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

May 12, 1988

NRC INFORMATION NOTICE NO. 88-23: POTENTIAL FOR GAS BINDING OF HIGH-PRESSURE SAFETY INJECTION PUMPS DURING A LOSS-OF-COOLANT ACCIDENT

Addressees:

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

Purpose:

The purpose of this information notice is to alert addressees to potential problems resulting from hydrogen transport from the volume control tank and accumulation in emergency core cooling system piping. 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 February 26, 1988, the licensee was operating Farley 1 at power near the end of the current fuel cycle. Valves 8706A and B (see Figure 1) had been stroked as required for surveillance testing. After testing was completed, the licensee noted that the boron concentration in the reactor coolant system was higher than expected and suspected that there was leakage through one of these valves. To determine whether valve 8706A was seated, the licensee took a coolant sample from a vent downstream from the valve in order to analyze the sample for boron concentration. Fifty cubic feet of gas was vented from the line before a coolant sample could be obtained. The gas was 98 percent hydrogen.

Discussion:

Farley 1 has three centrifugal charging pumps and two centrifugal residual heat removal (RHR) pumps. During a loss-of-coolant accident (LOCA), the charging pumps function as high-pressure safety injection (HPSI) pumps, and the RHR pumps function as low-pressure safety injection (LPSI) pumps. When a safety injection signal is generated, the discharge sides of the HPSI and LPSI pumps are aligned to supply coolant to the cold legs of the reactor coolant system, the suction sides of the HPSI and LPSI pumps are aligned to the refueling water storage tank (RWST), and the pumps are started. At the low water level setpoint for the RWST

when transferring to the recirculation mode, the suction sides of the LPSI pumps are realigned from the RWST to the sump. At the same time, the discharge sides of the LPSI pumps are aligned to supply coolant to the suction header for the HPSI pumps as well as the cold legs of the reactor coolant system. In addition, the two block valves in the HPSI suction header between HPSI pumps B and C close to establish independent trains.

Had a small-break LOCA occurred before the line downstream of valve 8706A was vented, 50 cubic feet of hydrogen would have been swept through HPSI pumps A and B when valve 8706A opened. The licensee stated that if 6 cubic feet of hydrogen were swept through one HPSI pump as a single gas bubble, the pump might be damaged significantly. Whether or not hydrogen gas causes significant damage to HPSI pumps A and B depends on the amount of mixing of hydrogen and water before the mixture enters the pumps and on the distribution of hydrogen bubbles between HPSI pumps A and B. Because of this uncertainty, the operability of HPSI pumps A and B would be in question with hydrogen trapped in lines upstream of the pumps.

Figure 1 shows the layout for piping and components on the suction side of the HPSI pumps for Units 1 and 2. For Unit 1, to provide physical separation of the lines from the LPSI pumps to the suction header for the HPSI pumps, the architect-engineer routed the line containing valve 8706A so that part of the line is 32 feet above the line from the volume control tank (VCT). Figure 2 shows the elevations of horizontal piping on the suction side of the HPSI pumps. The lines for Unit 2 were arranged in a similar way.

Hydrogen is normally used for the cover gas in the VCT; thus, water flowing through the VCT is saturated with hydrogen while it is in the VCT. If the local pressure in the piping at some point between the VCT and HPSI pump suction nozzles is less than VCT pressure, the dissolved hydrogen will come out of solution and will not immediately go back into solution even if the pressure downstream from that point is greater than VCT pressure. The licensee believes that the pressure distribution in some elbows and tees downstream from the VCT is such that some hydrogen comes out of solution in those fittings and that these hydrogen bubbles are swept through the pumps without damaging them. In the suction piping of pump A, however, some of the bubbles are trapped in the vertical section of line that runs to the high point vent. Data obtained by the licensee indicate that the collection rate is approximately 5 cubic feet per day.

At Unit 2, there is a second hydrogen collection point in the suction piping for HPSI pump B (see Figure 3). With pump B out of service, hydrogen gas collects between the tee and the closed valve.

The licensee has taken interim corrective action to avoid declaring HPSI pump A in Unit 1 and HPSI pumps A and B in Unit 2 inoperable. In Units 1 and 2, the line downstream from valves 8706A is vented once each shift to remove accumulated hydrogen gas. In Unit 2, only pump B is normally operated so that hydrogen gas bubbles are swept through the pump and cannot accumulate.

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: Roger Woodruff, NRR
(301) 492-1180

Attachments:
1. Figure 1 - Farley 1 & 2 Charging Pump Schematic
2. Figure 2 - Farley 1 Horizontal Piping Elevations
3. Figure 3 - Farley 2 Horizontal Piping Elevations
4. List of Recently Issued NRC Information Notices

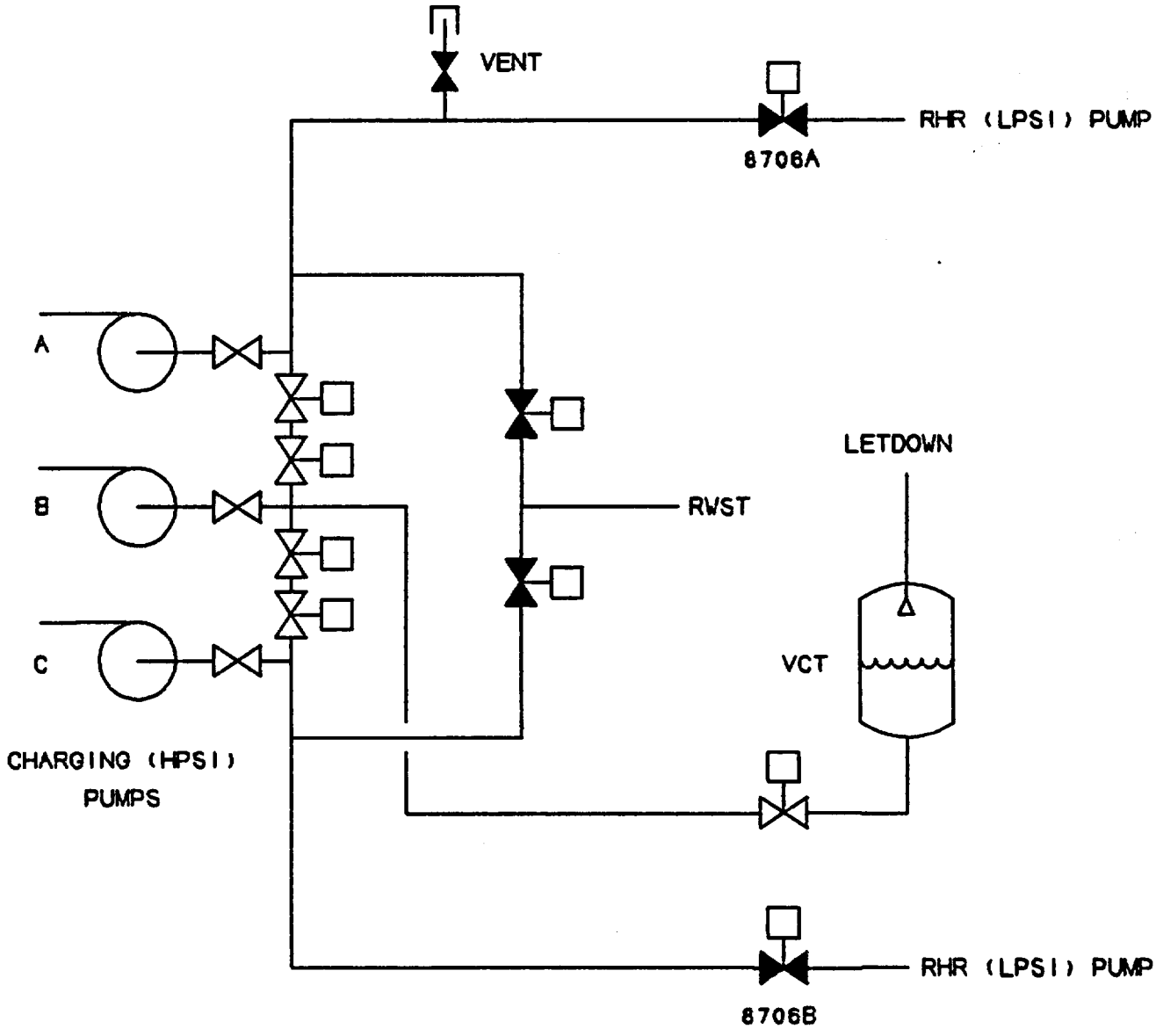

FIGURE 1 - FARLEY 1 & 2 CHARGING PUMP SCHEMATIC

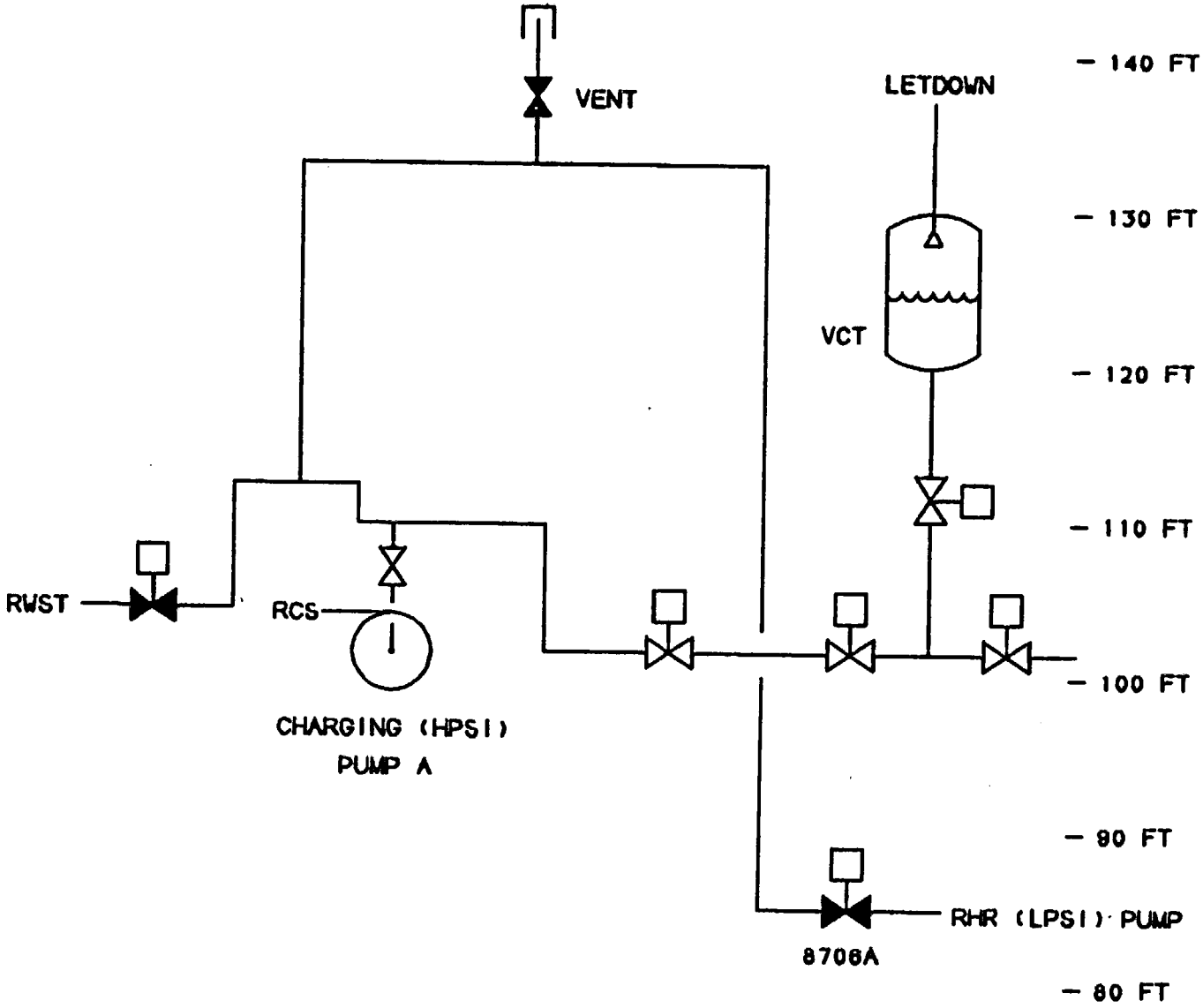

FIGURE 2 - FARLEY 1 HORIZONTAL PIPING ELEVATIONS

Attachment 2

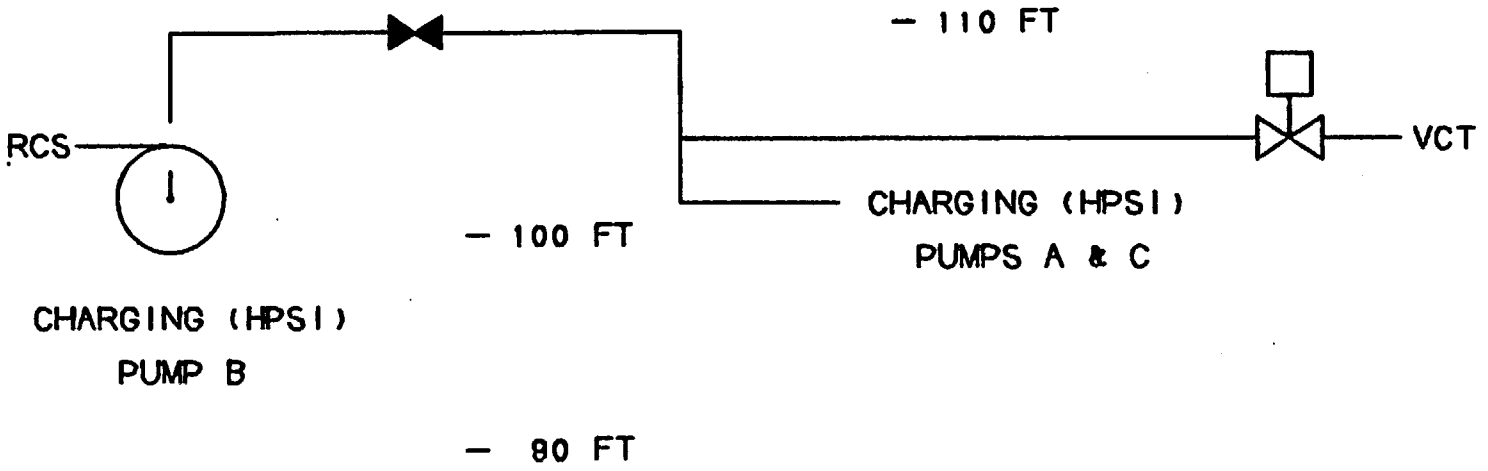

FIGURE 3 - FARLEY 2 HORIZONTAL PIPING ELEVATIONS

Attachment 3

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
88-22	Disposal of Sludge from Onsite Sewage Treatment Facilities at Nuclear Power Stations	5/12/88	All holders of OLs or CPs for nuclear power reactors.
88-21	Inadvertent Criticality Events at Oskarshamn and at U.S. Nuclear Power Plants	5/9/88	All holders of OLs or CPs for nuclear power reactors.
88-20	Unauthorized Individuals Manipulating Controls and Performing Control Room Activities	5/5/88	All holders of OLs or CPs for nuclear power, test and research reactors, and all licensed operators.
88-19	Questionable Certification of Class 1E Components	4/26/88	All holders of OLs or CPs for nuclear power reactors.
88-18	Malfunction of Lockbox on Radiography Device	4/25/88	All NRC licensees authorized to manufacture, distribute, and/or operate radiographic exposure devices.
88-17	Summary of Responses to NRC Bulletin 87-01, "Thinning of Pipe Walls in Nuclear Power Plants"	4/22/88	All holders of OLs or CPs for nuclear power reactors.
88-16	Identifying Waste Generators in Shipments of Low-Level Waste to Land Disposal Facilities	4/22/88	Radioactive waste collection and service company licensees handling prepackaged waste, and licensees operating low-level waste disposal facilities.

OL = Operating License
CP = Construction Permit

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* See previous concurrence

EAB:NRR*	EAB:NRR*	TECH:ED*	C:EAB:NRR*	C:GCB:NRR	D:DOEA:NRR
RWoodruff:	RLobel	MMejac	WLanning	CHBerlinger	CERossi
4/29/88	4/29/88	5/4/88	4/29/88	5/ /88	5/ /88

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R.W.W. RL

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