

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

January 29, 1990

NRC INFORMATION NOTICE NO. 90-06: POTENTIAL FOR LOSS OF SHUTDOWN COOLING  
WHILE AT LOW REACTOR COOLANT LEVELS

Addressees:

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

Purpose:

This information notice is intended to alert addressees to a potential problem affecting the operability of the residual heat removal (RHR) system during operating conditions involving mid-loop operation. 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 do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

On July 18, 1989, at Comanche Peak Unit 1, train "A" of the residual heat removal system was in operation prior to initial fuel loading. The air operated RHR heat exchanger flow control valve (FCV) was being used to maintain system flow below 2000 gpm. The reactor vessel water level was being maintained slightly above the center line of the hot legs.

The inverter supplying power to the controller for the FCV failed. The loss of power to the controller resulted in the FCV failing to its emergency core cooling system (ECCS) position of being fully open. The open valve caused an increase in system flow to 4400 gpm. This sudden, increased flow caused conditions where vortexing was expected at the suction of the RHR pipe connection to the RCS.

The power supply for the controllers was manually transferred to an alternate source and the FCV was throttled, thus terminating the event.

Discussion:

The FCV is manually throttled to maintain a desired rate of flow through the RHR heat exchanger. The heat exchanger flow rate is adjusted to control the temperature of the water being returned to the vessel. Total system flow is regulated by throttling the heat exchanger bypass valve coincident with the adjustment of the FCV.

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Concurrence

During this event, there were no indications of pump air ingestion. However, the increased system flow corresponded to the rate at which vortexing had been calculated to occur based on the existing RCS level. The licensee had previously determined maximum permitted flow rates for various reduced levels of the RCS to prevent the possibility of vortexing and air entrainment into the RHR pump.

Although RHR pump operation was never actually impaired, the potential existed for air to be introduced to the pump's suction. This concern is exacerbated by the fact that the heat exchanger FCVs for both trains of RHR are powered from the same inverter. Since the FCVs open fully on a loss of power, both trains of RHR could become inoperable on a loss of power during mid-loop operation. (A loss of instrument air would also cause the FCVs to fail to the full open position and could also result in the loss of both trains of the RHR system).

During most modes of operation, having the FCVs go fully open on loss of power or instrument air is not a safety concern because having the valves fully open does not normally prevent the system from performing its safety function. However, having the valves go fully open while at mid-loop could result in the loss of decay heat removal capability. This loss could persist until electrical power or instrument air is restored and air is vented from the RHR system.

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The licensee has revised procedures for mid-loop operation to require manually positioning the cold leg injection isolation valves to limit the maximum flow through the system, even with the FCVs fully open. This lineup will be used whenever the unit is at mid-loop and protects against the consequences of failure of either electrical power or instrument air.

Several generic communications have been issued informing licensees of the consequences of the loss of residual (decay) heat removal and the operating conditions under which the probability of a loss increases; i.e., reduced inventory conditions. The most recent publications include Generic Letter (GL) No. 87-12, "Loss of Decay Heat Removal While the Reactor Coolant System is Partially Filled;" GL No. 88-17, "Loss of Decay Heat Removal;" NRC Information Notice (IN) 87-23, "Loss of Decay Heat Removal During Low Reactor Coolant Level Operation;" IN 88-36, "Possible Sudden Loss of RCS Inventory During Low Coolant Level Operation;" and IN 89-67, "Loss of Residual Heat Removal Caused by Accumulator Nitrogen Injection." The event described above introduces a subtle failure scenario which licensees may not have considered.

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 NRR project manager.

*Charles E. Rossi*  
Charles E. Rossi, Director  
Division of Operational Events Assessment  
Office of Nuclear Reactor Regulation

Technical Contacts: Nick Fields, NRR  
(301) 492-1173

Steve Bitter, RIV  
(817) 897-1500

Attachment: List of Recently Issued NRC Information Notices

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Attachment  
IN 90-06  
January 29, 1990  
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LIST OF RECENTLY ISSUED  
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
90-05	Inter-System Discharge of Reactor Coolant	1/29/90	All holders of OLs or CPs for nuclear power reactors.
90-04	Cracking of the Upper Shell-to-Transition Cone Girth Welds in Steam Generators	1/26/90	All holders of OLs or CPs for Westinghouse-designed and Combustion Engineering-designed nuclear power reactors.
90-03	Malfunction of Borg-Warner Bolted Bonnet Check Valves Caused by Failure of the Swing Arm	1/23/90	All holders of OLs or CPs for nuclear power reactors.
90-02	Potential Degradation of Secondary Containment	1/22/90	All holders of OLs or CPs for BWRs.
90-01	Importance of Proper Response to Self-Identified Violations by Licensees	1/12/90	All holders of NRC materials licenses.
89-90	Pressurizer Safety Valve Lift Setpoint Shift	12/28/89	All holders of OLs or CPs for PWRs.
89-89	Event Notification Worksheets	12/26/89	All holders of OLs or CPs for nuclear power reactors.
89-88	Recent NRC-Sponsored Testing of Motor-Operated Valves	12/26/89	All holders of OLs or CPs for nuclear power reactors.
89-87	Disabling of Emergency Diesel Generators by Their Neutral Ground-Fault Protection Circuitry	12/19/89	All holders of OLs or CPs for nuclear power reactors.
89-45, Supp. 2	Metaclad, Low-Voltage Power Circuit Breakers Refurbished with Substandard Parts	12/15/89	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License  
CP = Construction Permit

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\*SEE PREVIOUS CONCURRENCE

EAB:NRR	TECH:EDITOR	EAB:NRR	C:EAB:NRR	C:OGCB:NRR	NRR:SRXB
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1/12/90	1/13/90	1/16/90	1/16/90	1/17/90	1/23/90

D:DOEA:NRR  
C:EROSST  
1/23/90

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<i>NF</i> EAB:NRR NFields:db # 1/2/90	<i>DCF</i> Comments on draft Version incorporated TECH:EDITOR 1/13/89	<i>DCF</i> EAB:NRR DCFischer 1/16/90	<i>DCF FOR</i> C:EAB:NRR CJHaughney 1/14/90	<i>CUB</i> C:OGCB:NRR CHBerlinger 1/17/90	D:DOEA:NRR CERossi / /90
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