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

October 4, 1990

NRC INFORMATION NOTICE NO. 90-64: POTENTIAL FOR COMMON-MODE FAILURE OF HIGH PRESSURE SAFETY INJECTION PUMPS OR RELEASE OF REACTOR COOLANT OUTSIDE CONTAINMENT DURING A LOSS-OF-COOLANT ACCIDENT

Addressees:

All holders of operating licenses or construction permits for pressurized-water reactors.

Purpose:

This information notice is being provided to alert addressees to the potential for the common-mode failure of the high-head safety injection pumps (charging pumps) due to gas binding or the release of reactor coolant outside of containment during a loss of coolant accident (LOCA), depending upon the manner in which the vent line isolation valves have been installed. 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:

On July 9, 1990, with the plant in cold shutdown in preparation for refueling operations, the Haddam Neck licensee had the Volume Control Tank (VCT) discharge and vent flow paths isolated in the Chemical and Volume Control System (CVCS). The charging pumps were aligned to the refueling water storage tank (RWST), with a train of the residual heat removal (RHR) system in operation. The Haddam Neck licensee subsequently discovered that water was draining from the VCT through the high-point vent isolation valves (see Figure 1). The 3/4-inch vent line, containing two ASCO solenoid-operated isolation valves, provides for continuous venting of hydrogen from the high points of the charging pump suction piping to the VCT, during normal CVCS letdown operations. Further investigation by the licensee revealed that the ASCO valves would not isolate in the reverse flow direction because the valve disc unseats with a differential pressure across the valve seat of 15-30 psid. The licensee indicated, as a result of discussions held with ASCO, that no ASCO-manufactured solenoid-operated valves were designed to provide isolation in the reverse flow direction.

Initiation of a safety injection actuation signal (SIAS) causes the normal discharge path from the VCT to isolate by automatic closure of the VCT discharge isolation valves. The suction of the charging pumps is then switched

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from the VCT to the RWST. The ASCO vent line isolation valves are shut automatically upon closure of the VCT discharge isolation valves and manually de-energized. With the valves in the closed position, a differential pressure in the reverse flow direction could allow gases in the VCT to pass through the high-point vent line and cause gas binding of the pumps. Haddam Neck responded to this concern by adding two check valves as shown in Figure 1.

Discussion:

At Haddam Neck, the licensee identified a possible common-mode failure to both high-point vent isolation valves in the suction vent line that connects the charging pumps to the VCT. The common mode failure occurs if there is leakage flow through both valves after they have been shut. From their discussions with the valve manufacturer (ASCO), the licensee learned that these valves are designed to provide isolation in one flow direction only. The ASCO valves are identified as solenoid-operated, two-way, 1/2 inch isolation valves with a maximum pressure rating of 400 psig and are commerical grade. The model numbers of the valves are 6109R and L8211D89. The installed configuration of the ASCO valves at Haddam Neck was such that failure of these valves to isolate during a LOCA (i.e., during the ECCS injection phase) could drain down the VCT and allow hydrogen gas in the VCT (and any gas that had accumulated in the vent line) to be transported to the suction of the charging pumps by way of the high-point vent charging pump suction line.

A second scenario, was identified by the licensee involving the recirculation phase of a small-break LOCA, when the RHR pumps supply reactor coolant from the sump to the suction header of the charging pumps. If the ASCO valves are installed in the reverse direction (i.e., to isolate venting from the VCT to the suction of the charging pumps), then the discharge pressure from the RHR pumps would be enough to increase pressure in the vent line to the ASCO isolation valves so as to lift the valve discs off of their seats and pressurize the VCT in excess of the 75 psig VCT relief setpoint. This would allow a release of reactor coolant outside containment.

In addition, if the two ASCO vent line valves are installed in opposite directions, a single failure of a vent line isolation valve could lead to either gas binding or a release of reactor coolant outside of containment. Licensees with similar vent lines and ECCS pump arrangements may wish to review the above information for applicability to their plants.

The effectiveness of the Haddam Neck high point vent configuration (as shown in Figure 1) was not evaluated in conjunction with the development of this information notice. It is important that any plant modifications made to alleviate hydrogen buildup concerns do not introduce other ways for gas to be ingested into the charging pump suction or other safety concerns.

Information notice 88-23, "Potential for Gas Binding of High Pressure Safety Injection Pumps During A Loss-Of-Coolant Accident" (including Supplements 1 and 2) also describes situations that could result in gas binding of high pressure safety injection pumps.

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 NRC regional office.

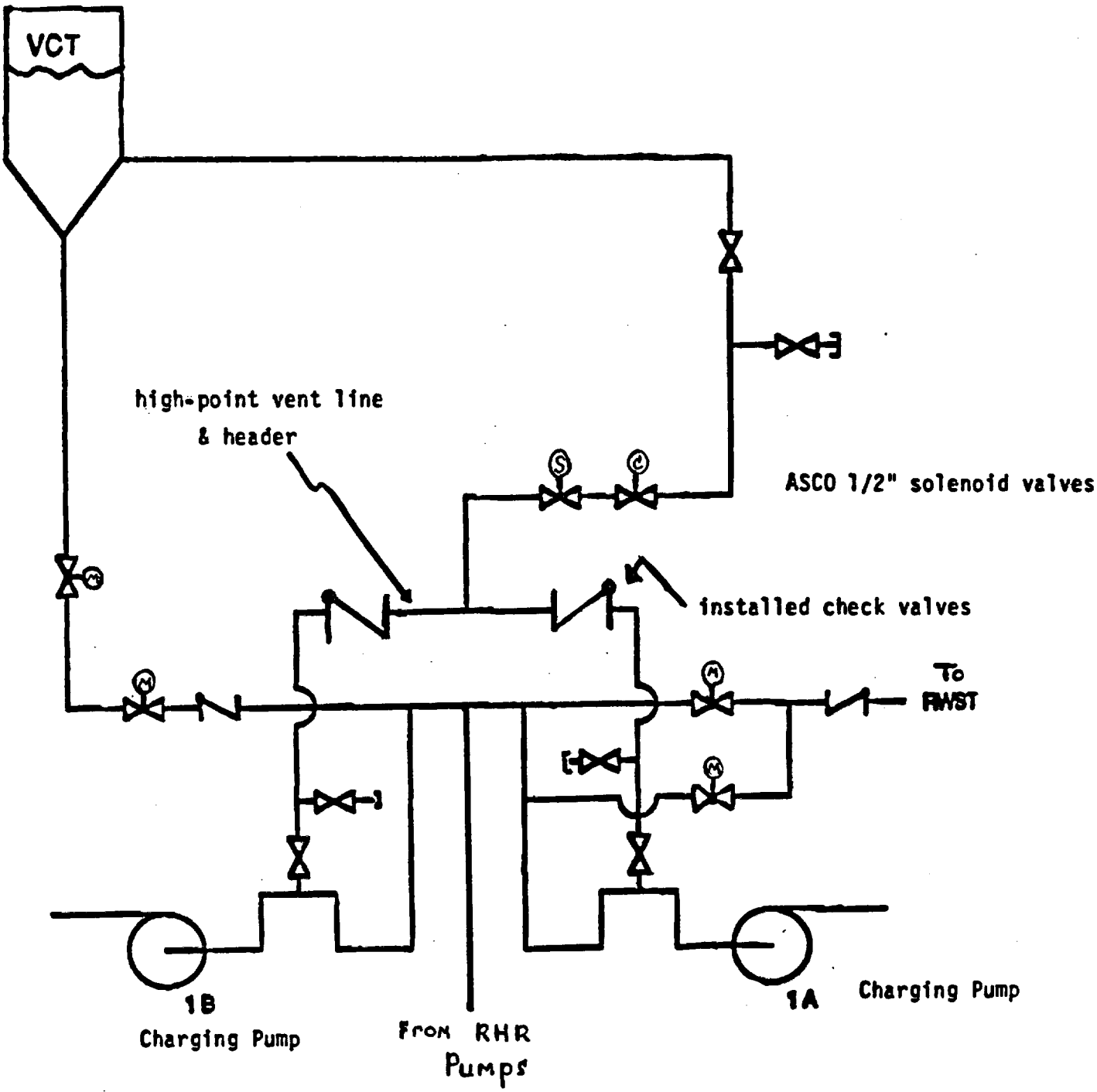
for Carl H. Berlinger

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

Technical Contact: John Thompson, NRR
(301) 492-1171

Attachments: 1. Figure 1, Haddam Neck High Point Vent Line
2. List of Recently Issued NRC Information Notices

Haddam Neck High Point Vent Line



LIST OF RECENTLY ISSUED NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
90-63	Management Attention to the Establishment and Maintenance of A Nuclear Criticality Safety Program	10/3/90	All fuel cycle licensees possessing more than critical mass quantities of special nuclear material.
90-62	Requirements for Import and Distribution of Neutron-Irradiated Gems	9/25/90	All irradiated gemstone importers and distributors, and all non-power licensees.
90-61	Potential for Residual Heat Removal Pump Pump Damage Caused By Parallel Pump Interaction	9/20/90	All holders of OLs or CPs for nuclear power reactors.
90-60	Availability of Failure Data In the Government-Industry Data Exchange Program	9/20/90	All holders of OLs or CPs for nuclear power reactors.
90-59	Errors In the Use of Radioactive Iodine-131	9/17/90	All medical licensees.
90-58	Improper Handling of Ophthalmic Strontium-90 Beta Radiation Applicators	9/11/90	All NRC medical licensees.
90-57	Substandard, Refurbished Potter & Brumfield Relays Misrepresented As New	9/5/90	All holders of OLs or CPs for nuclear power reactors.
90-56	Inadvertent Shipment of A Radioactive Source In A Container Thought To Be Empty	9/4/90	All U.S. Nuclear Regulatory Commission (NRC) licensees.

OL = Operating License
CP = Construction Permit

Information notice 88-23, "Potential for Gas Binding of High Pressure Safety Injection Pumps During A Loss-Of-Coolant Accident" (including Supplements 1 and 2) also describes situations that could result in gas binding of high pressure safety injection pumps.

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/s/ Carl H. Berlinger

for Charles E. Rossi, Director
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and 2) also describes situations that could result in gas binding of high pressure safety injection pumps.

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valves are de-energized and shut upon closure of the VCT discharge isolation valves. With the valves in the closed position, a differential pressure buildup in the reverse flow direction could allow gases in the VCT to be siphoned through the high-point vent line and gas bound the pumps. Haddam Neck responded to this concern by adding two check valves as shown in Figure 1.

Discussion:

At Haddam Neck the licensee identified a possible common-mode failure to both high-point vent isolation valves in the suction vent line that connects the charging pump to the VCT. The common mode failure occurs if there is flow through both valves after they have been shut. From their discussions with the valve manufacturer (ASCO), the licensee learned that these valves are designed to provide isolation in one flow direction only. The installed configuration of the ASCO valves at Haddam Neck was such that failure of these valves to isolate during a LOCA could allow hydrogen gas in the VCT (and any gas that had accumulated in the vent line) to be transported to the suction of the charging pumps by way of the high-point vent charging pump suction line. If the ASCO valves are installed in the reverse direction (i.e., to isolate venting from the VCT to the suction of the charging pumps), then operation of the RHR pumps in a LOCA scenario could allow enough differential pressure to be exerted against the valve discs to lift them off of their seats and pressurize the vent line to the VCT in excess of the 75 psig VCT relief setpoint. This could allow a release of reactor coolant outside containment. If the vent line valves are installed in opposite directions, the safety concern is that a single failure could lead to either gas binding or release of reactor coolant outside of containment. Licensees with similar vent lines and ECCS pump arrangements may wish to review the above information for applicability to their plants.

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