UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555-0001

July 21, 2005

NRC INFORMATION NOTICE 2005-21: PLANT TRIP AND LOSS OF PREFERRED AC POWER FROM INADEQUATE SWITCHYARD MAINTENANCE

ADDRESSEES

All holders of operating licensees 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 to inform addressees about loss of power events as a result of inadequate preventive and corrective maintenance practices on switchyard breakers and current transformers. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

DESCRIPTION OF CIRCUMSTANCES

On May 5, 2004, Dresden Unit 3 was at full power and Dresden Unit 2 was shutdown when an automatic reactor scram and a subsequent loss of offsite power event occurred during activities to reconfigure breakers in the 345 kV switchyard. Operations personnel manually opened switchyard breaker 8-15 in accordance with the switching order. However, when the A and B phases opened, the C phase of switchyard breaker 8-15 failed to fully open within the required time. This failure produced current imbalances in Unit 2 and Unit 3 switchyard ring busses (tied together through a breaker), which led to the opening of several other switchyard breakers. Unit 3 scrammed due to turbine load reject, and offsite power was lost to the Unit 3 safety-related emergency core cooling system (ECCS) busses. The failed breaker was an I-T-E Imperial Corporation (current vendor ABB) sulfur hexafluoride (SF6) gas circuit breaker (type 362GA). This breaker used independent pole operators for each of the three phases. The breaker was built and installed in the Dresden 345 kV switchyard in the late 1970's.

On May 6, 2004, the licensee and personnel of the transmission and distribution company, Exelon Energy Delivery (EED), discovered that ABB, the current breaker vendor, had issued a product advisory in July 2003 for I-T-E Imperial Corporation GA and GB breakers to warn that the operating mechanisms may experience delayed trip or in some cases failures to trip due to age and application related problems. In addition, the advisory noted that the breakers at

highest risk were those operated less than twice per year. The product advisory recommended that the operating mechanism in high-risk applications be rebuilt using new trip latch mechanism kits at the earliest convenience.

While disassembling the trip latch mechanism of Breaker 8-15, EED and licensee personnel discovered that the sealed bearing for the trip latch mechanism did not roll freely. The failure of the sealed bearing to roll freely, directly contributed to the failure of the C phase of Breaker 8-15 to open within the required time. The NRC special inspection team reviewed the maintenance history of Breaker 8-15. The last preventive maintenance on Breaker 8-15 was done on March 27, 2002, and included routine inspection, lubrication and maintenance, a contact resistance test, and a travel timing test. The inspection team noted that the breaker failed the timing test on the C Phase. The breaker was last cycled in October 2002 and then remained in the closed position until May 5, 2004.

The NRC inspection team noted that the EED procedure stated that the breaker should be lubricated after a failed timing test. However, the vendor manual stated that, the operating mechanism should be disassembled and cleaned and lubricated when the operating mechanism showed signs of difficult or sluggish operation. In addition, the manual stated that under ordinary circumstances, the life of the grease in sealed bearings should be at least 10 years and that if oxidation of the lubricant made the bearing sluggish, the bearing must be replaced. The EED preventive maintenance program and procedures for breakers did not include routine replacement of worn out breaker parts. In addition, the EED maintenance procedures did not instruct maintenance personnel to disassemble sluggish operating mechanisms to check for degraded bearings, nor did the procedures specify the appropriate lubricants for the various parts of the breaker.

On June 12, 2002, with DC Cook Unit 1 at approximately 68% power and Unit 2 at 100% power, an emergency alert condition was entered after a catastrophic failure and resultant fire of a current transformer for the 345 kV switchyard L breaker. The catastrophic failure of the current transformer and the subsequent switchyard switching actions resulted in the loss of the preferred offsite power source to Units 1 and 2. On June 19, 2002, the NRC special inspection team reviewed the licensee's preventive maintenance program for 345 kV switchyard current transformers. The vendor's preventive maintenance recommendations included annual inspections and transformer oil analysis every 2 years. The inspection team reviewed historical maintenance activities on the L breaker current transformers and determined that preventive maintenance activities were last done in October 1998. The periodicity of preventive maintenance activities was consistent with American Electric Power (AEP) system guidelines, but not with the vendor's recommendations. Additionally, the licensee did not periodically perform several vendor-recommended tests, including tests of oil dielectric strength and oil acid factor, and a measurement of the resistance of the current transformer primary (to compare with the results in the test report). During followup discussions, licensee personnel stated that the types of testing performed and the testing frequencies were based on AEP system operating experience rather than vendor recommendations. Licensee personnel were unable to readily provide specific operating experience data that justified the 4-year preventive maintenance testing frequency. Licensee personnel subsequently determined that there were approximately one hundred twenty six 345 kV current transformers in the AEP system similar in design to the transformers located in the DC Cook 345 kV switchyard. Since 1990, there have been two catastrophic failures (both associated with the D. C. Cook 345 kV switchyard L breaker). No current transformers of this type had been removed from service based on preventive maintenance testing.

Following the June 12, 2002, current transformer failure, AEP collected oil samples from the D.C. Cook 345 kV switchyard breaker current transformers for analysis. The oil analyses were completed 3 months before the normal schedule as part of the licensee's extent-of-condition evaluation. During the oil sampling, AEP personnel discovered that two current transformers for N1 switchyard breaker were last sampled in September 1998, with gas analyses results significantly above the acceptable level. Based on this result, licensee replaced the N1 breaker current transformers and returned the breaker to service on June 29, 2002. The AEP system operating experience data did not justify a less frequent analysis than recommended by the vendor.

DISCUSSION

The discrepancies, between the licensee's maintenance practices for switchyard breaker and current transformers and the vendor recommendations, contributed to the inadvertent switchyard breaker trips that resulted in a plant trip and loss of offsite power (LOOP) to safety busses. Unnecessary plant trips and LOOP events could be reduced by following vendor recommendations with feedback from operating experience to determine the appropriate schedule and extent of maintenance.

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 Office of Nuclear Reactor Regulation (NRR) project manager.

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Note: NRC generic communications may be found on the NRC public Website, http://www.nrc.gov, under Electronic Reading Room/Document Collections.

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