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

July 2, 1992

NRC INFORMATION NOTICE 92-49: RECENT LOSS OR SEVERE DEGRADATION OF
SERVICE WATER SYSTEMS

Addressees

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to recent operating experience problems involving the loss or potential loss of safety-related heat transfer capability in service water systems. 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 information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

Nine Mile Point, Unit 1, February 21, 1992. When performing post-maintenance testing while the reactor was shut down, the licensee, Niagara Mohawk Power Corporation, inadvertently isolated the ultimate heat sink by closing all gates to the SWS inlet bay. Because one SWS pump and two circulating water pumps were running, the water level in the bay rapidly decreased. For about 6 minutes, the level was below that assumed in the licensing basis and below the minimum level necessary to maintain net positive suction head for any of the SWS pumps in the bay. The running SWS pump cavitated; the licensee started the emergency SWS pump as required by procedures, but then had to stop it because of low discharge pressure (NRC Augmented Inspection Team (AIT) Report 50-220/92-80).

The licensee had aligned the gates in the intake SWS bay in an off-normal configuration for reverse flow to allow post-maintenance testing of the gate D opening circuit. The licensee uses the reverse flow configuration to prevent icing during winter months. The maintenance included the removal of an undocumented electrical jumper used to bypass the mechanical tension overload protection switch in the drive motor circuit. The licensee did not know if the gate could be opened or closed during reverse flow operation with the jumper removed. After closing the gate, the licensee could not then reopen it. Within 2-3 minutes the level decreased to a point where neither the normal SWS pumps nor the emergency SWS pumps could maintain adequate suction.

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The licensee promptly opened gate D by jumpering the tension overload switch and also opened one of the normal lineup inlet gates. The gates take about 5 minutes to fully open. The intake bay level returned to normal within 6 minutes and both emergency SWS pumps were successfully started within another 3 minutes.

The AIT concluded that the root causes of this event were: the failure to follow the established work control process, inadequate management oversight, inadequate communications within and among organizations participating in the work activities, and an insensitivity to shutdown risk among multiple licensee organizations.

Arkansas Nuclear One, Unit 2, April 16, 1991. The licensee, Arkansas Power and Light Company, declared both loops of the safety-related SWS inoperable with the reactor in startup conditions. Debris from the lake, the normal supply of cooling water, had bypassed the screens at the pump suction and clogged the pump discharge strainers of both operating loops. Fortunately, the standby SWS pump was not operating at the time and its discharge strainer remained free of debris. The licensee switched the suction of the standby SWS pump to its emergency source and started the pump within about 3 minutes. The licensee restored the clogged loops to operable status within about 2 hours (LER 50-368/91-12).

The loss of both SWS trains meant that cooling was not available to engineered safety features equipment and component cooling water heat exchangers, which cool systems carrying fluids that may be radioactive. This condition resulted when maintenance personnel performed sections of the procedure for rotating the traveling screens out of sequence and, thus, allowed screen rotation without wash water flow. Consequently, the flow of debris bypassed the traveling screens and entered the suction of the two operating SW pumps. Had the standby SW pump discharge strainer become clogged, the event would have been much more severe.

Ineffective communication between operations and maintenance personnel prevented a complete understanding of the operation in progress at the time. The licensee took steps to strengthen management control and the training of personnel in this procedure and in communications.

Fitzpatrick, October 19, 1990. The licensee, Power Authority of the State of New York, manually scrammed the reactor from 45 percent of full power because the fouling rate for the circulating water traveling screens exceeded the cleaning rate of the screen wash system. A shift in wind direction contributed to an unusually large debris accumulation on the screens. Shear pins on the two operating screens failed. As the screens bowed inward because of the high differential pressure, some of the debris floated around the screens. The licensee scrammed the reactor to mitigate this degrading condition (LER 50-333/90-23).

In this event, while performing maintenance on one of the traveling screens, personnel unintentionally disabled the screen differential pressure alarm system, which would have provided early indication of fouling. The licensee determined the root cause of the event to be that the applicable operating and

maintenance procedures did not specify the need to isolate the differential pressure instrument system from only the specific intake bay that is drained.

Millstone Unit 1, October 4, 1990. The licensee, Northeast Nuclear Energy Company, manually tripped the reactor from 45 percent of full power because of circulating water system and service water system fouling that resulted in degraded SWS cooling, which resulted in increased containment temperature and pressure. Storm-induced high winds and seas caused an excessive amount of seaweed to accumulate on the traveling screens of the circulating water system. After first questioning the off scale indication of the differential pressure instruments, the licensee stopped two of the four operating circulating water pumps to relieve stress on the screens, but the relief was insufficient to prevent three of the five screens from collapsing. The two operating pumps reduced the water level in the intake structure bays, which caused the operating SWS pumps to cavitate. This condition decreased SWS pressure, degraded the performance of the reactor building closed cooling water heat exchanger, increased the containment temperature and pressure, and decreased the main condenser vacuum (LER 50-245/90-16).

The SWS provides cooling to the turbine and the reactor building closed cooling water heat exchangers and to the heat exchangers for the diesel generators. The emergency SWS provides long-term cooling to the suppression pool during a loss-of-coolant accident (LOCA). The licensee noted that the concurrent loss of these systems with a LOCA is outside the design basis for Millstone Unit 1.

The licensee concluded that if all the circulating water pumps had been tripped on increasing differential pressure, the three damaged screens might not have been breached, and SWS performance might not have been degraded. The licensee delayed its decision to trip circulating water pumps because control room personnel had not been informed that plant equipment operations personnel had disabled all the screens for manual cleaning. The control room personnel did not trip all circulating water pumps as required by the applicable operating procedure.

Discussion

"Operating Experience Feedback Report - Service Water System Failures and Degradations in Light Water Reactors," NUREG-1275, Volume 3, November 1988, summarized and discussed service water system (SWS) events from 1980 to early 1987. Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment," July 18, 1989, requested specific licensee actions to resolve SWS problems.

The Nine Mile Point Unit 1 event shows that personnel errors and failure to follow procedures can cause the safety-related SWS to become inoperable. The other 3 events are examples in which intake debris, caused by adverse environmental conditions, together with personnel errors, either caused or could have caused the safety-related SW system to become inoperable. All four events illustrate that recovery strongly depends on human action, particularly with respect to following procedures and accurately communicating information.

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This information notice requires no specific action or written response. 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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Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
92-48	Failure of Exide Batteries	07/02/92	All holders of OLs or CPs for nuclear power reactors.
92-47	Intentional Bypassing of Automatic Actuation of Plant Protective Features	06/29/92	All holders of OLs or CPs for nuclear power reactors.
92-46	Thermo-Lag Fire Barrier Material Special Review Team Final Report Findings, Current Fire Endurance Tests, and Ampacity Calculation Errors	06/23/92	All holders of OLs or CPs for nuclear power reactors.
92-45	Incorrect Relay Used in Emergency Diesel Generator Output Breaker Control Circuitry	06/22/92	All holders of OLs or CPs for nuclear power reactors.
92-44	Problems with Westinghouse DS-206 and DSL-206 Type Circuit Breakers	06/18/92	All holders of OLs or CPs for nuclear power reactors.
92-43	Defective Molded Phenolic Armature Carriers Found on Elmwood Contactors	06/09/92	All holders of OLs or CPs for nuclear power reactors.
92-42	Fraudulent Bolts in Seismically Designed Walls	06/01/92	All holders of OLs or CPs for nuclear power reactors.
92-41	Consideration of the Stem Rejection Load in Calculation of Required Valve Thrust	05/29/92	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit