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

February 25, 1992

NRC INFORMATION NOTICE 92-16: 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) is issuing this information notice to alert addressees to a recent event involving the loss of flow from the residual heat removal pump during refueling cavity draindown. 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 October 26, 1991, the Vogtle Electric Generating Plant, Unit 1, was in Mode 6 (Refueling) with the reactor vessel head removed. The Georgia Power Company (the licensee) had reloaded the core and reinstalled the upper internals. The licensee was using the 1B residual heat removal (RHR) pump to provide shutdown cooling and the 1A RHR pump to drain the refueling cavity by taking suction from one of the reactor coolant system (RCS) hot legs and discharging to the refueling water storage tank (RWST). The RCS temperature was approximately 87°F. The water level in the refueling cavity was at 210 feet 4 inches. Operations personnel were preparing to lower the level to 192 feet, 2 feet below the reactor vessel head flange, to allow the reactor vessel head to be reinstalled. The mid-loop elevation of the RCS for Unit 1 is 187 feet. An assistant plant operator (APO) in the Unit 1 containment was directed to establish a watch at a tygon tube to monitor the RCS level during draindown and mid-loop operations. During the outage, the licensee had installed a permanent sight glass in the Unit 1 containment for monitoring the RCS level. This new sight glass had neither been tested nor aligned for the operators to use. The APO assumed that the new sight glass was operable and established communications with the control room at the permanent sight glass, rather than at the tygon tube, to monitor the draindown. The licensee then started the draindown.

When the day shift ended, a night shift plant equipment operator (PEO) relieved the day shift APO who was monitoring the permanent sight glass. The PEO discovered that the valves for the permanent sight glass were not aligned correctly. The PEO informed the control room and the operators stopped the

draindown while the problem was investigated. The PEO and APO then filled and vented the sight glass without using a procedure. In their attempt to place the permanent sight glass in service, the upper isolation valve, which was not readily visible, was not opened as required.

The licensee resumed the cavity draindown and, approximately 2 hours later, received a control room annunciator which indicated a high level, 192 feet 6 inches, in the reactor vessel. The control room operator observed that the control room level indicator was at the top of scale (100 percent) and tapped on the indicator, causing it to drop to a reading of 60 percent (190 feet 9 inches). The licensee again stopped the draindown. The PEO monitoring the sight glass level reported that reactor vessel water level appeared to be even with the reactor vessel head flange (194 feet), which agreed with the level indicated by the permanent sight glass and the temporary tygon tube. The licensee assumed that the control room level indicator was inaccurate and continued the draindown, believing that it had three reliable indications of the RCS level, i.e., visual vessel water level, the permanent sight glass, and the temporary tygon tube.

When the level in the RCS reached approximately 193 feet, as indicated by the sight glass, a control room operator observed discharge pressure, flow, and motor current oscillations for the 1B RHR pump, indicating that the coolant was forming a vortex on the suction side of the pump or that the pump was cavitating. The operators closed the discharge valve for the 1B RHR pump, thus putting the 1B RHR pump on the miniflow line. Although the electrical current reading for the motor of the 1B RHR pump became more stable, the discharge pressure remained low.

The licensee again stopped the draindown by shutting down the 1A RHR pump and realigning its suction to the refueling water storage tank (RWST) to refill the refueling cavity. Shortly after beginning to refill the RCS, the licensee noted that the discharge pressure of the 1B RHR pump began to improve. When the flow of the 1B RHR pump reached approximately 2600 gallons per minute, the licensee again observed indications of vortex formation or cavitation. The licensee reduced the flow from the 1B RHR pump to 1800 gallons per minute and found that the pump operated satisfactorily with no indication of vortex formation or cavitation. The licensee used the 1A RHR pump to refill the refueling cavity from the RWST and stopped refilling when the sight glass indicated a level of 194 feet 10 inches. The licensee increased the flow from the 1B RHR pump to approximately 3000 gallons per minute and found that the pump operated satisfactorily with no further indication of vortex formation or cavitation.

When operators performed a walkdown inspection of the tygon tube and the sight glass level indicators, they found the upper isolation valve for the sight glass closed with a tag on it which indicated that the new sight glass had not been released for use. The licensee later determined that a similar tag had also been installed on the lower isolation valve but apparently had fallen off the valve.

The licensee also discovered that a high efficiency particulate absorber (HEPA) filter unit was connected, by means of a flexible duct, to the opening from which a pressurizer safety valve had been removed to provide a vent path for all level instrumentation. The licensee found that the HEPA unit was running and the flexible duct was collapsed, apparently caused by the vacuum created by the running HEPA filter unit and the RCS draindown. This resulted in an inadequate vent path from the pressurizer. (LER 50-424/91-09 and NRC Inspection Report 50-424,425/91-30)

Discussion

False high RCS level indications led to the RCS level being inadvertently lowered to the point at which the coolant formed a vortex in the RHR pump suction line. The false high level indications were caused by an inadequate vent path from the pressurizer and by the closed upper isolation valve for the sight glass. When conditions in the pressurizer changed, it affected all of the reactor vessel level instruments, because their reference legs connected to the pressurizer. The system installed at Vogtle did not meet the intent of two independent continuous water level indications as discussed in Generic Letter 88-17, "Loss of Decay Heat Removal."

Procedures for the initial RCS draindown during refueling operations provided sufficient steps to ensure that the level instrumentation was installed properly and the vent paths were adequate. However, the procedures for the subsequent draindowns did not include sufficient steps to reverify these actions. Administrative controls were inadequate in addressing the reviews and documents required for attaching HEPA filter units to plant equipment. In this case, the HEPA filter unit was installed without a temporary modification or a work order, and consequently the control room was not aware of the installation.

During the event, the 1B RHR pump was not available to provide recirculation shutdown cooling for approximately 16 minutes. Core temperature as indicated at the RHR pump discharge increased from approximately 87°F to 107°F. There was no radiological release to the environment. The licensee reviewed available data further and found that the coolant on the suction side of the 1B RHR pump had formed a vortex but the pump did not cavitate.

Air may have begun entering the 1A RHR pump shortly before the pump's discharge valve was closed. This resulted in a slightly reduced discharge pressure and flow. The coolant in the RCS reached the lowest level, 186 to 187 feet, when the discharge valve for the 1A RHR pump's heat exchanger was closed. After the event, the licensee performed an inservice test on the 1A and 1B RHR pumps and found that the performance of neither pump was degraded.

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

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LIST OF RECENTLY ISSUED NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
92-15	Failure of Primary System Compression Fitting	02/24/92	All holders of OLs or CPs for nuclear power reactors.
92-14	Uranium Oxide Fires at Fuel Cycle Facilities	02/21/92	All fuel cycle and uranium fuel research and developme licensees.
92-02, Supp. 1	Relap5/Mod3 Computer Code Error Associated with the Conservation of Energy Equation	02/18/92	All holders of OLs or CPs for nuclear power reactors.
92-13	Inadequate Control Over Vehicular Traffic at Nuclear Power Plant Sites	02/18/92	All holders of OLs or CPs for nuclear power reactors.
92-12	Effects of Cable Leakage Currents on Instrument Settings and Indications	02/10/92	All holders of OLs or CPs for nuclear power reactors.
92-11	Soil and Water Contamination at Fuel Cycle Facilities	02/05/92	All uranium fuel fabrication and conversion facilities.
92-10	Brachytherapy Incidents Involving Iridium-192 Wire Used in Endobronchial Treatments	01/31/92	All Nuclear Regulatory Commission (NRC) licensees authorized to use iridium-192 for brachytherapy; manufacturers and distributors of iridium-192 wire for use in brachytherapy.
92-09	Overloading and Subsequent Lock Out of Electrical Buses During Accident Conditions	01/30/92	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit