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O-P1-17

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

September 18, 1998

NRC INFORMATION NOTICE 98-36: INADEQUATE OR POORLY CONTROLLED, NON-SAFETY-RELATED MAINTENANCE ACTIVITIES UNNECESSARILY CHALLENGED SAFETY SYSTEMS

Addressees

All holders of operating licenses for nuclear power reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to alert addressees to several recent events in which inadequate or poorly controlled, non-safety-related maintenance activities resulted in unnecessary challenges to safety systems. It is expected that recipients will review the information for applicability to their facilities and consider action, 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

BRAIDWOOD UNIT 2

On January 18, 1996, with Braidwood Unit 2 operating at full power, offsite power was lost. Inadequately secured roofing repair materials located on the roof of the adjacent service building were blown off the roof during a rain storm, causing a phase-to-ground arc on one of two station auxiliary transformers (SATs). As designed, the second SAT tripped when the first SAT failed. Both emergency diesel generators (EDGs) automatically started and all safe-shutdown loads automatically sequenced on to the engineered safety feature (ESF) buses. All automatic bus transfers occurred as designed, maintaining power to non-ESF buses from the unit auxiliary transformers (UATs). The reactor remained stable at full power throughout the event. To restore offsite power to Unit 2, the licensee cross-tied both Unit 2 ESF buses to the respective ESF buses of Unit 1, which also remained at full power throughout the event.

Inspection of the faulted SAT revealed damage to (1) the Phase B and C bushings and (2) a gas detector relay on top of the transformer where heavy arcing occurred. The licensee determined that the initiating event was a Phase C arc-to-ground, followed by a Phase B to

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Phase C arc. A 345-kilovolt switchyard breaker, which connected the SAT to the switchyard ring bus, was also damaged. Approximately one square foot of the Phase B bushing was blown out.

BYRON UNIT 1

On May 23, 1996, with the Unit 1 reactor shut down in excess of a month for a refueling outage, offsite power was lost when one of the two Unit 1 SATs isolated because of a Phase A to Phase B current differential relay operation. The second SAT tripped as designed when the first SAT failed. Both EDGs automatically started and all safe-shutdown loads automatically sequenced on to the ESF buses. Because the reactor was shut down, power to non-ESF buses was lost and two service water pumps and a station air compressor common to both Byron units tripped. Without the service water pumps, Unit 2, which was operating at full power, had no cooling water to many loads, including the main generator auxiliaries, station air compressors, condensate pumps, and condensate booster pumps. Subsequently, Unit 2 was manually tripped.

The licensee determined that the SAT that initially tripped underwent a phase-to-ground fault on a Phase B insulator. The failed insulator was located outdoors, about halfway between the SAT and the auxiliary building. After initiating, the arc continued down the bus bar, increasing in width until it involved the other two phases. Air and water present in the bus bar duct was heated by the arc and resulted in pressurization of the duct.

Chronic water leakage through inadequately caulked insulator mounting holes and through an improperly compressed gasket caused degradation of the insulator metal inserts and insulator material between these inserts. Eventually, the bus flashed to ground through the degraded insulator and initiated the transient.

PERRY

On June 5, 1997, Perry was operating at full power when an automatic reactor scram occurred following a three-phase fault in one of two high-voltage secondary winding termination compartments of the UAT. The fault resulted in the actuation of the auxiliary transformer phase differential relay, a main generator lockout, a main turbine trip, and fast closure of the turbine control valves.

At the time of the transient, safety-related electrical loads were being supplied by the in-service startup transformer. The non-safety-related electrical loads supplied by the transformer automatically transferred to the startup transformer except for the bus that was faulted. Operators stabilized the plant without major complication.

The licensee determined that the fault had developed as a result of an accumulation of moisture and dust that had entered the termination compartment housing where a 2-inch-long piece of gasket material was missing from the compartment housing-to-transformer sealing surface. The missing piece of gasket material may have been lost during work performed when

replacing the auxiliary transformer following failure of the transformer on May 30, 1996. The cause of that failure was attributed to inadequate original design or poor assembly practices or both.

POINT BEACH UNIT I

During a severe storm on January 8, 1998, a ground in the low-voltage-side bus duct caused the failure of the Unit 1 SAT. This failure and a failure of the 13.8-kilovolt automatic bus transfer to the Unit 2 SAT resulted in the loss of normal power to the Unit 1 safeguards buses. The EDGs subsequently started and restored power to the buses. Unit 1 remained at 98 percent power throughout the transient. Unit 2 was in cold shutdown.

The licensee attributed the failure of the transformer to the buildup of condensation internal to the buses and long-term insulation degradation in the bus duct on the low-voltage side of the transformer. Before the transformer failed, the circuit breaker for a heater designed to keep the bus duct dry would not remain closed. Consequently, in August 1996, the licensee left the circuit breaker open and wrote a work order for its repair. However, work schedulers did not recognize that the bus duct heater was inoperable with the circuit breaker open, and the work order was erroneously classified as "minor maintenance" and given low priority. At the time the transformer failed, the work order was in the "backlog" of maintenance items. In addition to the inoperable heater, the licensee determined that the lack of a routine inspection program for the bus ducts may have contributed to the event. Inspection of the bus ducts after the transformer failed revealed insulation breakdown that would likely have been identified through a periodic inspection program.

Discussion

These events illustrate the potentially significant consequences of inadequate or poorly performed maintenance activities on non-safety-related plant components. Unnecessary challenges to plant safety systems or control room operators or both could result from inadequate control or inattention to detail during non-safety-related maintenance activities. The potential impact on safety systems of such activities as the re-roofing of nuclear power plant support buildings, the installation of gaskets, or the caulking of outdoor components, could easily be overlooked. In addition, several of the events discussed here highlight the need for licensees to have better control over the maintenance activities of contractor and non-station utility employees, and the need for thorough periodic walkdowns or preventive maintenance on auxiliary transformers and the associated outdoor bus ducts.

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This information notice requires no specific action or written response. However, recipients are reminded that they are required to consider industry-wide operating experience (including NRC INs) where practical, when setting goals and performing periodic evaluations under Section 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," of Part 50 of Title 10 of the Code of Federal Regulations. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

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for Jack W. Roe, Acting Director
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

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LIST OF RECENTLY ISSUED
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Information Notice No.	Subject	Date of Issuance	Issued to
98-35	Threat Assessments and Consideration of Heightened Physical Protection Measures	9/4/98	All U.S. NRC fuel cycle facilities power and non-power reactor licensees (Safeguard issues, not for public disclosure.)
98-34	NRC Configuration Control Errors	8/28/98	All holders of Operating licenses for nuclear power reactors, except for those who have ceased operations and have certified that fuel has been permanently removed from the reactor vessel
98-33	NRC Regulations Prohibit Agreements that restrict or Discourage an Employee from Participating in Protected Activities	8/28/98	All holders of a U.S. Nuclear Regulatory Commission (NRC) license.
98-32	Problems Associated with Post-Fire Safe-Shutdown Circuit Analyses	8/26/98	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 form the reactor
98-31	Fire Protection System Design Deficiencies and Common-Mode Flooding of Emergency Core Cooling System Rooms at Washington Nuclear Project Unit 2	8/26/98	All holders of operating licences for nuclear power reactors, except those licensees that have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

OL = Operating License

CP = Construction Permit

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