

## **Summary of U.S. Nuclear Regulatory Commission Staff Review of Emergency License Amendment Requests Regarding Emergency Diesel Generators at Palo Verde Nuclear Generating Station**

On December 15, 2016, the Unit 3 train B emergency diesel generator (EDG) at Palo Verde Nuclear Generating Station was undergoing a routine surveillance run when it unexpectedly failed. The EDG experienced a connecting rod failure, which resulted in cylinder damage and an automatic trip on low oil pressure. The licensee immediately contacted the U.S. Nuclear Regulatory Commission (NRC) to report the event and the potential need for an emergency license amendment request (LAR) for a one-time extension of the 10-day EDG completion time described in Technical Specification 3.8.1.B.4 for the purpose of repairing EDG 3B. A presubmittal conference call with the licensee took place on December 20, 2016, to discuss a path forward to bring EDG 3B to operable condition. The licensee identified a similar event at the South Texas Project (STP) in 2003, in which STP submitted two emergency LARs. The first LAR was to extend the completion time to collect and analyze data associated with the failure of the EDG, and the second LAR was to repair the EDG. Following this presubmittal call, the licensee pursued a similar path by submitting two LARs.

By letter dated December 21, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16356A689) as supplemented by letter dated December 23, 2016 (ADAMS Accession No. ML16358A715), the licensee submitted a deterministic LAR requesting a one-time extension of the EDG 3B completion time from 10 days to 21 days to conduct repairs, perform a root-cause investigation, and evaluate the extent of condition. As part of the LAR, the licensee submitted risk insights, including the risk reductions provided by the compensatory measures. Although the NRC staff reviewed the first LAR primarily based on deterministic criteria, the staff also considered the risk insights provided by the licensee on the incremental conditional core damage probability and incremental large early release probability for the plant-specific configuration. Furthermore, the additional risk information allowed the NRC staff to get a head start its risk-informed review of the anticipated second LAR. The NRC issued the first amendment on December 23, 2016 (ADAMS Accession No. ML16358A676), based on its review of defense-in-depth for onsite and offsite electrical power sources, safety margin at the facility, compensatory measures and regulatory commitments, and the use of risk management during the extended completion time.

On December 29, 2016, another presubmittal conference call took place to discuss the second LAR and ensure mutual understanding of the path forward. After having determined that the EDG 3B failure was not a common-mode failure affecting the operable EDGs, the licensee submitted a risk-informed LAR by letter dated December 30, 2016 (ADAMS Accession No. ML16365A240), as supplemented by letters dated January 2, 2017, and January 4, 2017, (ADAMS Accession Nos. ML17002A001 and ML17004A238, respectively), requesting to extend the one-time extension of the EDG 3B completion time further to 62 days to complete repairs and test EDG 3B to reestablish its operability. The NRC staff reviewed this LAR consistent with the risk-informed regulatory framework that considers defense-in-depth strategies, risk insights, and safety margins by using the applicable guidance that implements this framework. This guidance includes Regulatory Guide (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Revision 2, issued May 2011 (ADAMS Accession No. ML100910006); RG 1.177, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications," Revision 1, issued May 2011 (ADAMS Accession No. ML100910008); and RG 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for

Risk-Informed Activities,” Revision 2, issued March 2009 (ADAMS Accession No. ML090410014).

The increase in risk associated with the unavailability of EDG 3B was dominated by the fire hazard, with internal event hazards contributing only about 7 percent. The significant impact of these hazards on critical safety functions was the loss of heat removal from the steam generators (SG) as a result of the failure of all auxiliary feedwater pumps or loss of power to those pumps (e.g., station blackout). Loss-of-coolant accidents were not a significant contributor to the risk increase, and the likelihood of a loss-of-coolant accident coincident with a loss of offsite power was determined to be very low. Therefore, the compensatory measures identified in the LAR (e.g., deployment of three portable diesel generators (DGs), use of one diesel-driven flexible coping strategy (FLEX) SG makeup pump, protection of a firewater cross-connect to the SGs) were effective in reducing the sources of increased risk associated with the EDG outage and provided additional assurance that defense-in-depth and safety margins were maintained. In addition, risk-assessment results showed a substantial margin in the requested completion time extension of 62 days. For example, crediting the portable DGs in the risk assessment would support a 230-day completion time. Crediting the FLEX SG makeup pump with the portable DGs would have yielded an even longer completion time (greater than one year); however, the licensee chose the more conservative completion time because the portable DGs were integrated into the plant design and operational procedures. The NRC issued the amendment for the second LAR on January 4, 2017 (ADAMS Accession No. ML17004A020), based on the review of the licensee’s detailed risk evaluation (including FLEX equipment), deterministic evaluation, causal evaluation of the EDG 3B failure, compensatory measures and regulatory commitments, operator training, use of risk management, and imposed license conditions.