

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

December 26, 2006

NRC INFORMATION NOTICE 2006-31: INADEQUATE FAULT INTERRUPTING RATING
OF BREAKERS

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 to inform addressees about the concerns associated with inadequate fault interrupting rating of breakers at Point Beach Nuclear Plant (PBNP) and D.C. Cook nuclear plants. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar concerns. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

DESCRIPTION OF CIRCUMSTANCES

In the Event Notification (EN) 42020 dated September 27, 2005, the Nuclear Management Company (NMC) identified that, in the electrical distribution system of its PBNP, the postulated three-phase fault currents exceed the maximum listed interrupting rating of circuit breakers and associated bus bar bracing rating at some of the 13.8 kV, 4.16 kV, and 480 V switchgear (includes power panels, motor control centers etc.). Relating to this EN, NMC also issued a licensee event report (LER) # 266/2005-005 dated November 18, 2005, which described the condition as Operable but potentially Nonconforming with respect to Title 10 of the *Code of Federal Regulations* (10 CFR) Appendix R requirements. Inadequate capacity of 4.16 kV breakers/switchgear to withstand three-phase bolted fault was also reported at the D.C. Cook Nuclear Plant in the NRC Inspection Report 50-315/316/01-19 (Agencywide Documents Access and Management System (ADAMS) Accession No.: ML020230387).

DISCUSSION

LER # 266/2005-005 referred to LER # 266/97-032, dated July 30, 1997, which described the underlying condition and stated the issue's identification in 1993. The short circuit current calculation in 1993 concluded that under specified plant conditions, at certain 480 V, 4.16kV, and 13.8 kV switchgear buses, the postulated bolted three-phase symmetrical fault currents may be higher than the capability of the equipment involved. The root cause of the problem was the design of the switchgear based on initial short circuit calculations which did not take into account the contributions of the motor currents. In general, if a fault is considered

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downstream of a load breaker, on a given switchgear bus, the electrical motors fed from the same bus can contribute to the fault current significantly, typically six times the motor rated current; motors act as generators during the fault duration. Both safeguards and non-safeguards buses were potentially affected by this condition. However, based on the low probability for an actual "bolted fault," the judgment in 1993 was that actual cable impedance would limit any fault current to a value below the equipment rating.

In 2004, NMC performed a revision of the Short Circuit and Degraded Voltage Analysis for the PBNP. The results of the short circuit calculation reaffirmed that a large number of 13.8 kV, 4.16 kV, and 480 V switchgear had calculated short circuit currents greater than the equipment rating. The results did not meet the acceptance criteria described in the above analysis, which stated that "Electrical plant equipment shall be rated to withstand and properly interrupt the largest credible short circuit current available at the specified equipment location for licensed plant alignments." NMC implemented interim compensatory measures, such as twice-per-shift fire watches in applicable fire-zones. The long term measures, such as replacement of breakers, bracing of bus bars, transformer tap setting changes, etc., are also in progress. The 4.16 kV breakers are being replaced at D.C. Cook nuclear plant to resolve the issue of inadequate interrupting rating of breakers.

It is important that electrical switchgear is adequately rated not only for the normal operating current, but also able to safely interrupt a three-phase bolted fault, even though the probability of such a fault is very low. An inadequately rated breaker can fail or destroy itself in trying to open a three-phase bolted fault, resulting in a secondary fire at the switchgear. According to the NRC research report titled "Operating Experience Assessment, Energetic Faults in 4.16 kV to 13.8 kV Switchgear and Bus Ducts That Caused Fires in Nuclear Power Plants 1986-2001" (Agencywide Documents Access and Management System Accession No. ML021290358), the consequences of an electrical fire (especially at medium voltage) can be wide-ranging, with the potential to damage an entire line of switchgear. National Electric Code, Section 110-9 states, "Equipment intended to interrupt current at fault levels shall have an interrupting rating sufficient for the nominal circuit voltage and the current that is available at the line terminals of the equipment." In general, the industry practice has been to provide switchgear adequately rated to withstand and safely interrupt a three-phase bolted fault current. It is also important that voltage drop and short circuit calculations are updated after each significant electrical plant modification and the switchgear is adequately rated to withstand and safely interrupt an appropriate fault current.

RELEVANT GENERIC COMMUNICATIONS

Generic Letter 88-15, "Electric Power Systems - Inadequate Control Over Design Processes," also emphasized the issue of inadequate fault current interrupting capability of the breakers.

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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