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

January 3, 1996

NRC INFORMATION NOTICE 96-01: POTENTIAL FOR HIGH POST-ACCIDENT CLOSED-CYCLE COOLING WATER TEMPERATURES TO DISABLE EQUIPMENT IMPORTANT TO SAFETY

Addressees

All holders of operating licenses or construction permits for pressurized water reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to the potential for high post accident closed-cycle cooling water system temperatures to disable equipment important to safety. 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

On November 14, 1994, the licensee for Fort Calhoun initiated a plant shutdown because engineering analysis had shown that the control room air conditioners, which operate in a vapor compression refrigeration cycle, could be disabled by a large primary coolant system pipe rupture or a main steamline break inside the containment. Loss of the control room air conditioners could cause certain engineered safety feature equipment in the control room to become overheated. The engineering analysis was initiated during preparations for a service water system operational performance assessment.

At Fort Calhoun, the closed cooling water (CCW) system operates in a closed cycle and transfers heat to the raw water system from various pieces of equipment, including the containment coolers and the control room air conditioning units. The raw water system operates in an open cycle and rejects the heat to the Missouri River. A large primary coolant system pipe rupture or main steamline break inside the containment could cause the CCW temperature to rise rapidly because of the large heat input from the containment coolers during these postulated accidents. The licensee calculated that under design-basis conditions, with the maximum available containment cooling capacity and the minimum permissible heat rejection capability of the CCW system, the system temperature could reach a maximum of

86 °C [187 °F], which exceeds the maximum post accident CCW temperature specified in the final safety analysis report (FSAR) and the temperature used to calculate thermal stress in certain piping segments.

The control room air conditioning units, which operate with the condenser refrigerant in a two-phase equilibrium state, are equipped with rupture discs that were designed to blow out at a CCW supply temperature of 54.5 °C [130 °F]. If the refrigerant was released, the air conditioning units could not be recovered. The licensee does not consider a release of the refrigerant to be a personnel safety concern. However, without any air conditioning, and with the control room ventilation system operating in the emergency pressurization mode, the control room temperature could increase to levels that could hinder operator activities and cause the design temperatures of safety-related equipment in the control cabinets to be exceeded.

The licensee identified two root causes associated with the design deficiency (Licensee Event Report 50-285/94-010 and supplements):

1. The use of an inappropriate methodology to establish the maximum post accident CCW system temperature.

2. The failure to include a maximum condenser temperature for post accident conditions in the procurement specifications for the air conditioning units. The procurement specifications gave the normal CCW system temperatures.

The Fort Calhoun FSAR documented the loss of an emergency onsite power source as the most limiting single failure for the CCW system. However, such a failure would reduce containment heat transfer to the CCW system, as well as reduce the heat rejection capability of the CCW system. During preparations for the self-assessment, the licensee identified certain initial equipment configurations that could result in a significant reduction in the heat rejection capability of the CCW system without reducing the potential heat transfer from containment.

The licensee justified continued operation until the March 1995 refueling outage based on implementation of certain compensatory measures and the existence of low river water and air temperatures at that time. The licensee subsequently completed modifications that installed air-cooled condenser units for the control room air conditioning units, increased the minimum design CCW heat rejection capability, and determined that the calculated piping thermal stress was within acceptable limits for post accident CCW transient temperatures. The licensee has also implemented administrative controls to ensure that post-accident CCW temperatures remain within acceptable limits while a request for a Technical Specification amendment is pending.

Discussion

Closed cooling water systems are subject to significant transient temperature variations because of the limited system heat capacity and the potential for substantial changes in heat addition and heat rejection rates. The complex nature of some such systems may make difficult the correct identification of the most limiting potential operating configuration of the system. Certain safety-related components served by CCW systems, such as air conditioning units and emergency diesel generators may fail in a non-recoverable manner as a result of temperature transients outside the system design basis. Because temperature transients initiated by an accident may affect redundant parts of the closed cooling water system, safety-related components in redundant trains necessary for mitigation of an accident may be affected.

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.

Dennis M. Crutchfield, Director
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Technical contacts: Steven R. Jones, NRR
(301) 415-2833
Internet:srj@nrc.gov

William F. Burton, NRR
(301) 415-2853
Internet:wfb@nrc.gov

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95-57	Risk Impact Study Regarding Maintenance During Low-Power Operation and Shutdown	12/18/95	All holders of OLs or CPs for nuclear power reactors.
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95-55	Handling Uncontained Yellowcake Outside of a Facility Processing Circuit	12/06/95	All Uranium Recovery Licensees.
95-54	Decay Heat Management Practices during Refueling Outages	12/01/95	All holders of OLs or CPs for nuclear power reactors.
95-53	Failures of Main Steam Isolation Valves as a Result of Sticking Solenoid Pilot Valves	12/01/95	All holders of OLs or CPs for nuclear power reactors.
95-47, Rev. 1	Unexpected Opening of a Safety/Relief Valve and Complications Involving Suppression Pool Cooling Strainer Blockage	11/30/95	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

Discussion

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DOCUMENT NAME: 96-01.IN
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