UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, DC 20555-0001

August 6, 2007

NRC INFORMATION NOTICE 2007-27: RECURRING EVENTS INVOLVING EMERGENCY DIESEL GENERATOR OPERABILITY

ADDRESSEES

All holders of operating licenses for nuclear power reactors, except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to inform addressees of the results of a staff evaluation of recent operating experience to identify recurring events involving the operability of emergency diesel generators (EDGs). The NRC expects that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. Suggestions contained in this IN are not NRC requirements; therefore, no specific action or written response is required.

DESCRIPTION OF CIRCUMSTANCES

The Office of Nuclear Reactor Regulation (NRR) recently conducted a review of operating experience related to EDG failures that have occurred since the beginning of 2004 and identified the following recurring events and overall tendencies:

- Vibration-induced failures of EDG piping and tubing (recurring)
- Failure to take prompt corrective action, especially to repair EDG fluid leaks
- Inadequate EDG post-maintenance testing
- Failure to follow procedures.

The following are representative examples of the EDG-related events:

Kewaunee Power Station

During an EDG test run, a minor fuel oil leak was identified at a brass fitting located on a copper diesel fuel oil line. Plant personnel failed to follow the procedural requirements to enter the identified degraded condition into their corrective action program, and no written operability determination or repair was performed. Fifty one days later the EDG had to be secured during a surveillance run when a plant operator noticed that the leak rate had rapidly increased to a point where a pencil-sized stream of fuel oil was observed to be issuing from the original leak location. Approximately three EDG run hours had elapsed between the initial identification

of the leak and the time when the leak became more significant. The licensee's analysis could not prove that the EDG was operable for this 51 day period. The resulting NRC inspection finding involving corrective action was determined to be of substantial safety significance (Yellow). ("NRC Inspection Report 05000305/2007007; Preliminary Yellow Finding for Kewaunee Power Station," dated March 2, 2007, Agencywide Documents Access and Management System (ADAMS) Accession No. ML070640045 and "Final Significance Determination for a Yellow Finding and Notice of Violation (NRC Inspection Report 05000305/2007009) Kewaunee Power Station," dated April 3, 2007, ADAMS Accession No. ML070940146)

River Bend Station Unit 1

During EDG testing, a minor leak was identified at a compression fitting in the jacket water cooling system. A mechanic performed a tightness check on the fitting, but the leakage rate did not change. During a subsequent EDG run, the jacket water tubing separated at the same fitting, causing a significant leak. The results of an event analysis determined that the EDG was inoperable for approximately 23 days. The most probable cause of the failure was a combination of normal engine vibration and damage caused by over-tightening during past maintenance. The resulting NRC inspection finding involving corrective action was determined to be of very low safety significance (Green). (Licensee Event Report 05000458/2005-003-00, November 4, 2005, ADAMS Accession No. ML053180172 and "River Bend Station - NRC Integrated Inspection Report 05000458/2005004," dated November 14, 2005, ADAMS Accession No. ML053190140)

Crystal River Unit 3

An EDG output breaker failed to close during a surveillance test. The breaker closing spring was found not charged with the charging motor control power switch in the "OFF" position. The licensee's root cause investigation determined that following breaker maintenance, the charging motor control power switch was not verified to be in the "ON" position. The EDG was determined to be inoperable for approximately 28 days. The resulting NRC inspection finding for exceeding the EDG technical specification allowed outage time was determined to be of very low safety significance (Green). ("Crystal River Unit 3 - NRC Integrated Inspection Report 05000302/2006005," dated January 25, 2007, ADAMS Accession No. ML070260154)

Indian Point Nuclear Generating Unit 2

During an extent of condition review for post-maintenance test concerns, the licensee determined that one EDG had not been run at its full load rating following a governor replacement that took place about six months earlier. During a subsequent full load test, the EDG could not achieve its rated load of 2300 kW. The licensee determined that the fuel rack linkage was improperly set after the EDG governor replacement. The resulting NRC inspection finding for inadequate post-maintenance testing was determined to be of very low safety significance (Green). ("Indian Point Nuclear Generating Unit 2 - NRC Integrated Inspection Report No. 05000247/2006003," dated August 11, 2006, ADAMS Accession No. ML062260074)

Brunswick Steam Electric Plant Unit 1

During a loss of offsite power event Unit 2, a Brunswick Unit 1 EDG experienced a high lubricating oil strainer differential pressure alarm. The EDG later tripped due to a momentary drop in lube oil header pressure that occurred while plant personnel refilled the cleaned lube oil duplex strainer. The alarm condition was caused by the presence of fibrous lint material in the strainer, the remnants of a cleaning towel that was inadvertently left in the EDG lube oil sump during a previous maintenance activity. It was subsequently learned that the licensee had failed to take effective corrective action after similar high differential pressure alarms were received during two prior post maintenance testing runs. During the event follow-up it was discovered that the EDG #9 crankshaft bearing was wiped. While the licensee's bearing failure analysis concluded that the exact cause of the failure could not be determined with certainty, the analysis did conclude that the bearing lost effective lubrication and the surface of the bearing was wiped. The resulting NRC inspection finding for exceeding the EDG technical specification completion time was determined to be of low to moderate safety significance (White). ("Brunswick Steam Electric Plant - NRC Inspection Report Nos. 05000324/2007008 and 05000325/2007008; Preliminary White Finding," dated February 28, 2007, ADAMS Accession No. ML070590404 and "Final Significance Determination for a White Finding and Notice of Violation (Brunswick Steam Electric Plant - NRC Inspection Report Nos. 05000324/2007009 and 05000325/2007009)," dated April 20, 2007, ADAMS Accession No. ML071130028)

BACKGROUND

The examples of vibration-induced failures of EDG small bore piping and tubing are similar to the concerns discussed in NRC IN 89-07, "Failures of Small-Diameter Tubing in Control Air, Fuel Oil, and Lube Oil Systems Which Render Emergency Diesel Generators Inoperable," dated January 25, 1989, ADAMS Accession No. ML031180501.

DISCUSSION

Licensees rely on EDGs to provide emergency alternating current power in response to loss of offsite power events. EDGs are required to be operable as specified in plant technical specifications. As described above, the NRR staff reviewed recent operating experience related to EDG failures and identified several recurring events and general tendencies. The staff noted that since the beginning of 2004, eight of the 27 "greater than Green" inspection findings within the mitigating systems cornerstone have been EDG-related (one Yellow and seven White). These findings involved either the failure to take prompt corrective action, the failure to perform adequate post-maintenance testing, or the failure to follow procedures.

One recurrent event that continues to stand out involves the vibration-induced failure of EDG piping and tubing. In many cases, major piping failures occurred after minor leaks were identified and not immediately or properly repaired by the licensee. One licensee recently noted that (1) the training for their employees did not cover common industry-known tubing failure mechanisms, and (2) their managers and supervisors lacked knowledge of industry operating experience relating to this type of failure. To prevent this type of failure, it is important that EDG piping and tubing be properly routed, supported and maintained. This topic was previously addressed by NRC IN 89-07.

CONTACT

This information notice requires no specific action or written response. Please direct any questions about this matter to the technical contact listed below or the appropriate NRR project manager.

/RA by TQuay for/

Michael J. Case, Director
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Technical Contact: Stephen J. Pannier, NRR
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Note: NRC generic communications may be found on the NRC public Web site, http://www.nrc.gov, under Electronic Reading Room/Document Collections.

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