

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555-0001

July 8, 1998

**NRC INFORMATION NOTICE 98-25: LOSS OF INVENTORY FROM SAFETY-RELATED,
CLOSED-LOOP COOLING WATER SYSTEMS**

Addressees

All holders of operating licenses for nuclear power reactors, except those licensees who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to potential inoperability of safety-related, closed-loop cooling water systems due to loss of inventory from excessive leakage combined with the absence of a reliable and timely annunciation and/or makeup system. 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

Palisades

On January 1, 1998, Palisades Nuclear Plant was operating at 100 percent power when a leak from the safety-related, closed-loop component cooling water (CCW) system at the 'A' radioactive waste evaporator distillate cooler increased from about 100 ml/min to about 757 l/min (200 gpm,) which was more than the makeup capacity to the CCW system. The leak emptied the CCW surge tank and resulted in a reduction in the normal CCW discharge header pressure from about 929 kPa (135 psia) to 777 kPa (113 psia). The licensee identified the source of the leak and isolated the applicable components within about 15 minutes. The licensee did not observe any abnormal component temperatures and did not identify any effect on the primary coolant pump seals. After isolating the leak, the operators refilled and vented the CCW system and returned it to service.

Calvert Cliffs 1

In September 1993, at Calvert Cliffs Nuclear Power Plant, Unit 1, a 91 l/min (24 gpm) leak occurred in the safety-related, closed-loop service water system. The flow path for the makeup system from the demineralized water and condensate systems is not seismically qualified and

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the transfer pumps are not powered from a Class 1E source. Therefore, the service water system could have been rendered inoperable in less than an hour in the event of a loss of offsite power or a seismic event based on the available volume in the surge tank.

Perry 1

On July 2, 1993, during a performance test at Perry Nuclear Power Plant, Unit 1, the licensee determined that inadequate procedural direction for setting motor-operated valve limit switches and mechanical stops resulted in a leak rate of 946 l/min (250 gpm) through the isolation valve between the non-safety-related and the safety-related portions of the emergency closed cooling water (ECCW) system. This leakage would have exceeded the seven-day, design basis inventory of the ECCW surge tank. In addition, under specific conditions (i.e., loss-of-offsite power concurrent with the single failure of the Division 2 diesel generator), both ECCW trains could have failed.

San Onofre 2

In March 1988, at the San Onofre Nuclear Generating Station, Unit 2, the licensee determined that the safety-related, closed-loop CCW system may have operated outside its design basis for leakage before a 1984 design modification. In 1983, the licensee realized that the original basis (CCW leakage of .537 l/min [.142 gpm]) for having only a non-safety-related and a non-seismically qualified makeup system could not be maintained. The licensee concluded that on the basis of the magnitude of the potential leakage, the ability to mitigate the consequences of postulated accidents could have been impaired.

Discussion

At most boiling-water and pressurized-water reactor plants, a safety-related, closed-loop cooling water system is provided to supply cooling water to safety-related components, including components that may carry radioactive or potentially radioactive fluids. This closed-loop cooling water system provides a monitored, intermediate barrier between the radioactive or potentially radioactive fluid and the environment. The closed-loop cooling water system usually transfers its heat to the ultimate heat sink through a safety-related open-loop cooling water system. In most cases, the safety-related, closed-loop cooling water systems are required to operate during normal, shutdown, and accident conditions.

Many of these closed-loop cooling water systems also have portions that are not safety related and not designed to seismic Category I requirements. A failure in these non-safety-related portions of the system during normal operation or as a result of a seismic event can lead to excessive loss of inventory from the safety-related portion of the system. Therefore, in addition to postulated leaks in the safety-related portions of the system, postulated leaks or breaks in the non-safety-related portions also have the potential to result in an excessive loss of inventory from the safety-related portions of the system.

An excessive loss of inventory from the closed-loop system, without makeup, could prevent it from performing its safety function and may result in the plant being outside its design basis. Components that could be adversely affected are plant dependent and could include the reactor

coolant pumps and seals, emergency core cooling system pumps, containment coolers, containment spray pumps, emergency diesel generators, safety-related room coolers, residual heat removal heat exchangers, suppression pool coolers, and other safety-related equipment.

The events previously discussed underscore the possibility that an excessive leakage from the safety-related, closed-loop cooling water system could render it inoperable under one of the following conditions:

1. Non-safety-related annunciation for low inventory failing to alert the operators.
2. Inadequate bases for low inventory alarm setpoint resulting in insufficient time for operator action.
3. Non-safety-related or non-seismically qualified makeup supply and inadequate bases for its startup setpoint with no procedures available for providing makeup from a seismic category I source.
4. Non-conservative assumptions about the leakage resulting in actual leakage that exceeds the makeup capacity.
5. Insufficient surge or makeup tank capacity to accommodate expected leakage from the system for an extended period (7 days recommended by Standard Review Plan Section 9.2.2, "Reactor Auxiliary Cooling Water Systems.")

Some of the actions taken by the above-mentioned licensees to address this issue are as follows:

At Palisades, the licensee reported that the low-level alarm setpoint was changed. The licensee also changed the makeup actuation setpoint to 41 percent. The licensee revised Off-Normal Procedures to include appropriate immediate actions. The licensee also performed a root cause analysis to determine the cause of the leak and conducted a programmatic review to prevent the system from leaking in the future.

At Calvert Cliffs, the licensee wrote procedures for a cross-connect path by way of hoses from the safety-related saltwater system to the service water system for extreme emergencies. In addition, precautionary limits have been incorporated into plant procedures to ensure that engineering and maintenance personnel are informed before leakage approaches the specified operability limit.

At Perry, the licensee readjusted the limit switches and mechanical stops for isolation valves. The licensee revised the applicable procedure to provide the requisite level of direction for setting limit/torque switches and adjusting mechanical stops.

At San Onofre, the licensee had already made a design modification in 1984 to add the capability of supplying makeup water from a seismically qualified source.

Related Generic Communications

NRC INFORMATION NOTICE 93-92: "PLANT IMPROVEMENTS TO MITIGATE COMMON DEPENDENCIES IN COMPONENT COOLING WATER SYSTEMS," dated December 7, 1993.

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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**LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES**

Information Notice No.	Subject	Date of Issuance	Issued to
98-24	Stem Binding in Turbine Governor Valves in Reactor Core Isolation Cooling (RCIC) and Auxiliary Feedwater (AFW) Systems	7/08/98	All holders of operating licenses for nuclear power reactors except those who have permanently ceased operation and have certified that fuel has been permanently removed from the reactor vessel
98-23	Crosby Relief Valve Setpoint Drift Problems Caused by Corrosion of the Guide Ring	6/26/98	All holders of operating licenses for pressurized water reactors (PWRs), except those licensees permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel
98-22	Deficiencies Identified During NRC Design Inspections	6/23/98	All holders of operating licenses for nuclear power reactors, except those licensees who have permanently ceased operations and have certified that fuel has been permanently removed from the vessel
98-21	Potential Deficiency of Electrical Cable/Connection Systems	6/4/98	All holders of operating licenses for nuclear power reactors, except those licensees who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

OL = Operating License
CP = Construction Permit

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