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

September 15, 2009

NRC INFORMATION NOTICE 2009-16: SPURIOUS RELAY ACTUATIONS RESULT IN LOSS OF POWER TO SAFEGUARDS BUSES

ADDRESSEES

All holders of operating licenses or construction permits for nuclear power reactors under the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," except those that have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessels. All holders of and applicants for combined licenses under the provisions of 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants."

PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to alert addressees of an event at Point Beach Nuclear Plant (PBNP) in which spurious relay actuation resulted in the loss of offsite power to a safety-related 480 Volts alternating current (Vac) safeguards bus for more than 6 hours. The NRC expects that recipients to 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

On January 15, 2008, PBNP Unit 1 experienced a loss of power to the safety-related train B 480 Vac safeguards bus which was followed by a lockout and loss of the 13.8 kilovolt alternating current (kV)/4.16 kV transformer that supplies offsite power to both safety-related 4.16 kV safeguards buses. This electrical isolation resulted in the licensee declaring an Unusual Event, and a plant shutdown required by technical specifications (TSs).

The event was caused by a spurious relay actuation when deterioration of insulation on a submerged electrical supply cable from the 13.8 kV/4.16 kV transformer to a non-safety-related bus resulted in repeated cable groundings. The repeated groundings caused high-frequency current transients to propagate through circuits on the low side of the transformer which spuriously actuated a ground fault protection relay (50G) tripping the supply breaker to the train B 480 V safeguards bus. Twenty-four seconds later, a lockout and loss of the 13.8 kV/4.16 kV transformer occurred.

The licensee concluded in its root cause evaluation that the length of the cables (5,010 feet) associated with the supply breaker for the train B 480 Vac safeguards bus was a significant

factor in the spurious actuation of the 50G relay. Specifically, the potential for high-frequency currents to adversely affect the 50G relay increases as the length of the conductors increase. Based on its analysis of cable lengths, numbers of conductors per phase, and pickup setpoint, the licensee found that the 50G relay of this breaker was particularly susceptible to this potential actuation mechanism.

In 1995, the licensee for PBNP completed a significant modification to the PBNP 4.16 kV electrical distribution system that included the installation of six Asea Brown Boveri (ABB) 50G relays. The other 4.16 kV breaker ground fault relays at PBNP are Westinghouse 50G relays with an average of 364 feet of supply cables. As such, the licensee concluded that the likelihood of developing similar undesired high frequency currents in the Westinghouse 50G relays was very low. The Westinghouse 50G relays are also considered immune to high-frequency signal interference due to basic internal design differences.

The 50G relay that actuated during this event was removed and sent to a laboratory for additional testing. This testing confirmed that the relay was particularly responsive to high-frequency primary currents. The relay was found to actuate on a primary current spike that lasted less than the time delay setting. Therefore, if the high frequency current pulse was of sufficient magnitude, the relay would spuriously actuate before the time delay setpoint.

As a result of the evaluation, the licensee implemented corrective actions to increase the primary current pickup setpoint of the subject 50G relay from 10 Amperes (Amps) to 30 Amps in order to provide additional margin to prevent premature tripping. Additionally, the licensee changed the time delay setpoint from 0.1 seconds to 0.3 seconds to also decrease the probability of spurious relay actuation. The licensee planned to change the setpoint of all six ABB 50G relays in the same manner.

Additional information is available in NRC Special Inspection Report 05000266/2008007 and 05000301/2008007, dated April 21, 2008, available on the NRC's public Web site in the Agencywide Documents Access and Management System (ADAMS), under Accession No. ML081130194. This event is also discussed in PBNP Licensee Event Report 50-266/2008-001, dated March 14, 2008, which can be found in ADAMS under Accession No. ML080770186.

BACKGROUND

This IN focuses on the safety issues related to relay setpoints and actuations. The NRC addressed safety issues related to submerged electrical cables in Generic Letter 2007-01, "Inaccessible or Underground Power Cable Failures that Disable Accident Mitigation Systems or Cause Plant Transients," dated February 7, 2007, available on the NRC's public Web site at http://www.nrc.gov/reading-rm/doc-collections/gen-comm/gen-letters/2007/gl200701.pdf.

Previously issued INs related to relays include the following:

- NRC IN 2008-12, "Braidwood Unit 1 Reactor Trip due to Offsite Power Fluctuation," dated July 7, 2008

- NRC IN 2007-14, "Loss of Offsite Power and Dual-Unit Trip at Catawba Nuclear Generating Station," dated March 30, 2007

- NRC IN 2005-15, "Three-Unit Trip and Loss of Offsite Power at Palo Verde Nuclear Generating Station," dated June 1, 2005

DISCUSSION

Licensees rely on electrical circuit breakers and their associated relays operating at the correct setpoints to satisfy TSs related to electrical power and the operability of TS-required equipment. Licensees must consider the design of circuits when determining setpoints at which the relays will actuate their associated circuit breakers to ensure that power is not unnecessarily interrupted to safety-related equipment. Because licensees often use relays and circuit breakers of the same type and manufacturers in redundant trains of safety systems, certain relay and breaker problems raise the possibility of a common-mode failure.

CONTACT

This IN requires no specific action or written response. Please direct any questions about this matter to the technical contacts listed below or to 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 Web site, http://www.nrc.gov, under Electronic Reading Room/Document Collections.

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