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

December 9, 1987

NRC INFORMATION NOTICE NO. 87-63: INADEQUATE NET POSITIVE SUCTION HEAD IN LOW PRESSURE SAFETY SYSTEMS

Addressees:

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

Purpose:

This information notice is being provided to alert addressees to problems which could result in inadequate net positive suction head (NPSH) at the inlet to the low pressure pumps following a loss-of-coolant accident (LOCA). 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:

A Nuclear Regulatory Commission review has identified several similar reported problems related to excessive flow rates in low pressure safety systems that could occur following a LOCA. Higher than expected flow rates in the pump discharge lines can lead to lower than calculated suction line pressures and consequently to inadequate pump NPSH.

On May 19, 1987, Turkey Point, Unit 3, personnel reported that during a reexamination of the containment spray (CS) system the hydraulic resistance of the CS system was found to be less than that assumed in the design calculations. Furthermore, they reported that adequate NPSH for the CS pumps could not be assured during the injection phase following a LOCA when the CS system was drawing water from the refueling water storage tank. This deficiency was caused by missing flow orifices in the pump discharge lines that were assumed in the system design but never installed. The licensee corrected the problem by installing the missing flow orifices and reported the event in Licensee Event Report 250-87-014.

On December 12, 1986, while designing modifications for the facility residual heat removal (RHR) system, the Haddam Neck licensee discovered that pump cavitation could occur in the low pressure pumps during the recirculation phase

following a LOCA (in a narrow range of break sizes). A combination of break flow, a system arrangement where the high pressure pumps are downstream of the low pressure pumps, and a certain volume of water in the containment sump at the time of switchover from the injection to the recirculation phase all contributed to the scenario in which inadequate NPSH would exist at the low pressure pump inlet. The licensee corrected the problem by throttling the RHR system control valves to balance the flowpaths and effectively increase the system hydraulic resistance on the low pressure pump discharge line while maintaining minimum flow requirements.

On March 31, 1986, the Trojan licensee discovered that there would be inadequate NPSH at the inlet to the low pressure pumps of the emergency core cooling system (ECCS) at Trojan under certain accident conditions. During the recirculation phase following a LOCA, two low pressure pumps feed the charging pumps, the safety injection pumps, and the cold leg injection paths. If only one low pressure pump is operating (accounting for a single failure) and the cross-tie between ECCS trains is open, the low pressure pump NPSH would be deficient by about 10 feet. The licensee corrected the problem by modifying procedures to (1) isolate the cross-tie between trains prior to entering the recirculation phase and (2) secure all other pumps in the same train as the inoperable low pressure pump.

In July 1977, the Farley, Unit 1, licensee reported that the residual heat removal (RHR) pump flow rate at that facility would be significantly above the expected flow rate during the cold leg recirculation mode of operation following a LOCA. Investigations by the licensee revealed that the high flow rates were due to lower than expected hydraulic resistances in the RHR pump discharge piping. The actual roughness of the installed piping was less than the standard commercial steel roughness assumed in the calculations, and the hydraulic resistance of installed check valves was less than estimated. Consequently, the licensee installed orifices in the pump discharge piping to reduce the flow to a rate that would provide adequate NPSH at the low pressure pumps under all post-LOCA conditions.

Discussion:

Inadequate NPSH can cause pump cavitation and lead to pump unavailability. Identification of deficiencies in system design, installation, or operation that could result in inadequate NPSH can occur in any type of pump system arrangement and may require more than a review of the original design calculations, as noted by the above mentioned events. In general, pump availability may also be affected by sudden suction pressure oscillations during pump starts that may cause unexpected pump trips. This is discussed in NRC Information Notice 87-53, "Auxiliary Feedwater Pump Trips Resulting From Low Suction Pressure".

No specific action or written response is required by this information notice. If you have any questions about this matter, please contact the technical contact listed below or the Regional Administrator of the appropriate regional office.

Charles E. Rossi

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

Technical Contact: Sanford Israel, AEOD
(301) 492-4437

Attachment: List of Recently Issued NRC Information Notices

Attachment 1
IN 87-63
December 9, 1987

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES 1987

Information Notice No.	Subject	Date of Issuance	Issued to
87-62	Mechanical Failure of Indicating-Type Fuses	12/8/87	All holders of OLs or CPs for nuclear power reactors
87-61	Failure of Westinghouse W-2-Type Circuit Breaker Cell Switches.	12/7/87	All holders of OLs or CPs for nuclear power reactors.
87-60	Depressurization of Reactor Coolant Systems in Pressurized-Water Reactors	12/4/87	All holders of OLs or CPs for PWRs.
86-108, Supp. 2	Degradation of Reactor Coolant System Pressure Boundary Resulting from Boric Acid Corrosion	11/19/87	All holders of OLs or CPs for nuclear power reactors.
87-59	Potential RHR Pump Loss	11/17/87	All holders of OLs or CPs for nuclear power reactors.
87-58	Continuous Communications Following Emergency Notifications	11/16/87	All nuclear power reactor facilities holding an OL and the following fuel facilities that have Emergency Notification Systems: Nuclear Fuel Services, Erwin, TN; General Atomics, San Diego, CA; UNC, Montville, CT; and B & W LRC and B & W Navy, Lynchburg, VA.
87-57	Loss of Emergency Boration Capability Due to Nitrogen Gas Intrusion	11/6/87	All holders of OLs or CPs for nuclear power reactors.
87-56	Improper Hydraulic Control Unit Installation at BWR Plants.	11/4/87	All holders of OLs or CPs for boiling water reactors (BWRs).

OL = Operating License
CP = Construction Permit

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(AEOD)

(TRANSMITTED BY MEMORANDUM TO C.E.ROSSI FROM T.M.NOVAK DATED OCTOBER 7, 1987)

*SEE PREVIOUS CONCURRENCES

*OGCB:DOEA:NRR	*ROAB:DSP:AEOD	*PPMB:ARM	*C/OGCB:DOEA:NRR	D/DOEA:NRR
JGuillen	SIsrael	TechEd	CHBerlinger	CERossi
11/06/87	11/06/87	11/06/87	11/17/87	12/3/87

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11/6/87	By Phone 11/6/87	11/6/87	11/ /87	11/ /87