

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

February 26, 2018

NRC INFORMATION NOTICE 2018-04: OPERATING EXPERIENCE REGARDING FAILURE
OF OPERATORS TO TRIP THE PLANT WHEN
EXPERIENCING UNSTABLE CONDITIONS

ADDRESSEES

All holders of an operating license for a non-power reactor (research reactor, test reactor, or critical assembly) under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," except those who have permanently ceased operations.

All holders of an operating license or construction permit for a nuclear power reactor under 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 combined license under 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 inform addressees of several reactor events during which operators failed to take timely action to place the plant in a stable condition. It is expected 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

Fermi, Unit 2

On March 19, 2015, Fermi, Unit 2 (Fermi) experienced a closed cooling water leak within primary containment, causing operators to trip one of the two reactor recirculation pumps. The resulting reactor conditions (45 percent recirculation flow, 61 percent reactor power) placed the plant in the "exit" region of the power-to-flow map. This required the licensee to place the plant in a more stable configuration (either by raising flow or lowering power) to avoid thermal-hydraulic instability (THI) and the oscillating flux distributions this can cause within the active fuel region. Control room operators entered the appropriate abnormal operating procedures (AOPs) for the plant conditions, but failed to prioritize the inserting of rods to quickly lower power during the trip of the recirculation pump. As the transient progressed, the expected loss of feedwater heating caused a 12 percent power increase over approximately a 10-minute

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period. This drove the reactor further into the "exit" region of the power-to-flow map, and while operators were initiating actions to insert control rods, two channels on the oscillation power range monitor (OPRM) system tripped, resulting in an automatic reactor scram.

When the OPRM system was first made operable at Fermi in May 2000, three AOPs were revised. These AOPs were "Loss of Feedwater Heating," "Recirculation Pump Trip," and "Jet Pump Failure." These revisions incorporated the functions of the OPRM system, but removed important control room operator actions from the procedures. In all cases, the requirement to monitor for THI through the selection of control rods was removed, as was the statement to place the reactor mode switch in "shutdown" if THI was observed. The bases for the procedure changes reflected the licensee's belief of the superior capability of the newly installed electronic OPRM system to detect and suppress neutron flux instability as compared to a human operator. The procedure changes during implementation of the OPRM system negatively impacted licensed operator training, which in turn affected the ability to maneuver the plant when confronted with plant conditions susceptible to THI. Post-trip review of operator actions during this event found a lack of timely operator response during power oscillations caused by THI.

Further details are available in Fermi Licensee Event Report 05000341/2015-003, dated May 5, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15127A176) and in NRC Integrated Inspection Report 05000341/2015003, dated November 5, 2015 (ADAMS Accession No. ML15309A680).

Grand Gulf Nuclear Station, Unit 1

On June 17, 2016, Grand Gulf Nuclear Station, Unit 1 (Grand Gulf) was operating at approximately 65 percent rated thermal power while performing surveillance testing on the turbine stop valves. With the "B" turbine stop valve shut as part of the surveillance procedure, the "D" turbine stop valve unexpectedly shut. While operators attempted to reset the "B" turbine stop valve, the "A" and "C" turbine control valves were challenged in their ability to provide the required control of turbine pressure and reactor pressure, resulting in oscillations of turbine pressure, and hence reactor pressure and reactor power. Control room operators, including managers in oversight roles, focused on the turbine control valve movements and possible recovery actions, and failed to appreciate the impact that the turbine control valve fluctuations and reset efforts were having on reactivity. Reactor power oscillations of 10–20 percent were seen over the course of the next 42 minutes, with a maximum recorded power of 87 percent before an automatic reactor scram occurred on an OPRM trip.

Operators had recently received training on the Fermi event discussed above. The training emphasized the need to scram the reactor in the event that THI resulted in reactor power oscillations. However, Grand Gulf lacked a procedure for responding to malfunctions of the reactor pressure control system, and after verifying that the power oscillations they were seeing were not the result of THI, the operators concluded that the guidance to insert a manual scram did not apply.

Following the event, the licensee implemented a standing order that gave clear guidance on how to address issues that cause oscillations and has since created an off-normal event procedure for reactor pressure control system malfunctions.

Further details on this event can be found in Grand Gulf Licensee Event Report 05000416/2016-004-00, dated August 12, 2016 (ADAMS Accession No. ML16225A724) and in

NRC Integrated Inspection Report 05000416/2016003, dated November 10, 2016 (ADAMS Accession No. ML16315A372).

Joseph M. Farley Nuclear Plant, Unit 1

On October 1, 2016, with the Joseph M. Farley Nuclear Plant, Unit 1 (Farley) operating at 99 percent power, operators in the control room received indications that the 1A steam generator main steam isolation valve (MSIV) had drifted off its backseat and was in an intermediate position, including a main control board annunciator for low air pressure for the valve. In accordance with the annunciator response procedure, operators attempted to recharge the accumulator by moving the switch for the valve to “open,” but the indications remained.

The next step of the procedure directed a manual reactor trip in order to reduce the challenge to the plant that would result from the MSIV failing shut. Instead, operators attempted to isolate the leaking test solenoid valve that was causing the loss of air pressure and restore the MSIV to the full open position. Prior to performing the test valve isolation, and 37 minutes after operators first received an alarm in the control room, the MSIV failed shut on loss of air pressure. This resulted in an automatic reactor trip and a safety injection on low steam line pressure (rate compensated) in the 1B and 1C steam lines, as expected for this event. Contrary to procedural requirements, licensed senior reactor operators decided to maintain the reactor online while attempting to isolate the leak. Had operators followed the procedure and manually tripped the reactor, they could possibly have prevented the safety injection.

To address the issue, the licensee conducted simulator training for all crews emphasizing procedure use and adherence standards, and took further steps to address gaps in operator performance.

Additional information appears in Farley Licensee Event Report 05000348/2016-002-00, dated November 30, 2016 (ADAMS Accession No. ML16335A450) and NRC Integrated Inspection Report 05000348/2016004 and 05000364/2016004, dated January 17, 2017 (ADAMS Accession No. ML17027A147).

DISCUSSION

Since the average nuclear power plant now spends over 90 percent of its time online, operators have less experience dealing with transients, startup, and shutdown operations than in the past. This places increased emphasis on the importance of complete and accurate procedures to guide operators through unfamiliar situations. Regulations in 10 CFR 50 Appendix B, Criterion V, “Instructions, Procedures, and Drawings,” as well as individual plant technical specifications, require licensees to maintain and adhere to quality procedures for activities affecting safety. Regulatory Guide 1.33, “Quality Assurance Program Requirements (Operation),” provides a comprehensive list of systems, situations, and processes that might require quality procedures, as specified by the individual plant licensing basis. However, emergency operating procedures are symptom-driven and are not intended to cover every possible contingency. Regulatory requirements for licensee training programs are structured to ensure that operators have a thorough understanding of integrated plant operations and system interactions so that they can respond appropriately to events not anticipated by procedures to place the plant in a safe condition.

The events discussed in this IN involved operators misinterpreting procedures, failing to adhere to procedure requirements, or failing to recognize incomplete or faulty procedures. In each case, the failure to maintain a conservative bias in the decision-making process left the reactor in an unstable condition for extended periods of time before automatic protective features actuated, increasing the probability that a more significant event could occur. Industry operating experience has shown the importance of diverse simulator scenarios that accurately represent plant response while incorporating complex system interactions. By stressing procedure adherence and challenging critical thinking skills, these scenarios can improve operator understanding of event consequences and the actions necessary to mitigate those consequences.

CONTACT

This information notice 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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Note: NRC generic communications may be found on the NRC public Web site, <https://www.nrc.gov>, under NRC Library.

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*via email

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