the NRC of your intentions. If we have not heard from you within ten days, we will continue with our significance determination and enforcement decision.

This letter, its enclosure, and your response (if any) will be made available for public inspection and copying at http://www.nrc.gov/reading-rm/adams.html and at the NRC Public Document Room in accordance with Title 10 of the *Code of Federal Regulations* 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,

RAYMOND MCKINLEY

Digitally signed by RAYMOND MCKINLEY
Date: 2024.09.19 08:40:47 -04'00'

Raymond R. McKinley, Deputy Director
Division of Operating Reactor Safety

Docket No. 05000333
License No. DPR-59

Enclosure:
Inspection Report 05000333/2024011
w/Attachment: Detailed Risk Evaluation

cc w/ encl: Distribution via LISTSERV

SUBJECT: JAMES A. FITZPATRICK NUCLEAR POWER PLANT – FOLLOW-UP TO INSPECTION PROCEDURE 71153 REPORT 05000333/2024011 AND PRELIMINARY WHITE AND APPARENT VIOLATION DATED SEPTEMBER 19, 2024

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U.S. NUCLEAR REGULATORY COMMISSION
Inspection Report

Docket Number:	05000333
License Number:	DPR-59
Report Number:	05000333/2024011
Enterprise Identifier:	I-2024-011-0044
Licensee:	Constellation Energy Generation, LLC
Facility:	James A. FitzPatrick Nuclear Power Plant
Location:	Oswego, NY
Inspection Dates:	July 1, 2024 to September 10, 2024
Inspectors:	E. Miller, Senior Resident Inspector V. Fisher, Resident Inspector F. Arner, Senior Reactor Analyst C. Bickett, Senior Reactor Analyst
Approved By:	Raymond R. McKinley, Deputy Director Division of Operating Reactor Safety

Enclosure

SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring the licensee's performance by conducting baseline inspection at James A. FitzPatrick Nuclear Power Plant, 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

'B' Emergency Diesel Generator (EDG) Gallery Lube Oil Supply Check Valve Failure			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Preliminary White AV 05000333/2024011-01 Open EA-24-088	[H.6] - Design Margins	71153
A self-revealed preliminary White finding and apparent violation of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," and Technical Specification (TS) 3.8.1, "AC Sources-Operating," was identified because Constellation did not provide adequate work instructions affecting quality for the repair of the 'B' EDG. Specifically, on October 11, 2023, Constellation did not provide clear acceptance criteria in the form of precautions or torque values in the work instructions for the reassembly of the valve cap to the 93EDG-57B oil check valve. As a result, during surveillance testing on April 24, 2024, the 'B' EDG became unavailable after a 2.3 gallons per minute (gpm) lube oil leak developed, and the 'B' EDG was rendered inoperable for greater than its TS allowed outage time.			

Additional Tracking Items

Type	Issue Number	Title	Report Section	Status
LER	05000333/2024-001-00	EDG Lube Oil Check Valve Bonnet Cap Leak due to Failed Gasket	71153	Closed
LER	05000333/2024-001-01	Supplement to EDG Lube Oil Check Valve Bonnet Cap Leak due to Failed Gasket	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's event reporting determinations to ensure it complied with reporting requirements.

(1) Licensee Event Reports (LERs) 05000333/2024-001-00, EDG Lube Oil Check Valve Bonnet Cap Leak due to Failed Gasket (ADAMS Accession No. ML24176A253); and 05000333/2024-001-01, Supplement to EDG Lube Oil Check Valve Bonnet Cap Leak due to Failed Gasket (ADAMS Accession No. ML24234A140). The inspectors reviewed the updated LER submittals. The inspection conclusions associated with these LERs are documented in this report under Inspection Results. These LERs are closed.

INSPECTION RESULTS

<table>
<tr><td colspan="4">'B' Emergency Diesel Generator (EDG) Gallery Lube Oil Supply Check Valve Failure</td></tr>
<tr><td>Cornerstone</td><td>Significance</td><td>Cross-Cutting Aspect</td><td>Report Section</td></tr>
<tr><td>Mitigating Systems</td><td>Preliminary White
AV 05000333/2024011-01
Open
EA-24-088</td><td>[H.6] - Design Margins</td><td>71153</td></tr>
<tr><td colspan="4">A self-revealed preliminary White finding and apparent violation of 10 CFR Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," and TS 3.8.1, "AC Sources-Operating," was identified because Constellation did not provide adequate work instructions affecting quality for the repair of the 'B' EDG. Specifically, on October 11, 2023, Constellation did not provide clear acceptance criteria in the form of precautions or torque values in the work instructions for the reassembly of the valve cap to the 93EDG-57B oil check valve. As a result, during surveillance testing on April 24, 2024, the 'B' EDG became unavailable after a 2.3 gpm lube oil leak developed, and the 'B' EDG was rendered inoperable for greater than its TS allowed outage time.</td></tr>
<tr><td colspan="4">Description: FitzPatrick has two EDG subsystems. Each subsystem consists of two EDGs that provide power to a common four kilovolt electrical safety bus following a design basis accident signal. Each EDG contains a lube oil system to ensure adequate lubrication of the</td></tr>
</table>

engine's moving parts. The system has a 349-gallon supply of lube oil to support continuous operation for seven days. The system includes circulating pumps, valves, and a heat exchanger. In addition, a three gpm pump ensures a constant oil supply to the turbocharger both in standby and when in operation. A series of sight glasses with valves allows operators to ensure proper oil level for the turbocharger supply in standby. This includes a ½-inch gallery lube oil supply check valve.

On October 11, 2023, under Work Order (WO) 05153056, "EDG System Mechanical PM (MP-093.11)," the ½-inch gallery oil supply check valve 93EDG-57B was opened to ensure that the disc had not backed off the nut. This inspection was implemented due to previous operating experience within the industry and was previously performed on all four EDGs. Following this maintenance, on October 11, 2023, during a planned post-maintenance run of the 'B' EDG, maintenance staff identified a 45 drop per minute (dpm) leak from the 93EDG-57B check valve at the cap to body interface. Constellation staff entered this issue into the corrective action program as Issue Report (IR) 04708722. Constellation staff developed corrective maintenance WO 05407333 and engineering change (EC) 639982, "Install Gasket to Seal Bonnet Cap Leak on 93EDG-57B Check Valve," to correct the issue. The WO and EC were created, implemented, and completed on October 11, 2023.

On April 25, 2024, during performance of S-43D, "Remote Shutdown Panel 25ASP-3 Component Operation and Isolation Verification," Revision 23, a significant leak developed from the top of the 93EDG-57B check valve. The station estimated the new leak rate as 2.3 gpm. The inspectors observed replacement of the check valve and observed the failure of the gasket that was installed as part of the repair. The station entered this issue into the corrective action program as IR 04769343.

Constellation performed a failure analysis and sent the leaking check valve to PowerLabs to determine the cause of the leak. PowerLabs identified a through-wall crack in the root of one thread as well as deformation of threads in the valve cap. The inspectors noted the valve was constructed from brass, a soft material which can be easily damaged from high torque application during cap installation.

During review of WO 05153056 associated with the preventive maintenance, the inspectors noted MP-093.11, step 8.7.20 stated, "install cap (of 93EDG-57) wrench tight." During review of EC 639982 and WO 05407333 associated with the repair on October 11, 2023, the inspectors noted that step 4.1.12 stated, "install cap (of 93EDG-57B) wrench tight." No precautions or torque values were included to provide additional guidance on assembly of the check valve.

Procedure MA-AA-716-010, "Maintenance Planning," Revision 35, provides guidance on requirements and expectations of the maintenance planning process. Step 4.12.12 of the procedure states, "the work plan must clearly provide acceptance criteria such as torque values, clearance, current, and voltage measurements, etc., as required." Constellation's guidance on how to determine if torque is required to be applied to mechanical fasteners and connections is contained in MA-AA-716-010-F-03, "Torque Required Screening," Revision 0. The first question in MA-AA-716-010-F-03 asks if the equipment or component is "Safety-Related/Augmented Quality." The procedure states, if the answer is 'yes' to any of the questions and no torque value can be identified, the WO should be placed on hold for engineering review. Procedure MA-AA-736-600, "Torquing and Tightening of Bolted Connections," Revision 15, provides instructions for proper tightening of bolted connections, recommended torque values for pressure retaining bolted connections where none are

provided by the equipment manufacturer, and tightening requirements for structural joints. Prerequisite Section 3.3 of MA-AA-736-600 provides a process for determination of torque values using a four-level process. The final step in the process requires the planner, if there is no specified torque value, to contact engineering to determine an acceptable course of action. Contrary to these requirements, Constellation did not establish clear acceptance criteria (e.g., torque values, precautions, etc.), leading to failure of 93EDG-57B and a significant lube oil leak that resulted in the inoperability and unavailability of the 'B' EDG.

Constellation determined this deficiency rendered the 'B' EDG subsystem inoperable due to the increased rate of lube oil consumption caused by the oil leak, and subsequently reported this event as a condition prohibited by TS in LERs 05000333/2024-001-00 and 05000333/2024-001-01.

Corrective Actions: Constellation replaced the ½-inch lube oil supply check valve with work instructions that included a torque value to reinstall the cap.

Corrective Action References: IRs 04769343 and 04708722

Performance Assessment:

Performance Deficiency: Inspectors determined that Constellation did not provide adequate work instructions during maintenance activities on the 'B' EDG, in accordance with 10 CFR Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings."

Screening: The inspectors determined the performance deficiency was more than minor because it was associated with the Procedure Quality 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, on October 11, 2023, Constellation did not provide clear acceptance criteria in the form of precautions or torque values in the work instructions for the reassembly of the valve cap to the 93EDG-57B oil check valve. As a result, during surveillance testing on April 24, 2024, the 'B' EDG became unavailable after a 2.3 gpm lube oil leak developed.

Significance: The inspectors assessed the significance of the finding using IMC 0609, Appendix A, "The Significance Determination Process (SDP) for Findings At-Power." The inspectors assessed the significance by using IMC 0609, Appendix A, Exhibit 2, "Mitigating System Screening Questions," and determined this finding required a detailed risk evaluation because the degraded condition represented a loss of probabilistic risk assessment function of one train of a multi-train Technical Specification system for greater than its allowed outage time.

Region I senior reactor analysts (SRAs) performed the detailed risk evaluation. The finding was preliminarily determined to be of low-to-moderate safety significance (White), assuming an exposure time of 195 days. See Attachment, "'B' Emergency Diesel Generator Lube Oil Leak Detailed Risk Evaluation," for a summary of the preliminary risk determination.

Cross-Cutting Aspect: H.6 - Design Margins: The organization operates and maintains equipment within design margins. Margins are carefully guarded and changed only through a systematic and rigorous process. Special attention is placed on maintaining fission product barriers, defense-in-depth, and safety-related equipment. Constellation's failure to

demonstrate sufficient technical rigor during the installation of a gasket during a temporary corrective maintenance resulted in the 'B' EDG inoperability.

Enforcement:

Violation: Title 10 CFR Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," requires, in part, that activities affecting quality shall be prescribed by documented instructions, procedures, or drawings, of a type appropriate to the circumstances and shall include appropriate quantitative or qualitative acceptance criteria for determining that important activities have been satisfactorily accomplished.

FitzPatrick TS 3.8.1, "AC Sources-Operating," requires, in part, that two EDG subsystems be operable while in Modes 1, 2, or 3. If an EDG subsystem is determined to be inoperable, it shall be returned to an operable status within 14 days. If not restored to an operable status, the unit shall be shut down and placed in Mode 3 in 12 hours and Mode 4 in 36 hours.

Contrary to the above, on October 11, 2023, a WO instruction prescribing an activity affecting quality did not include appropriate quantitative or qualitative acceptance criteria to determine that the activity was satisfactorily accomplished. Specifically, on October 11, 2023, Constellation installed a gasket in ½-inch lube oil supply check valve 93EDG-57B in accordance with WO 05407333, which did not include appropriate acceptance criteria for tightening the joint. The failure to provide appropriate tightening acceptance criteria resulted in damage to the valve resulting in a 2.3 gpm lube oil leak on April 25, 2024, that would have prevented the system from performing its safety function. Consequently, the 'B' EDG subsystem was rendered inoperable prior to April 25, 2024, for a period longer than its TS allowed outage time, and the unit was not shut down and placed in Mode 3 within 12 hours and Mode 4 within 36 hours.

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 September 10, 2024, the inspectors presented the inspection results to Alex Sterio, Site Vice President, and other members of the licensee staff.

DOCUMENTS REVIEWED

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
71153	Calculations	JF-SDP-004	FitzPatrick 2024 'B' EDG FTR Calculations in Support of PRA Significance Determination	1
	Corrective Action Documents	04708722		
		04769343		
	Drawings	FE-1AK	125VDC One Line Diagram Sheet 3	18
	Engineering Changes	639982	Install Gasket to Seal Bonnet Cap Leak on 93EDG-57B Check Valve	
	Miscellaneous		FitzPatrick Updated Final Safety Analysis Report	April 2023
		JF-PRA-004	Human Reliability Analysis	2
		JF-PRA-013	James A. FitzPatrick Nuclear Power Plant Probabilistic Risk Assessment Summary Document Notebook	1
		JF-PRA-021.11	James A. FitzPatrick Fire Probabilistic Risk Analysis Summary and Quantification Notebook	4
	Procedures	AOP-49	Station Blackout	31
		CC-JF-118	Site Implementation of Diverse and Flexible Coping Strategies (FLEX) and Spent Fuel Implementation Program	8
		FSG-002	ELAP DC Bus Load Shed and Management	5
		FSG-ELAP	Extended Loss of AC Power (ELAP)	7
	Work Orders	05153056		
		05407333		

ATTACHMENT

James A. FitzPatrick Nuclear Power Plant
'B' Emergency Diesel Generator (EDG) Lube Oil Leak
Detailed Risk Evaluation

Conclusion

The senior reactor analysts (SRAs) estimated the total increase in core damage frequency (ΔCDF) related to the 'B' EDG lube oil leak to be preliminary White, a finding with low-to-moderate safety significance. Based on the best-estimate assumptions discussed below, the SRAs determined the ΔCDF associated with this performance deficiency to be approximately 4.2E-6/year.

Exposure Time

The SRAs assumed that thread cracking was either initiated or adversely impacted when Constellation installed the gasket during repair of 93EDG-57B on October 11, 2023, in response to a leak from the check valve cap. The SRAs noted there was uncertainty in this assumption, as it did not explain why the valve cap developed a 45 drop per minute oil leak prior to repairs associated with gasket installation. Crack propagation would be primarily affected by high vibration and compounded by higher system temperature and pressure. Given that check valve 93EDG-57B was located on the EDG skid, all these conditions would be present while the EDG was running. Therefore, the SRAs assumed that degradation of the seal continued as Constellation ran the 'B' EDG until April 25, 2024, when the operators secured the 'B' EDG during surveillance testing due to the oil leak.

As such, the SRAs used the methodology described in the *Risk Assessment of Operational Events (RASP) Handbook*, Volume 1, Revision 2.02, Section 2.5, "Exposure Time for Component Run Failures," to determine the exposure time. The SRAs used the run history of the 'B' EDG to determine the number of intervals of accumulated operation for its 24-hour probabilistic risk assessment mission time. The SRAs determined the exposure time to be 195 days, starting on October 13, 2023, when Constellation declared the 'B' EDG operable following gasket installation, and ending on April 25, 2024, when Constellation completed repairs and returned the 'B' EDG to service.

Assumptions

<u>Credit for Demonstrated EDG Runtime</u>
The SRAs reviewed FitzPatrick's switchyard design and operation and determined that adjustment to offsite power nonrecovery probabilities, based on demonstrated successful 'B' EDG runtime (10.94 hours), was appropriate for the internal events risk evaluation. This method credited the demonstrated runtime as time the 'B' EDG would have run during an event supporting safety-related system loads and accounted for the reduction in decay heat as time after reactor shutdown increased.

The SRAs divided the exposure period into eight separate run intervals for the analysis, corresponding to the eight test intervals that occurred since October 11, 2023. This approach assumes that the observed failure that occurred on April 25, 2024, would be consistent with the

expected average time of operation before failure if viewed probabilistically (i.e., if considering more than one sample, the EDG would be expected to run on average, for 10.94 hours prior to failure). This essentially reduced the offsite power nonrecovery probabilities for this analysis which resulted in reducing the risk of the performance deficiency. The SRAs also conducted a sensitivity analysis (Sensitivity 1) that did not include credit for demonstrated EDG runtime.

Diverse and Flexible Coping Strategies (FLEX)
The SRAs reviewed FitzPatrick's FLEX support guidelines and human error probability calculations associated with FLEX strategies. The SRAs also conducted a field walkdown of FLEX equipment. Based on this review, the SRAs determined it was appropriate to credit FLEX mitigating strategies and equipment in this detailed risk evaluation. However, based on inconsistencies between the assumptions in FitzPatrick's human error probability calculations and the FLEX support guidelines, and their impact on timing considerations for deployment of FLEX equipment, the SRAs credited only one FLEX diesel generator (i.e., FLEX(N)) in the analysis. To model the FLEX diesel generator equipment reliability, the SRAs used information contained in PWROG-18042-NP, "FLEX Equipment Data Collection and Analysis," Revision 1, which was considered best-available information for this application. The SRAs also conducted a sensitivity analysis (Sensitivity 2) that included credit for both FLEX diesel generators (FLEX (N+1)).

SPAR Model Changes

The SRAs evaluated the finding using Systems Analysis Programs for Hands-On Evaluation (SAPHIRE) version 8.2.11, and a test and limited use (TLU) version of the FitzPatrick Standardized Plant Analysis Risk (SPAR) model created by Idaho National Laboratories (TLU1). This TLU1 model included revisions to the FitzPatrick SPAR model of record (version 8.82) to more closely reflect the as-built, as-operated plant. The SPAR model used for this detailed risk evaluation included the following:

- The SPAR model utilized equipment failure data as documented in INL/EXT-21-65055, "Industry Average Performance for Components and Initiating Events at U.S. Commercial Nuclear Power Plants: 2020 Update," as this was considered best-available information for this analysis.
- In accordance with the *Risk Assessment of Operational Events (RASP) Handbook*, Volume 1, Revision 2.02, Section 3.2, the SRAs set basic event EPS-DGN-FR-DGB, "Diesel Generator B Fails to Run," to TRUE to represent the failure of the 'B' EDG and to account for the increased potential for common cause failure of the remaining EDGs in the common cause control group, which includes all four EDGs. This reflected the possibility that the performance deficiency, which is the proximate cause of the degraded condition, probabilistically could affect other components on the EDGs. This assumption was consistent with the *Risk Assessment of Operational Events (RASP) Handbook,* Volume 1, Revision 2.02, Section 5.0 and NUREG-2225, "Basis for the Treatment of Potential Common-Cause Failure in the Significance Determination Process." This practice is also scrutable, repeatable, and consistent with other detailed risk assessments.
- The SRAs updated the loss of offsite power initiating event probabilities to reflect the data provided in report INL/RPT-22-68809, "Analysis of Loss of Offsite Power Events – 2021 Update."

- The SRAs adjusted the SPAR model by substituting the diesel driven fire pump for the FLEX pump since FitzPatrick's Phase 2 strategy used the diesel driven fire pump instead of a portable FLEX pump commonly used at other sites.
- The SRAs adjusted the SPAR model to support crediting demonstrated 'B' EDG runtime of 10.94 hours over eight intervals for the internal events evaluation.
- No additional credit for recovery of the EDG was provided in this analysis beyond the recovery credit provided for emergency power systems in the SPAR model sequences.
- The SRAs updated the model to account for actions taken during an extended loss of alternating current (AC) power event, specifically related to implementation of the deep direct current (DC) load shed to preserve station battery life. Operators would complete the deep DC load shed within 90 minutes of the start of the event. FitzPatrick's deep DC load shed procedure included removal of power from various systems, including key high pressure coolant injection components as well as EDG control power.
- The SPAR model was updated to include appropriate EDG logic for a loss of coolant accident/loss of offsite power event.

Contributions from Internal Events

Using the SPAR model modifications discussed above, the SRAs used the direct solve function of SAPHIRE to calculate the risk for the conditional case, which included the 'B' EDG failure to run, for each of the eight intervals. The results were subtracted from the nominal case and then summed to determine the internal events risk contribution related to the failure of the 'B' EDG. For an exposure period of 195 days, the internal events contribution to the total ΔCDF was approximately 2.7E-6/year. The FitzPatrick SPAR model does not include internal flooding. Using Constellation's estimates, the SRAs determined the contribution from internal flooding to be low E-7/year.

The dominant core damage sequences for internal events included losses of offsite power and common cause failure of the EDGs, resulting in station blackout, with failure of either the FLEX diesel generator or the reactor core isolation cooling system, and failure to recover offsite power or an EDG.

Contributions from External Events

Seismic, High Winds, and Tornadoes
Using the Events and Condition Assessment (ECA) module of SAPHIRE, the SRAs estimated the risk contribution from seismic, high winds, and tornadoes to be 3.1E-7/yr.

Fire
The FitzPatrick SPAR model does not evaluate fire risk. Therefore, the SRAs used Constellation's fire risk results for this issue. Constellation made significant changes to the fire PRA model of record to accomplish this SDP, including incorporation of multiple NUREGs and crediting demonstrated EDG runtime to reduce certain human error probabilities. Based on these changes, Constellation preliminarily determined their ΔCDF for fire to be approximately 5.0E-7/year. The SRAs conducted a review of these results and noted discrepancies with the associated core damage cutsets. Specifically, failures of FLEX equipment were not showing up as expected. Based on the SRAs' questions, Constellation performed a recalculation of fire risk

and determined ΔCDF for fire to be approximately 1.1E-6/year. This result included INL/PWROG failure data and FLEX(N). The top cutset was a panel high energy arc fault, common cause failure of the EDGs, with subsequent station blackout, and failure of the FLEX diesel generator.

Sensitivity Evaluations

Sensitivity 1: No EDG Runtime Intervals
The SRAs conducted a sensitivity analysis to determine the impact of the application of EDG runtime intervals on the risk associated with this issue. For this sensitivity, the SRAs used the ECA module of SAPHIRE to estimate the increase in risk without adjusting offsite power nonrecovery probabilities to account for demonstrated 'B' EDG runtime. Though the risk was higher if the SRAs did not consider EDG runtime intervals, this result would not affect the overall conclusions of the analysis. The SRAs determined that crediting demonstrated EDG runtime for this analysis was representative of the best-estimate risk.

Sensitivity 2: FLEX Diesel Generator (N+1) Credit with No EDG Runtime Intervals
Constellation credited FLEX diesel generator (N+1) in their model of record at failure probabilities that were significantly lower than PWROG data. The SRAs did not credit FLEX (N+1) as a best estimate due to inconsistencies between the assumptions in FitzPatrick's human error probability calculations and the FLEX support guidelines, and their impact on timing considerations for deployment of FLEX equipment. However, the SRAs performed a sensitivity analysis crediting the FLEX (N+1) diesel generator at PWROG failure probabilities and determined that this would not affect the overall conclusions of the analysis.

Overall Results

	Best Estimate	Sensitivity 1 (no runtime credit)	Sensitivity 2 (FLEX N+1, no runtime credit)
Internal Events	2.7E-6/yr	3.4E-6/yr	3.0E-6/yr
Seismic/High Winds/Tornadoes	3.1E-7/yr	3.1E-7/yr	3.2E-7/yr
Fire	1.1E-6/yr	1.1E-6/yr	9.3E-7/yr
Total ΔCDF	**4.2E-6/yr**	4.9E-6/yr	4.3E-6/yr

The SRAs estimated the ΔCDF related to the 'B' EDG lube oil leak to be 4.2E-6/year, a preliminary White finding with low-to-moderate safety significance.

Contributions from Large Early Release Frequency (LERF)

Per IMC 0609, Appendix H, Table 5.2, LERF factors of 1.0 and 0.6 are used for high pressure core damage accident sequences with the drywell dry or flooded, respectively. These LERF factors are considered conservative bounding values. More recent insights from an NRC Office of Research sponsored study by Energy Research, Inc. (ERI/NRC 03-204), November 2003 and subsequent NUREG/CR-7110, "State-of-the-Art Reactor Consequence Analysis Project," Volume 1, identified that improved modeling and analysis of anticipated types and sizes of reactor coolant ruptures, projected containment heating and fuel-coolant interactions, and

operator actions taken to flood containment in accordance with Severe Accident Management Guidelines, significantly reduce the potential for containment breach and the likelihood of LERF. Additionally, the dominant sequences discussed in this detailed risk evaluation would result in considerable time before postulated core damage and a potential additional eight to 10 hours until containment breach. Therefore, the above reports indicate a more benign containment response at the time of vessel breach, in terms of direct containment heating and fuel-coolant interaction-induced containment failure. Therefore, the SRAs determined that Constellation's ∆LERF evaluation was reasonable. For this detailed risk evaluation, the impact to LERF was bounded by the increase in CDF.

Constellation's Risk Evaluation and Technical Analysis

Constellation's risk evaluation and technical analysis of this performance deficiency was documented in JF-SDP-004, "FitzPatrick 2024 B EDG FTR Calculations in Support of PRA Significance Determination," Revision 1. Constellation determined that their best representative case for this performance deficiency included:

- An exposure period of 195 days
- Credit for demonstrated EDG runtime over eight intervals by adjusting AC power recovery probabilities in the internal events model and multiple human error probabilities in both the internal events and fire probabilistic risk assessment models
- Failure data documented in Jensen Hughes report 32466.004.126-RPT-03, "Evaluation of Standby Equipment Runtime Failure Rates," Revision 3
- Baseline common cause failure probability (i.e., no increase in common cause failure probability due to the 'B' EDG failure). The basis for this assumption was that overtightening of the bonnet cap during installation of the gasket was an error unique to the 'B' EDG without common cause failure coupling relative to the remaining EDGs
- FLEX (N+1) equipment

Using these assumptions, Constellation's best representative ∆CDF was in the mid E-7 range. Constellation also ran a sensitivity analysis on their results including INL/PWROG failure data, conditional common cause failure probability, and FLEX(N) equipment. Constellation's results for this sensitivity were comparable to the NRC best estimate case discussed above.