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

March 15, 1995

NRC INFORMATION NOTICE 95-18: POTENTIAL PRESSURE-LOCKING OF SAFETY-RELATED POWER-OPERATED GATE VALVES

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 (IN) to alert addressees to a recent analysis demonstrating the potential susceptibility of safety injection valves to pressure-locking. It is expected that recipients will review this additional 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.

Background

IN 95-14, "Susceptibility of Containment Sump Recirculation Gate Valves to Pressure Locking," dated February 28, 1995, was written in response to the determination by the licensee of the Millstone Nuclear Power Station that both of the Unit 2 containment sump recirculation motor-operated gate valves may experience pressure-locking during a design-basis loss-of-coolant accident (LOCA) and fail to open. The failure of both of these valves would make a water source for the emergency core cooling system and the containment spray unavailable during the recirculation phase of the LOCA. The circumstances at Haddam Neck discussed in this supplement were identified as a result of licensee action in response to this previous Millstone determination.

Description of Circumstances

On March 9, 1995, the Connecticut Yankee Atomic Power Company reported that seven motor-operated gate valves in the safety injection systems at the Haddam Neck Nuclear Power Plant were susceptible to pressure-locking to the extent that the operability of valves may have been jeopardized. These susceptibilities were detailed as follows:

PDR I+E Notice 95-018. 950315

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1. Four high-pressure safety injection admission valves (SI-MOV-861A through 861D; see Attachment 1).

   These normally closed valves are susceptible to pressure-locking following a postulated LOCA in which the pressure in the reactor coolant system (RCS) drops substantially before the safety injection actuation signal initiates the opening of the valve. These valves are also susceptible tc pressure locking caused by the heating of fluid captured in the valve bonnet when the valves are stroked during the startup of the plant.

2. Two low-pressure safety injection admission valves (SI-MOV-871A and 871B; see Attachment 2).

   These normally closed safety injection valves are susceptible to pressure-locking following a postulated LOCA where the pressure in the RCS drops substantially before the safety injection actuation signal initiates the opening of the valve.

3. One common low-pressure safety injection isolation valve (SI-MOV-873; Attachment 2).

   This normally open valve would be closed during transfer to the recirculation mode following a LOCA if either SI-MOV-871A or B failed to close. Once this isolation valve was closed, it would be susceptible to pressure-locking as a result of temperature increase of fluid in the bonnet caused by high containment temperature. This condition could prevent the reopening of the valve should it be required for entrance into the two-path long term recirculation mode.

The Haddam Neck plant has been shut down for refueling since January 28, 1995. The licensee plans to modify the susceptible valves before restarting the plant. A modification being considered includes venting both the bonnet space and the packing gland seal leakoff back to the RCS to prevent pressure-locking. In addition, the licensee is considering procedural changes to minimize valve unseating forces.

Discussion

The licensee had previously evaluated these valves for possible pressure-locking and thermal-binding and had concluded that the valves were not susceptible to these problems. However, recent diagnostic testing has shown that the friction coefficients, the unseating forces, and the methodology previously used were nonconservative. The reexamination of the analysis by the licensee, using the test results, indicated that these valves may become inoperable due to pressure-locking problems.

As noted in IN 95-14, the NRC staff and the nuclear industry have been aware of disk binding problems of gate valves for many years. The industry has issued several event reports describing the failure of safety-related gate valves to operate because of pressure-locking or thermal-binding of the valve

disks. Several generic industry communications have given guidance for both identifying susceptible valves and performing appropriate preventive and corrective measures. In Enclosure 1 to Supplement 6 of Generic Letter 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," dated March 8, 1994, the NRC staff discussed pressure-locking and thermal-binding of motor-operated gate valves.

Pressure-locking may occur in flexible-wedge and parallel disk gate valves when fluid entrapped in the bonnet becomes pressurized and the actuator is incapable of overcoming the additional thrust requirements needed to overcome the increased friction resulting from the differential pressure on both valve disks from the pressurized fluid. IN 95-14 discusses several of ways in which fluid may enter the valve bonnet. Thermal binding of gate valves can result from contraction of a valve body as a result of cooling after a gate valve has seated. Like pressure locking, thermal binding can increase the forces that are necessary to unseat the valve. These mechanisms represent potential common-cause failure modes that can render redundant trains of safety-related emergency core cooling systems incapable of performing their safety functions.

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.

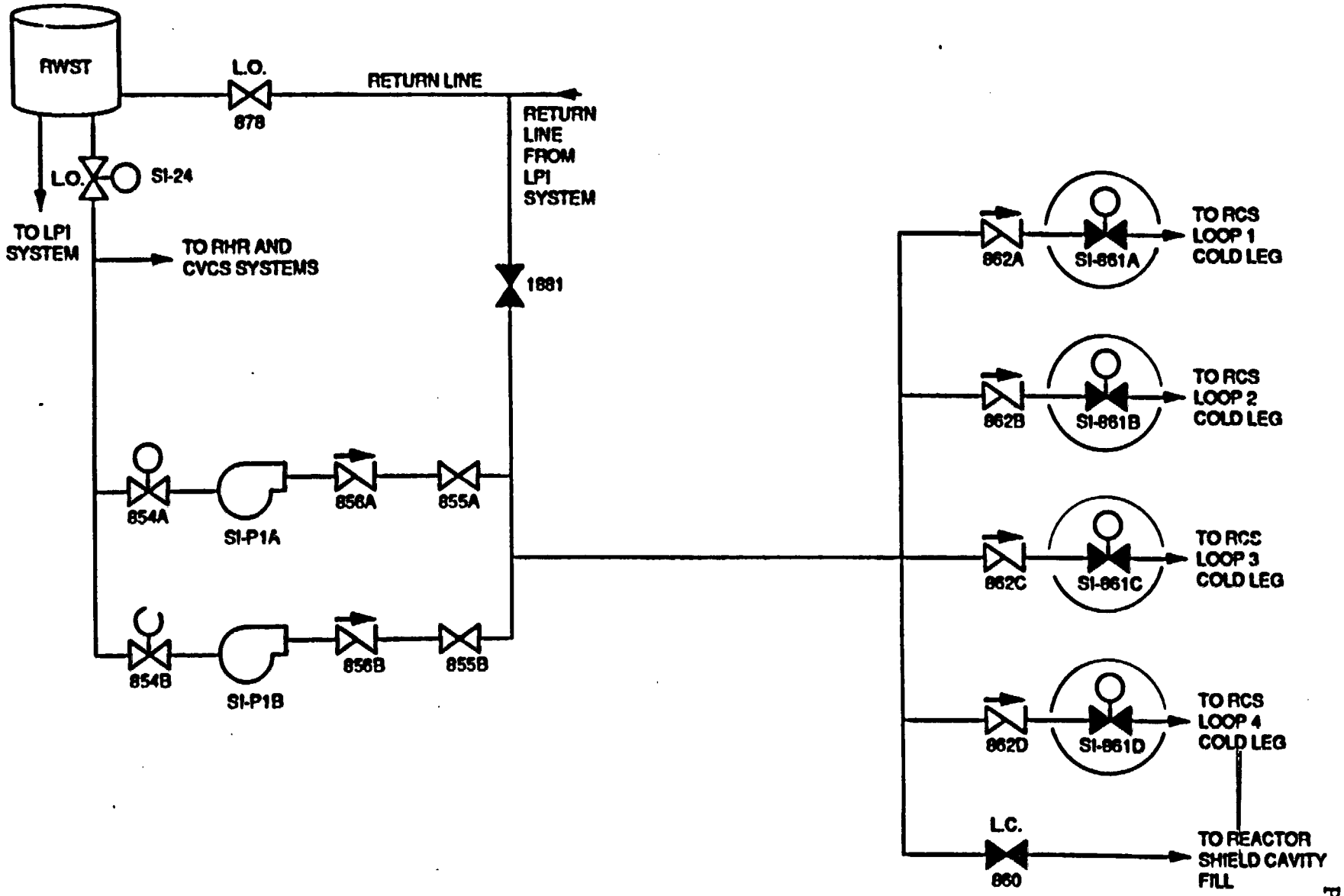
Brian K. Grimes, Director
Division of Project Support
Office of Nuclear Reactor Regulation

Technical contacts: Thomas Scarbrough, NRR
(301) 415-2794

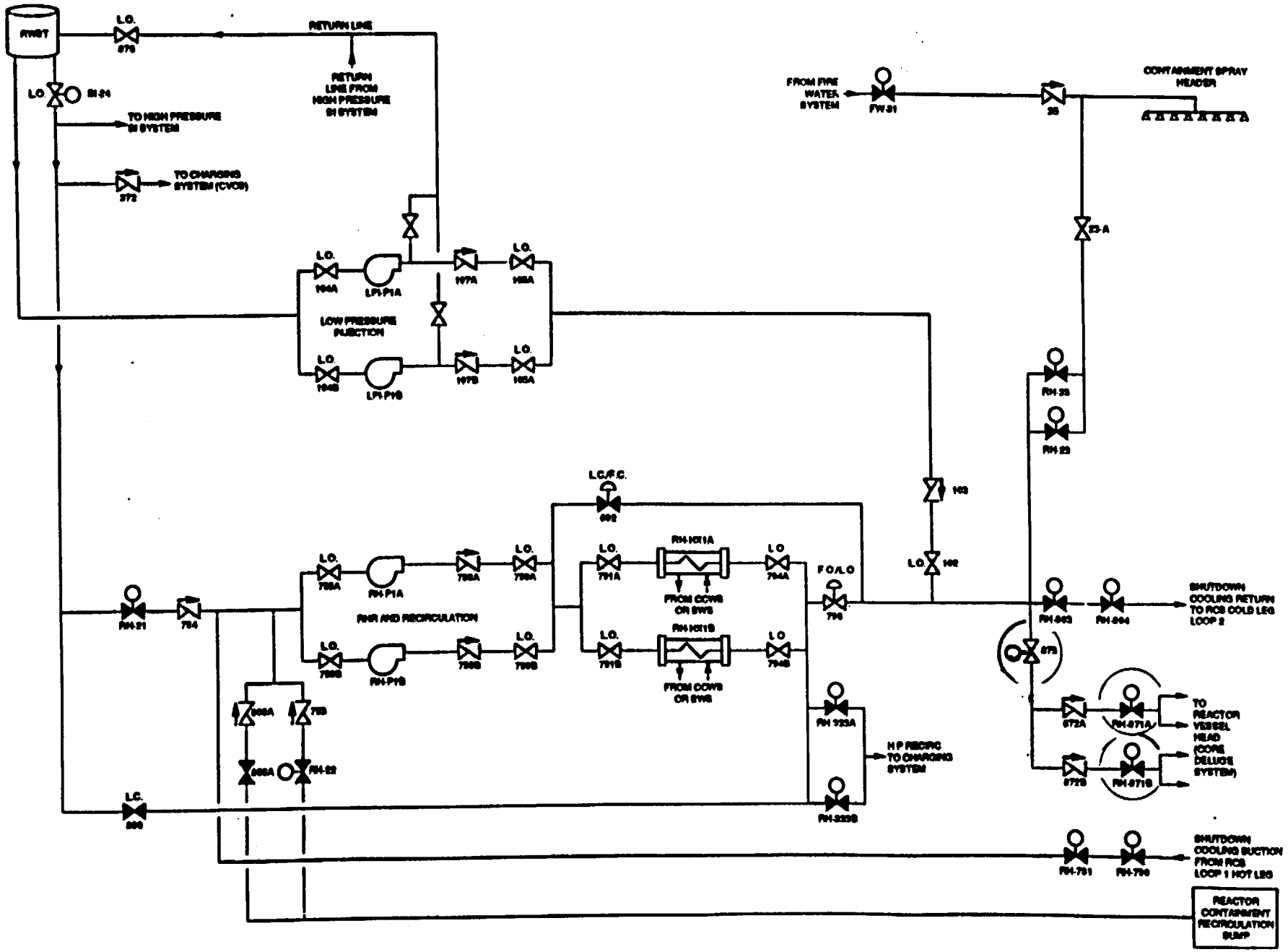
Donald Kirkpatrick, NRR
(301) 415-1849

Attachments:
1. Haddam Neck High Pressure Safety Injection
2. Haddam Neck Low Pressure Safety Injection and Heat Removal System
3. List of Recently Issued NRC Information Notices

Attachment filed in JACKET



Haddam Neck High Pressure Safety Injection (SI) System



Haddam Neck Low Pressure Safety Injection (LPI) and Residual Heat Removal (RHR) Systems

LIST OF RECENTLY ISSUED NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
95-17	Reactor Vessel Top Guide and Core Plate Cracking	03/10/95	All holders of OLs or CPs for boiling water reactors.
95-16	Vibration Caused by Increased Recirculation Flow in a Boiling Water Reactor	03/09/95	All holders of OLs or CPs for boiling water reactors.
95-15	Inadequate Logic Testing of Safety-Related Circuits	03/07/95	All holders of OLs or CPs for nuclear power reactors.
95-14	Susceptibility of Containment Sump Recirculation Gate Valves to Pressure Locking	02/28/95	All holders of OLs or CPs for nuclear power reactors.
95-13	Potential for Data Collection Equipment to Affect Protection System Performance	02/24/95	All holders of OLs or CPs for nuclear power reactors.
95-12	Potentially Nonconforming Fasteners Supplied by A&G Engineering II, Inc.	02/21/95	All holders of OLs or CPs for nuclear power reactors.
95-11	Failure of Condensate Piping Because of Erosion/ Corrosion at a Flow-Straightening Device	02/24/95	All holders of OLs or CPs for nuclear power reactors.
95-10 Supp. 1	Potential for Loss of Automatic Engineered Safety Features Actuation	02/10/95	All holders of OLs or CPs for nuclear power reactors.
95-10	Potential for Loss of Automatic Engineered Safety Features Actuation	02/03/95	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

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Pressure-locking may occur in flexible-wedge and parallel disk gate valves when fluid entrapped in the bonnet becomes pressurized and the actuator is incapable of overcoming the additional thrust requirements needed to overcome the increased friction resulting from the differential pressure on both valve disks from the pressurized fluid. IN 95-14 discusses several ways in which fluid may enter the valve bonnet. Thermal binding of gate valves can result from contraction of a valve body as a result of cooling after a gate valve has seated. Like pressure locking, thermal binding can increase the forces that are necessary to unseat the valve. These mechanisms represent potential common-cause failure modes that can render redundant trains of safety-related emergency core cooling systems incapable of performing their safety functions.

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Original signed by
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DOCUMENT NAME: 9514SP1.IN *See previous concurrence

OFFICE	OECB:DOPS	ADM:PUB	SC/OECB:DOPS	EMEB:DE	C:SRXB/DSSA
NAME	DKirkpatrick*	Tech Editor*	EGoodwin*	TScarbrough*	RCJones*
DATE	03/13/95	03/13/95	03/14/95	03/14/95	03/14/95

OFFICE	C/EMEB:DE	OECB:DOPS	C/OECB:DOPS	EMEB:DE	D/DOPS
NAME	RWessman*	RKiessel*	AChaffee*	PChen*	BGrimes
DATE	03/14/95	03/14/95	03/ 14 /95	03/14/95	03/ 15 /95

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DOCUMENT NAME: G:\DON\HDNPLOCK.IN *See previous concurrence

OFFICE	OECB:DOPS	ADM:PUB	SC/OECB:DOPS	EMEB:DE	C:SRXB/DSSA
NAME	DKirkpatrick*	Tech Editor*	EGoodwin*	TScarbrough*	RCJones*
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R.C Jones
3/14/95

SC:EMEB
3/14/95

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Discussion

Pressure-locking may occur in flexible-wedge and parallel disc gate valves when fluid becomes pressurized within the valve bonnet and the actuator is incapable of overcoming the additional thrust requirements needed to overcome the increased friction resulting from the differential pressure on both valve discs from the pressurized fluid. IN 95-14 discusses a number of ways in which fluid may enter the valve bonnet. Another mechanism for locking valves, not identified at Haddam Neck, is the thermal contraction of a valve body as a result of cooling after a gate valve has seated. This effect can increase the forces that are necessary to unseat the valve. These mechanisms represent potential common-cause failure modes that can render redundant trains of safety-related emergency cooling systems incapable of performing their safety functions.

The pressure-locking or thermal-binding of the safety injection admission valves could prevent both high-pressure and low-pressure coolant from promptly reaching the reactor vessel following a LOCA. In addition, the similar failure of a safety injection isolation valve after closure, such as the failure discussed here, could prevent two-path recirculation of the sump water following a LOCA.

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