UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS
WASHINGTON, DC 20555-0001

July 7, 2009

NRC INFORMATION NOTICE 2009-10: TRANSFORMER FAILURES—RECENT OPERATING EXPERIENCE

ADDRESSEES

All holders of operating licenses 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 who have ceased operations and have certified that fuel has been permanently removed from the reactor vessel. All holders of licenses or certificates of fuel cycle facilities. All holders of and applicants for nuclear power plant construction permits under the provisions of 10 CFR Part 50. All holders of licenses or certificates for fuel cycle facilities.

PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to inform addressees of recent operating experience involving failures of large transformers. The NRC expects 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 IN are not NRC requirements; therefore, no specific action or written response is required.

DESCRIPTION OF CIRCUMSTANCES

For several years, available industry operating experience has indicated an increasing trend in transformer failures, and has provided recommendations to reduce the chances of failure. Improved preventive maintenance and monitoring practices have helped to identify some problems before they developed to the point of failure, but the number of large transformers events has not decreased and in fact continues to rise. The following are relatively recent examples involving main power transformers:

- Indian Point, Unit 3—On April 6, 2007, while operating at 92-percent power, a fault occurred on the No. 31 main transformer resulting in an automatic reactor trip and transformer fire. Licensee Event Report (LER) 50-286/2007-002, which can be found on the NRC's public Web site using Agencywide Documents Access and Management System (ADAMS) Accession No. ML071620122, provides additional information.

- River Bend Station—On May 4, 2007, an unplanned manual reactor scram was initiated following the loss of cooling on the No. 2 main transformer (see LER 50-458/2007-002, ADAMS Accession No. ML071840161, for more information).

- Grand Gulf Nuclear Station—On January 12, 2008, a manual reactor scram was initiated following a loss of cooling to the main transformers (see LER 50-416/2008-001, ADAMS Accession No. ML080700702, for more information).

- Limerick Generating Station, Unit 2—On February 1, 2008, a low voltage bushing connection failed on the 2A main transformer resulting in a turbine trip and reactor scram.

- Diablo Canyon, Unit 2—On August 16, 2008, an automatic reactor trip occurred resulting from the failure of the main electrical transformer C phase. Plant operators subsequently declared a Notification of Unusual Event due to an observed fire at the C phase transformer (see LER 50-323/2008-001, ADAMS Accession No. ML082970221, for more information).

- North Anna, Unit 2—On October 29, 2008, while attempting to place the unit on line, the turbine tripped on a generator lockout relay actuation. The C main transformer was discovered to be spraying oil.

- Oyster Creek—On November 28, 2008, an electrical fault internal to the M1A main transformer led to an automatic reactor scram due to load reject. The transformer was replaced with the spare, and on February 1, 2009, this transformer failed due to a bushing failure, resulting in a reactor scram, fire, and declaration of a Notification of Unusual Event (see LER 50-219/2008-001, ADAMS Accession No. ML090260082, and LER 50-219/2009-001, ADAMS Accession No. ML090970735 for more information).

A review of licensees' root cause evaluations for the large transformer failures shows that the events are often the result of ineffective implementation of the transformer maintenance program.

DISCUSSION

The events described above illustrate instances in which the loss or tripping of large transformers resulted in plant transients, reactor trips, unnecessary starting of the emergency diesel generators (EDGs), and declaration of plant events. Transformer failures have resulted in eight declared plant events from January, 2007, to February, 2009, making them the second leading reason for such declarations. While the large transformers discussed in this IN are generally non-safety related, they are within the scope of the Maintenance Rule (Title 10 of the *Code of Federal Regulations,* Section 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants").

A relatively high incidence of transformer failures has occurred in the last few years, the majority of which could have been avoided had the licensee fully evaluated and effectively implemented corrective actions and recommendations identified in industry operating experience. These corrective actions included a more effective maintenance program and a more proactive approach to addressing abnormal indications. In particular, some utilities have installed online automated oil analysis and monitoring system to support decisions regarding preventive and corrective maintenance to improve transformer reliability. The Institute of Electrical and Electronics Engineers (IEEE) provides industry guidance on this matter in Standard C57.140-2006, "IEEE Guide for the Evaluation and Reconditioning of Liquid Immersed Power Transformers." However, it should be noted that the NRC has not endorsed this document, and the recommendations it contains do not constitute NRC requirements.

CONTACT

This IN requires no specific action or written response. Please direct any questions about this matter to the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

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