

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

October 8, 2019

NRC INFORMATION NOTICE 2019-08: FLOW-ACCELERATED CORROSION EVENTS

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 in which flow-accelerated corrosion (FAC) events resulted in reactor trips. The NRC expects that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. INs may not impose new requirements, and nothing in this IN should be interpreted to require specific action.

DESCRIPTION OF CIRCUMSTANCES

Indian Point Energy Center, Unit 3

On September 18, 2018, while in Mode 1 at 100 percent reactor power, operators at Indian Point Unit 3 manually tripped the reactor and closed all main steam isolation valves in response to a steam leak on a 6-inch elbow located upstream of the 36C feedwater heater. The direct cause of the steam leak was FAC. The root cause was attributed to the program engineers not using the replacement history to identify susceptibility to FAC, as components on this line had been replaced in 2007 because of previous failures. Contributing causes included weaknesses in the setup of the FAC program software model and inadequate procedure guidance for scope expansion from the 2007 failure. Corrective actions included replacing the failed component, revising the model to split the reheater drain branches into three separate runs with one run per heater, and revising procedures on scope expansion and system replacement history.

Additional information appears in "Indian Point – Integrated Inspection Report 05000247/2018004 and 05000286/2018004," dated February 7, 2019, on the NRC's public website in the Agencywide Documents Access and Management System (ADAMS) Accession No. ML19038A398, "Indian Point – Integrated Inspection Report 05000247/2019002 and

ML19065A123

05000286/2019002,” dated August 13, 2019 (ADAMS Accession No. ML19225C606), and Indian Point Licensee Event Report 50-286/2018-003-00, dated November 19, 2018 (ADAMS Accession No. ML18341A122).

Davis-Besse Nuclear Power Station

On May 9, 2015, while in Mode 1 at 100 percent reactor power, field operators at Davis-Besse reported a steam leak on a 4-inch pipe in the moisture separator reheater system. After initiating a rapid shutdown, the operators manually tripped the reactor from approximately 30 percent power. The direct cause of the steam leak was FAC. An incorrect data input caused the FAC software model to underestimate the predicted wear rate, so inspections had not been performed to identify the wall thinning before failure. Additionally, corrective action from a comparable event in 2006 did not include a validation of all critical data inputs. Corrective actions from the more recent event included improvements in the fidelity of the data in the FAC software model and improvements in the corrective action program with respect to root cause evaluations.

Additional information appears in “Davis-Besse—NRC Integrated Inspection Report 05000346/2015003,” dated October 21, 2015 (ADAMS Accession No. ML15295A107), and Davis-Besse Licensee Event Report 50-346/2015-002, dated July 8, 2015 (ADAMS Accession No. ML15194A013).

BACKGROUND

Related NRC Generic Communications

NRC Bulletin 87-01, “Thinning of Pipe Walls in Nuclear Power Plants,” dated July 9, 1987, requested addressees to submit information on their programs for monitoring the thickness of pipe walls in high-energy single-phase and two-phase carbon steel piping systems.

NRC Generic Letter 89-08, “Erosion/Corrosion-Induced Pipe Wall Thinning,” dated May 2, 1989, required addressees to provide assurances that they have implemented a program consisting of systematic measures to ensure that erosion/corrosion does not lead to degradation of single-phase and two-phase high-energy carbon steel systems.

DISCUSSION

These events demonstrate the importance of adequately implementing a FAC program, as both events resulted in reactor trips. While neither of these events caused personnel injury, workers have been seriously injured or killed in previous events because of failures resulting from FAC. In 1986, four workers died at Surry Power Station after a catastrophic failure of a pipe because of FAC. This event prompted the NRC to issue Bulletin 87-01, which requested the implementation of a program for monitoring the wall thickness of piping at each site.

It is important to apply appropriate engineering judgement and not to place overreliance on the FAC program software model. Correctly inputting data into the model ensures accurate modeling and consequential accurate wear rate prediction. Different inputs include, but are not limited to, diameter, geometry, chemistry, thermodynamic properties, and material content. For example, if an incorrect diameter is used, or if the presence of trace chromium is inputted when it is not present, then nonconservative wear rates may be predicted. As such, addressees may consider performing periodic verifications and validations of the model, in accordance with an

approved QC/QC program, and of the assumptions made to the initial setup and updates to the model.

CONTACTS

Please direct any questions about this matter to the technical contacts listed below.

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NRC INFORMATION NOTICE 2019-08, "OPERATING EXPERIENCE REGARDING
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***concurring via email**

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