

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

September 16, 2014

NRC INFORMATION NOTICE 2014-10: POTENTIAL CIRCUIT FAILURE-INDUCED
SECONDARY FIRES OR EQUIPMENT DAMAGE

ADDRESSEES

All holders of an operating license or construction permit for a nuclear power reactor under 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 vessel.

All holders of and applicants for a power reactor combined license, standard design approval, or manufacturing license under 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants." All applicants for a standard design certification, including such applicants after initial issuance of a design certification rule.

PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to inform addressees of recent operating experience related to a potential for circuit failure-induced secondary fire events or equipment damage. The NRC expects that recipients will review the information for applicability to their facilities and consider actions, as appropriate. Suggestions contained in this IN are not NRC requirements; therefore, no specific action or written response is required.

DESCRIPTION OF CIRCUMSTANCES

This section describes events caused by a possible unanalyzed condition involving a potential for circuit failure-induced secondary fire events or equipment damage. This unanalyzed condition has been reported in event notifications (ENs) and licensee event reports (LERs) to the NRC. Three examples are discussed below.

Browns Ferry Nuclear Plant

On October 15, 2011, the Browns Ferry Nuclear (BFN) Plant reported this issue via EN 47374 and subsequently on December 27, 2011, per BFN LER 2011-010 "DC Ammeter Cables Not Adequately Isolated" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12003A256). The LER documents that during reviews to transition to the National Fire Protection Association (NFPA) Standard 805, "Performance-Based Standard for

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Fire Protection for Light-Water Reactor Electric Generating Plants" (NFPA 805), the licensee identified that the ammeters located in the main control room (MCR) for Battery Boards 1, 2, and 3 were electrically connected to the safety-related 250-volt dc bus at the battery boards without electrical isolation. This condition may have the potential to cause secondary fires if two ungrounded common power supply circuit faults occur during a fire that impacts the ammeter.

This condition impacted all three nuclear units, as the electrical isolation requirements for the MCR ammeters were not maintained. This constituted a fire protection program deficiency that could adversely affect the ability to achieve and maintain safe shutdown of the plant in the unlikely event of a MCR fire. At the time of discovery, fire watches were already in place and will remain in place until the identified condition is resolved. Corrective actions included the addition of fuses to the ammeter circuits.

Clinton Power Station

During a Clinton Power Station (CPS) review of the event notification at the BFN Plant (EN 47374), CPS determined that the original plant design for the station battery ammeter circuits contains a shunt in the current flow from each station battery. Attached to the shunt bar are two leads to an ammeter in the MCR. The ammeter circuits attached to the shunt does not have fuses, and if one of the ammeter circuits shorts to ground due to a fire at the same time another dc circuit from the opposite polarity on the same battery also shorts to ground, a ground loop through the unfused ammeter circuit could occur. The circuit was bounded by testing showing that self-ignition of a secondary fire was not possible. However, the potential exists that overloaded ammeter circuit could result in thermal damage to safe shutdown circuits in direct physical contact with the ammeter circuit, resulting in a loss of the associated safe shutdown function or capability. CPS reported this information to the NRC on January 27, 2012, in LER 2011-007-00 (ADAMS Accession No. ML12053A099).

Nine Mile Point Nuclear Station, Unit 1

During a review of industry operating experience regarding the potential for secondary fires being caused by dc motor control circuits, Nine Mile Point Nuclear Station determined that the described condition could be applicable to Nine Mile Point, Unit 1. This resulted in a potentially unanalyzed condition with respect to 10 CFR Part 50, Appendix R analysis requirements. The original plant design and configuration for a containment isolation valve included only over current protection for the power circuits. There was no separate, properly-sized fuse protection for the control circuits. The only protection for the control circuits was provided by the power circuit fuses.

In the postulated event, a fire in the reactor building at the dc motor operated valve could cause one of the control circuits to short and potentially over heat since the current draw from the short circuit would not be large enough to open the power circuit fuse, creating the potential for a secondary fire in a different fire zone. The secondary fire could adversely affect safe shutdown equipment and potentially affect the ability to achieve safe shutdown as required by 10 CFR Part 50, Appendix R.

This event was entered into the Nine Mile Point corrective action program and reported via EN 50098 and subsequently on July 8, 2014, in LER 2014-002-00 "Unanalyzed Condition Due to Unfused Motor Operated Valve Control Circuit" (ADAMS Accession No. ML14205A279).

DISCUSSION

In the course of licensees performing self-assessments of their fire protection programs, several facilities have reported issues involving a potential for circuit failure-induced secondary fire events or thermal damage to equipment. In many cases, the issue is related to a lack of circuit isolation on ammeter circuits and, therefore, these circuits present a potential fire source in equipment if the ammeter circuit becomes grounded coincident with another circuit fault. In some other cases, the issue is related to a lack of circuit isolation for power and control circuits that can result in overheated cabling due to an electrical short and cause a secondary fire or thermal damage. In some cases, safety-related equipment could be impacted due to thermal damage. Note that there have been no fires reported to the NRC related to these issues. However, licensees are reporting the potential for this to occur and impact associated safe shutdown functions or capabilities.

Based on additional industry operating experience reviews, licensees have determined that unanalyzed conditions may exist with respect to their existing deterministic fire protection program requirements and analysis requirements involving dc ammeter circuits. Postulated events could cause an unfused dc ammeter circuit to be grounded. If the event also causes another dc circuit of the opposite polarity on the same component to become grounded, a ground loop through the unfused dc ammeter circuit could then exist. This ground loop could draw excessive current and the electrical conductor could overheat and damage adjacent cables, or may result in a secondary fire or damage depending on the cable size, insulation, and whether the type of cable would support self-ignition. NRC guidance contained in Generic Letter (GL) 81-12 - Fire Protection Rule (45 FR 76602, 11/19/80) concerning "associated circuits of common enclosures," aims to prevent secondary fires and equipment damage from adversely affecting safe shutdown. Licensee responses to GL 81-12 typically indicate that all circuits are provided with appropriately-sized circuit protection devices.

As noted in the LERs, compensatory measures (i.e., fire watches or other appropriate compensatory measures) for this type of issue were instituted for the affected areas of the plant. Some licensees have reported taking corrective actions for the circuits that might be susceptible to this unanalyzed condition in order to remove the possibility of grounded fault-induced damage in these circuits. At least one licensee's corrective actions included planned modifications to install fusing in the susceptible circuits to eliminate the potential for such events or damage.

Licensees are encouraged to review the information provided through this IN and review similar industry internal operating experience, as appropriate. Lessons learned during NFPA 805 transition evaluations may also be useful for other sites to consider. Licensee "extent of condition" reviews may be appropriate for other similar potential hot short concerns to help ensure plant safety.

CONTACT

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

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Note: NRC generic communications can be found on the NRC public Web site, <http://www.nrc.gov>, under Document Collections in the NRC Library.

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