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Information Notice No. 93-92: Plant Improvements to Mitigate Common Dependencies in Component Cooling Water Systems

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

December 7, 1993

NRC INFORMATION NOTICE 93-92: PLANT IMPROVEMENTS TO MITIGATE COMMON
DEPENDENCIES IN COMPONENT COOLING 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 potential problems resulting from common dependencies in component cooling water (CCW) systems. Such dependencies on loss of the CCW system were found to be contributors to the core damage frequency at several nuclear power plants. 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.

Background

On November 23, 1988, the NRC issued Generic Letter 88-20, "Individual Plant Examination for Severe Accident Vulnerabilities," requesting that each nuclear power plant perform a systematic examination to identify any plant-specific vulnerabilities to severe accidents and report the results to the Commission. As stated in the letter, licensees are expected to expeditiously correct any identified vulnerabilities. This notice provides insights gained from the individual plant examination (IPE) process regarding improvements in plant design or operational practices and procedures to mitigate potential problems resulting from common dependencies in CCW systems.

Description of Circumstances

CCW systems provide cooling for reactor coolant pump (RCP) seals, and in many cases also supply cooling water to emergency core cooling system (ECCS) components. Consequently, failure of the CCW system could cause a loss of RCP seal cooling leading to an RCP seal loss of coolant accident (LOCA) and could also disable the necessary accident mitigation systems. Several licensees have identified these common dependencies as contributors to the total plant

core damage frequency in their IPEs. The following cases illustrate the measures taken by several utilities to mitigate the consequences of such accidents.

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Turkey Point Units 3 and 4

The Turkey Point IPE documented a potential accident sequence caused by an unisolable rupture of the CCW system that could occur while the B charging pump is out of service. In this scenario, cooling to the RCP seals would be lost, as would cooling to the A and C charging pumps. If the charging pumps are run without CCW, they are predicted to fail. This scenario would, according to the IPE, cause an RCP seal LOCA because all means of providing seal cooling would be lost from either the normal CCW system supply or the alternate seal injection supply from the charging pumps. Additionally, because the CCW system supplies cooling to the low and high head safety injection pumps, these pumps also would fail. Thus, an unmitigated RCP seal LOCA would occur.

This finding led the licensee to modify the A and C charging pumps in 1991 so that the service water system can be aligned as an alternate cooling water supply to any of the charging pumps. (The B charging pump had been similarly modified in 1976.) Thus, a loss of the CCW system alone would not disable all of the ECCS components required for LOCA mitigation. This modification reduced the contribution of this sequence to the total core damage frequency. However, during an NRC Operational Readiness Assessment Team inspection at the facility, procedural deficiencies were identified that could have prevented this modification from performing its intended function. The licensee corrected the deficiencies.

H.B. Robinson Steam Electric Plant, Unit 2

During development of the Robinson IPE, the licensee identified an accident sequence that could be initiated by a total loss of the CCW system. The configuration at Robinson is similar to that at Turkey Point in that the CCW system supplies cooling to both the RCP seals and the charging pumps. Thus, loss of the CCW system could lead to an RCP seal LOCA coincident with the inability to provide high pressure makeup.

This discovery led the licensee to implement procedural revisions that allow the alignment of an alternate cooling supply to the charging pumps by connecting the firewater system to existing fittings on the charging pump couplings. This procedural revision reduced the estimated core damage frequency contribution for the sequence.

Watts Bar Nuclear Plant, Unit 1

Before performing the IPE, the licensee modified a procedure to align a backup cooling water supply to the 1A-A centrifugal charging pump (CCP) via the emergency raw cooling water (ERCW) system. The CCPs depend on the CCW system for normal cooling to the pump lube oil and gear oil coolers. The CCW system also supplies cooling to the residual heat removal pumps, safety injection pumps, containment spray pumps, and the

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RCP thermal barrier coolers. In the IPE, the licensee credited operator actions associated with aligning the ERCW backup during a total loss of CCW system scenario. The IPE indicated that alignment of the ERCW system to the CCP reduced the incremental core damage frequency.

A recent NRC Emergency Operating Procedure team inspection at the facility identified procedural deficiencies that could have prevented this alignment from performing its intended function. The licensee is developing measures to correct these deficiencies.

Diablo Canyon Nuclear Power Plant, Units 1 and 2

At Diablo Canyon Units 1 and 2, the CCW system provides cooling to the charging pumps, which supply cooling water to the RCP seals. While developing the probabilistic risk assessment, the licensee discovered that loss of the CCW system could result in loss of the charging pumps and the RCP seals and could lead to an RCP seal LOCA. To mitigate this consequence, the licensee provided an alternate means of cooling the charging pumps from the fire water system on loss of the CCW system. Hose connections and dedicated hoses were provided and operational procedures were changed to facilitate this alternate means of cooling. As a result, the licensee indicated that the core damage frequency associated with loss of the CCW system was reduced.

Donald C. Cook Nuclear Plant, Units 1 and 2

The CCW system for the Cook Nuclear Plant provides cooling to the RCP seals and various primary plant components. Loss of the CCW system leading to an RCP seal LOCA was identified as a dominant contributor to the core damage frequency. The licensee is currently investigating changes to operational procedures to instruct the operator to open the cross-tie valve of the chemical and volume control system of one unit to the opposite unit early in the accident response to provide RCP seal cooling and to prevent seal damage.

Discussion

As indicated above, several licensees have identified, through the IPE process, that a common dependency in the CCW system to provide cooling for RCP seals and ECCS components could result in a significant contribution to the core damage frequency. Licensees found that changes in plant operational practices and procedures or cost-effective improvements in design could reduce the calculated core damage frequency.

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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 the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation project manager.

/s/'d by BKGrimes

Brian K. Grimes, Director
Division of Operating Reactor Support
Office of Nuclear Reactor Regulation

Technical contacts: J. L. Shackelford, RII

(404) 331-0338

M. T. Drouin, RES
(301) 492-3917

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