

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

May 7, 1992

NRC INFORMATION NOTICE 92-16, SUPPLEMENT 1: LOSS OF FLOW FROM THE RESIDUAL
HEAT REMOVAL PUMP DURING
REFUELING CAVITY DRAINDOWN

Addressees

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

Purpose

The U.S. Nuclear Regulatory Commission (NRC) issued Information Notice (IN) 92-16 to alert addressees to an event at the Vogtle Electric Generating Plant, Unit 1, on October 26, 1991, involving the loss of flow from the residual heat removal (RHR) pump during a draindown of the refueling cavity. The staff discussed inadequacies in the draindown procedure and noted a failure mode in which a common vent path could affect all of the level instruments for the reactor vessel.

The NRC is issuing this supplement to IN 92-16 to alert addressees to another mechanism by which licensees may experience a loss of RHR while conducting draindown operations. This supplement describes an event at the Prairie Island Nuclear Generating Plant, Unit 2, in which RHR flow was lost during reactor vessel draindown. Unanticipated level instrument performance, due to plant conditions not foreseen in the level instrument design, led to draining the reactor coolant system (RCS) further than planned. This supplement also highlights the value of outage risk reduction efforts in mitigating the consequences of a loss of RHR event. 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 supplement are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

On February 20, 1992, at about 5:00 p.m., the Northern States Power Company (the licensee) began to drain down the RCS to the mid-loop level to install dams on the steam generator nozzles. The licensee was maintaining the RCS temperature at 133°F with the 22 RHR pump in service. The licensee had established a vent path from the RCS to the pressurizer relief tank (PRT) through a power-operated relief valve that was locked open. To prevent drawing a vacuum on the pressurizer and PRT while draining, the licensee was maintaining an overpressure of 3-6 psig in the system by periodically adding nitrogen to the PRT.

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The licensee was monitoring the reactor vessel level using a tygon tube which was vented to the containment atmosphere. The operators were performing calculations to correct the observed level in the tygon tube for the effects of the nitrogen pressure. The licensee also had two electronic level sensors installed to provide indication in the control room. These instruments were designed to use a PRT pressure sensor input to automatically correct the sensed level for the effects of any system pressure. After draining down the RCS for several hours, the operators began to suspect a problem with the electronic level instruments, which had not come on scale as anticipated. The operators continued the draindown, relying solely on the corrected level in the tygon tube, while attempting to diagnose the suspected problem with the electronic instruments.

Between approximately 11:00 and 11:10 p.m., the electronic instruments came on scale indicating a low level, the operators received indications of decreasing RHR flow, and they stopped the draindown. About one minute later, the operators stopped the 22 RHR pump when they noticed oscillations in the RHR flow and the pump motor electrical current, which indicated that a vortex was forming in the pump suction.

The operators immediately took actions to recover the RCS level and restore shutdown cooling. They increased the RCS level to the reactor vessel flange using both charging pumps and the 21 RHR pump to transfer water from the refueling water storage tank to the RCS. They then realigned the RHR system for shutdown cooling using the 21 RHR pump. The loss of forced shutdown cooling flow lasted approximately 21 minutes.

The level in the RCS, as measured by the electronic instruments, dropped approximately 8 inches below the center line of the reactor vessel nozzle. During the period that shutdown cooling flow was lost, the core exit temperature rose from 133°F to a maximum recorded value of 221.5°F. RCS samples drawn following the event showed that no fuel had been damaged.

Discussion

The nitrogen pressure on the RCS was a significant contributor to this event. The licensee found that the draindown procedure did not adequately address the capabilities and operation of the installed level instrumentation and the effects of the nitrogen pressure on these instruments. The procedure allowed a nitrogen pressure of up to 6 psig in the RCS. However, both electronic instruments were unable to provide accurate level indication whenever nitrogen pressure exceeded about 3.4 psig.

An NRC Augmented Inspection Team (AIT) dispatched to the site found that the draindown procedure did not provide sufficient guidance on the processes required to achieve a stable mid-loop condition. The procedure lacked guidance on verifying level instrument performance and on the accuracy required when correcting the observed tygon tube level for the effect of the nitrogen pressure. In the absence of such guidance, the operators did not act conservatively and continued to drain down the RCS without determining the cause of the unanticipated performance of the electronic instruments. Furthermore, the operators had frequently been rounding the pressure values to the nearest whole pound per

square inch when calculating corrected tygon tube levels, resulting in corrected levels that were in error by up to about 1 foot.

The AIT identified a design vulnerability in the level indication system in that the same PRT pressure instrument was used in correcting both electronic level instruments and used in the calculation to correct the tygon tube level. If not properly calibrated, this instrument would result in erroneous level indications for all instruments.

The licensee had taken steps to address loss of shutdown cooling events. These actions included administrative requirements during reduced inventory operations to maintain all offsite and onsite power sources available and to maintain sufficient secondary inventory in at least one steam generator to provide an alternate means of decay heat removal. The licensee had developed comprehensive abnormal and emergency operating procedures to deal with reduced inventory events. The operators responded effectively in implementing these procedures to stabilize the plant. These measures were effective in minimizing the risk of plant damage due to this event.

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.

Charles E. Rossi

Charles E. Rossi, Director
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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
92-36	Intersystem LOCA Outside Containment	05/07/92	All holders of OLs or CPs for nuclear power reactors.
92-35	Higher Than Predicted Erosion/Corrosion in Unisolable Reactor Coolant Pressure Boundary Piping Inside Containment at A Boiling Water Reactor	05/06/92	All holders of OLs or CPs for nuclear power reactors.
92-34	New Exposure Limits for Airborne Uranium and Thorium	05/06/92	All licensees whose operations can cause airborne concentrations of uranium and thorium.
92-33	Increased Instrument Response Time When Pressure Dampening Devices are Installed	04/30/92	All holders of OLs or CPs for nuclear power reactors.
92-32	Problems Identified with Emergency Ventilation Systems for Near-Site (Within 10 Miles) Emergency Operations Facilities and Technical Support Centers	04/29/92	All holders of OLs or CPs for nuclear power reactors.
92-31	Electrical Connection Problem in Johnson Yokogawa Corporation YS-80 Programmable Indicating Controllers	04/27/92	All holders of OLs or CPs for nuclear power reactors.
92-30	Falsification of Plant Records	04/23/92	All holders of OLs or CPs for nuclear power reactors and all licensed operators and senior operators.

OL = Operating License
CP = Construction Permit

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