

VCSNS 'A' EDG Fuel Oil Leak Regulatory Conference Significance Determination Discussion

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Apparent Violation Significance Discussion

- We agree with the apparent violation and facts as written and have asked for the Regulatory Conference to provide amplifying risk determination information, which was not available to the Significance and Enforcement Review Panel on Sept 13th.
- We understand that the Emergency Diesel Generators (EDGs) are safety significant pieces of equipment and we must have a reverence for maintaining them appropriately, to aggressively address any reliability concerns.
- The station acknowledges the performance deficiency documented in the AV and has responded by taking significant corrective actions including both short-term and planned long-term corrective actions, in accordance with our Root Cause Evaluation (RCE), to ensure EDG reliability.

Apparent Violation Significance Discussion

- The direct cause of the 'A' EDG FO Leak was a crack at the threaded section of the ¾" schedule 40 Carbon Steel Pipe. Failure was due to high cycle mechanical fatigue.
- Immediately following the November 2, 2022 event, the failed fuel oil pipe was replaced on 'A' EDG, retested satisfactorily, and returned to operable status on November 3, 2022. For Extent of Condition, the associated fuel oil piping was replaced on the 'B' EDG on March 14, 2023. No fuel oil leaks have occurred on either EDG since the November 2, 2022 event.
- VCSNS has completed a RCE to further understand and correct the organizational, process, and equipment aspects of the event. Insights include Corrective Action (CA) Program process weaknesses, FO system design vulnerabilities and inadequate management oversight. We look forward to sharing our lessons learned and CA's during the follow-up NRC inspections.

Response to 'A' EDG Fuel Oil Leak

- We are independently evaluating our regulatory performance, in aggregate, utilizing 3rd party and fleet oversight as our present regulatory performance is unacceptable.
- VCSNS is currently pursuing an EDG fuel oil piping design change to improve the design margin of the system with implementation, scheduled to be completed by the end of the first quarter 2024.
- We believe that the new amplifying risk determination information provided in the letter dated October 31, 2023 supports a final significance determination of White (Low to Moderate Safety Significance) for the issue described in the finding (EA-23-093).

VCS Nuclear Safety Improvements

- Over the last 20 years, we have made the following plant enhancements to improve nuclear safety and reduce plant risk:
 - Installed a dedicated underground power source from a nearby hydro-electric plant
 - Added an alternate RCP seal injection pump with independent diesel generator
 - Installed low leakage Flowserve N9000 RCP seals fitted with an abeyance seal to minimize RCS leakage upon loss of AC power
 - Transitioned from Appendix R to NFPA 805 Fire Protection Program
 - Implemented robust Flex/BDB Strategies including:
 - Purchased 2 portable 7.2 KV 1 MW Combustion Turbine Generators to power a safety bus
 - Added 300 KW diesel generators to the Electrical Building (EB) and Auxiliary Electrical Building's (AEB) to power a DC bus
 - Purchased 2 portable diesel-powered Emergency Backup Ultimate Heat Sink and 2 RCS Make-Up Pumps
 - Two 80 KW portable diesel generators

VCS 'A' EDG Fuel Oil Leak Risk Assessment

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Background

- NRC's preliminary assessment of Yellow significance was made using the best available information at the time of the Significance and Enforcement Review Panel meeting on Sept 13th.
- Dominion Energy report with supplemental information for the determination of safety significance provided to NRC by letter dated October 31, 2023.
- This supplemental information was not available to NRC at the time of their preliminary assessment of risk significance.
- This information reflects currently installed and available plant equipment, existing station operating procedures, and validated operator actions.
- The updated assessment concludes that combined risk from fire, internal events/internal flooding, and seismic events meets criteria for a White risk significance.

Background (Continued)

- The information we are providing supplements the NRC Senior Risk Analysts' preliminary assessment
- Key facts and assumptions are consistent with NRC's assessment:
 - Both assessments consider the successful operation of the 'A' EDG during the exposure window to determine exposure time
 - Conservative and simplifying "time-zero" assumption – both NRC's and Dominion Energy's preliminary risk assessments assumed postulated failures of accident-mitigating equipment at the same time as the initiating event
- Preliminary assessments highlighted significant risk contribution of that Station Blackout (SBO) scenarios concurrent with random Turbine Driven Emergency Feed Water Pump (TDEFWP) failure
- Refinements with time dependence pursued to address unnecessarily conservative initial risk assessment results

Overview of Risk Assessment

- In response to the identified Apparent Violation, Dominion Energy has updated the V. C. Summer Fire PRA to:
 - **Apply existing FLEX strategies in PRA accident sequences involving early failures of the Turbine Driven Emergency Feedwater Pump**
- The application of existing FLEX strategies to the Fire PRA was enabled by:
 - **The initial six-hour period of successful EDG ‘A’ operation**
 - **Validating specific FLEX strategies for this assessment**
- The supplemental analysis demonstrates that application of FLEX strategies:
 - **Supports the assessment of risk significance as White**
- The information to be presented was not available to NRC at the time of the preliminary significance determination.

Timeline of Analyzed FLEX Scenarios in FPRA

$t_0 = 0$ hours

- Time of Fire, Reactor Trip & LOOP
- B Train Safeguards AC Unavailable
- 'A' EDG and MDEFW pump running
- SG Level Maintained

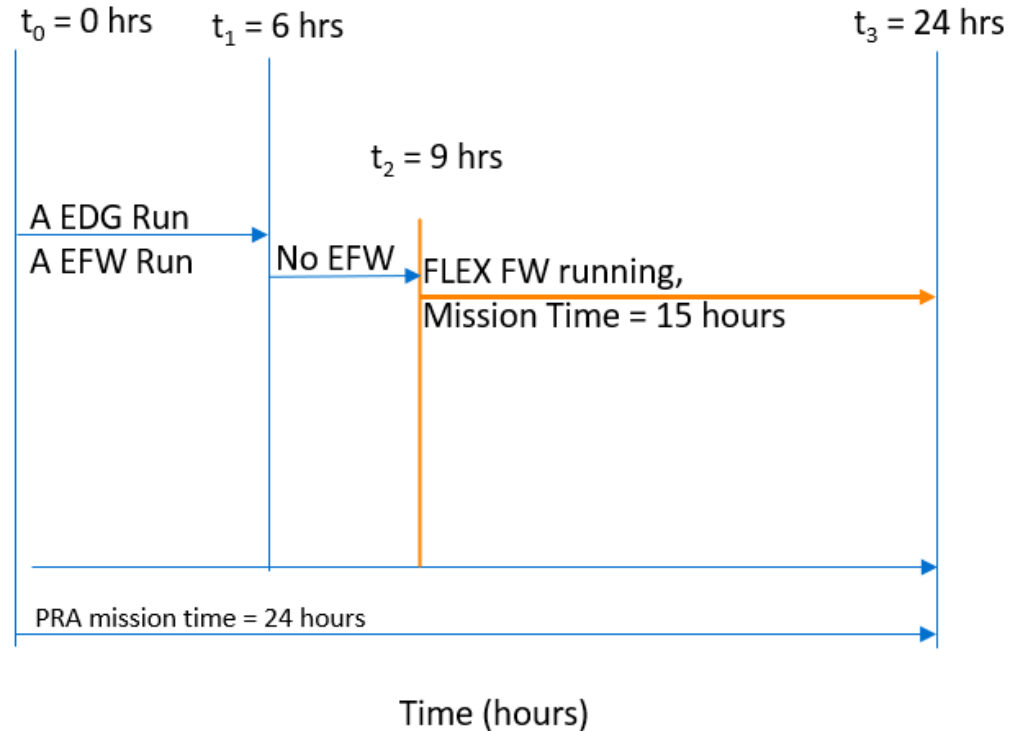
$t_1 = 6$ hours

- 'A' EDG fails
- Station Blackout condition
- Entry into EOP-6.0 Total Loss of AC
- Total Loss of EFW Flow
- SG Level begins decreasing

$t_2 = 9$ hours

- FLEX FW Strategy Implemented
- Core Damage Prevented

$t_3 = 24$ hours Mission Time



Supplemental Information – Feed Water

- Six-hour period of successful EDG ‘A’ Operation considered for use of currently available plant equipment, established procedures, and established operator actions to mitigate an SBO.
- Model updates to Fire PRA were made consistent with ASME/ANS RA-Sa-2009.
- Changes to Fire PRA only; no changes to internal events/internal flooding or seismic.
- Three established methods of restoring steam generator (SG) feed water (FW) for heat removal credited:
 - Energizing one installed Motor Driven Emergency Feed Water Pump (MDEFWP) using two-of-two available Combustion Turbine Generators (CTGs)
 - Staging and connecting the portable FLEX SG feed pump
 - Using one-of-two available pumper trucks to supply SG FW
- Each method uses maintained and confirmed available equipment.
- Each method has been quantified in risk assessment using appropriate industry, plant-specific, and generic data sources.
- Each method included operator validations.

Supplemental Information – Battery Chargers

- SBO scenarios also recognized as involving depletion of station batteries.
- Two established methods of charging station batteries to prevent depletion and preserve SG level indication and control capability:
 - Aligning one-of-two installed, available, and connected Electrical Building (EB) and Auxiliary Electrical Building (AEB) diesel generators to power a DC bus
 - Aligning one-of-two CTGs to energize a battery charger by way of 7.2kV switch gear
- Model updates to Fire PRA were made consistent with ASME/ANS RA-Sa-2009.
- Changes to Fire PRA only; no changes to internal events/internal flooding or seismic.
- Each method uses maintained and confirmed available equipment.
- Each method has been quantified in risk assessment using appropriate industry, plant-specific, and generic data sources.
- Each method included operator validations.

Results and Conclusion

- Combined internal events, internal flood, seismic PRA risk, and fire risk analysis results including the supplemental information for the identified deficiency and calculated exposure time:
 - Change in Core Damage Frequency (Δ CDF) calculated to be $5.49\text{E-}06/\text{yr}$
 - Change in Large Early Release Frequency (Δ LERF) calculated to be $4.10\text{E-}07/\text{yr}$
- Results are well below Yellow risk threshold of $1\text{E-}5/\text{yr}$ (Δ CDF) and $1\text{E-}6/\text{yr}$ (Δ LERF/yr).
- Dominion Energy has high confidence in this conclusion based upon:
 - Margin to the color thresholds
 - Availability of other areas for further refinement not pursued (see supplemental report)
- No Key PRA Assumptions were identified.
- **Dominion Energy respectfully requests consideration of the supplemental information in NRC's assessment of significance for this issue.**

