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

April 4, 1989

NRC INFORMATION NOTICE: NO. 89-36: EXCESSIVE TEMPERATURES IN EMERGENCY CORE COOLING SYSTEM PIPING LOCATED OUTSIDE CONTAINMENT

Addressees:

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

Purpose:

This information notice is being provided to alert addressees to an event that involved the potential for reactor coolant system (RCS) leakage outside containment. A check valve serving as the inboard containment isolation valve in a high-pressure injection (HPI) system injection line failed to seat properly after termination of HPI flow, allowing RCS backflow into HPI system piping that was not qualified for RCS temperatures. The HPI system piping was exposed to fluid temperatures in excess of design temperatures, resulting in stresses that exceeded the allowable limits for Class 1 piping according to the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section III. Recipients are expected to 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 January 20, 1989, at Arkansas Nuclear One, Unit 1 (ANO-1), a failure of the main generator exciter resulted in a generator lockout and subsequent trips of the main turbine and the reactor. Upon loss of power to plant loads from the main generator, one of the two non-safety-related 6.9 kV buses failed to automatically fast transfer from the unit auxiliary transformer to the startup transformer; this failure caused two of the four reactor coolant pumps (RCPs) to trip on undervoltage. A failure of one of the main feedwater (MFW) pumps to runback to minimum speed and a failure of a MFW block valve and control valves to close after the reactor trip resulted in overfeed of the once through steam generators; this overfeed caused a slight overcooling (11°F) of the RCS. The operators manually started one HPI system pump to maintain pressurizer level above the heater cutoff point. The pump was secured 2 minutes later; however, check valve MU-34B in the "B" HPI line did not seat properly (see Figure 1). The existing RCP configuration (i.e., two pumps running and two

IDR-11C

pumps tripped) created a differential pressure across MU-34B that caused RCS backflow into the HPI system piping outside containment. The flow path ran from the RCS and outside containment via MU-34B, through the crossover pipe to the "C" HPI line, and then back inside containment to the RCS via MU-34C as shown in Figure 1. The HPI system piping upstream of MU-34B was not qualified for RCS temperatures. Subsequent analysis by the licensee (assuming a RCS temperature of 545° F) showed that the temperature effects resulted in stresses that exceeded ASME code-allowable limits for Class 1 piping. The HPI system piping was qualified for RCS pressure but was only designed for a temperature of 145° F. The licensee became aware of RCS leakage outside containment when tape attached to the HPI piping began to melt, smolder and smoke, activating a local smoke detector and the associated control room alarm.

Discussion:

The primary concerns are that the failure of a check valve to seat properly exposed piping located outside containment to RCS temperature and that the piping was not designed for RCS temperatures. Furthermore, the check valve serves as the inboard containment isolation valve, but valve testing (consisting of visual inspection and vertical stroke of the valve disc) was not adequate to reveal the excessive wear problem that led to its failure. Because the piping outside containment was not monitored to detect RCS in-leakage (e.g., high temperature alarms), the piping potentially could be exposed to RCS temperatures for long periods without being detected. It is important for addressees to note the need for piping to be qualified for potential inservice conditions and that the associated components, that are part of the reactor coolant pressure boundary, are subject to applicable ASME Code requirements which include, in part, leak detection, isolation and periodic testing.

Corrective actions proposed by the licensee include installation of a second check valve in each HPI line inside containment, installation of temperature-monitoring instrumentation in the HPI lines outside containment between the containment penetration and the first outboard check valve, replacement of all piping that was determined to be overstressed from high temperature during the event, and leak rate testing for all check valves in the HPI lines inside containment.

Subsequent review by the licensee identified HPI system pipe supports that are not qualified for the maximum temperature to which the associated piping could be exposed when the HPI system is used in the piggyback mode of operation. The licensee is upgrading the pipe supports. It is important that system piping be analyzed and qualified for the maximum temperature and pressure to which it could be exposed, regardless of whether credit is given in the final safety analysis report (FSAR) transient/accident analysis for the associated mode of operation.

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

Edward L. Butcher/bor

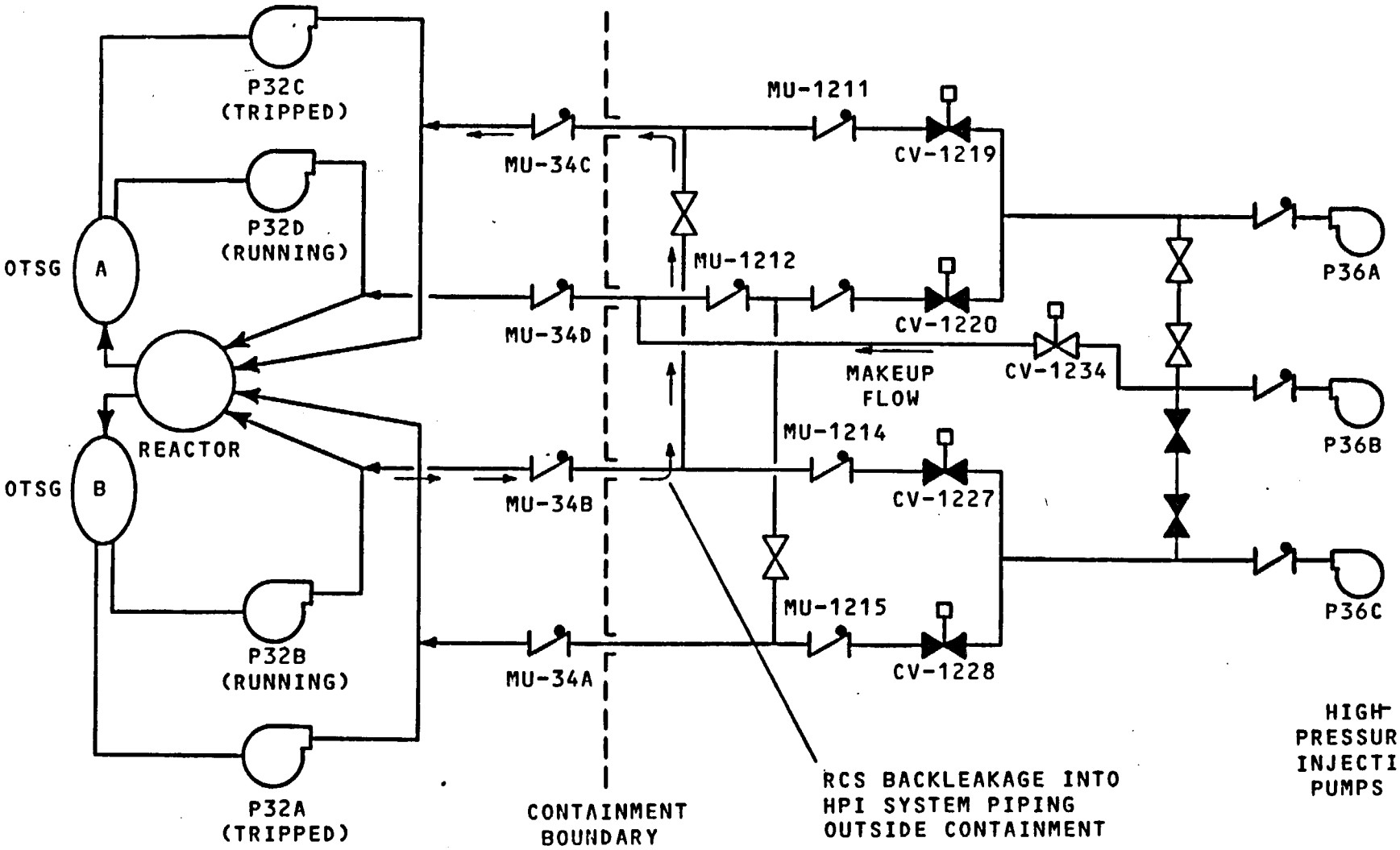
Charles E. Rossi, Director
Division of Operational Events Assessment
Office of Nuclear Reactor Regulation

Technical Contacts: Rick Kendall, NRR
(301) 492-3140

Yueh-Li Li, NRR
(301) 492-0915

Attachments:
1. Figure 1 - ANO High Pressure Injection System Flow Path to the Reactor Coolant System (Simplified Diagram)
2. List of Recently Issued NRC Information Notices

FIGURE 1 - ANO-1 HIGH PRESSURE INJECTION SYSTEM FLOW PATH TO THE REACTOR COOLANT SYSTEM (SIMPLIFIED DIAGRAM)




Attachment 1
1N 39-36
April 4, 1989
Page 1 of 1

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

| Information Notice No. | Subject | Date of Issuance | Issued to |
|---|---|---|---|
| 88-86, Supp. 1 | Operating with Multiple Grounds in Direct Current Distribution Systems | 3/31/89 | All holders of OLs or CPs for nuclear power reactors. |
| 89-35 | Loss and Theft of Unsecured Licensed Material | 3/30/89 | All U.S. NRC byproduct, source and special nuclear material licensees. |
| 89-34 | Disposal of Americium Well-Logging Sources | 3/30/89 | All holders of an NRC specific license authorizing well-logging activities. |
| 89-33 | Potential Failure of Westinghouse Steam Generator Tube Mechanical Plugs | 3/23/89 | All holders of OLs or CPs for PWRs. |
| 89-32 | Surveillance Testing of Low-Temperature Overpressure-Protection Systems | 3/23/89 | All holders of OLs or CPs for PWRs. |
| 89-31 | Swelling and Cracking of Hafnium Control Rods | 3/22/89 | All holders of OLs or CPs for PWRs with Hafnium control rods. |
| 89-30 | High Temperature Environments at Nuclear Power Plants | 3/15/89 | All holders of OLs or CPs for nuclear power reactors. |
| 89-29 | Potential Failure of ASEA Brown Boveri Circuit Breakers During Seismic Event | 3/15/89 | All holders of OLs or CPs for nuclear power reactors. |
| 89-28 | Weight and Center of Gravity Discrepancies for Copes-Vulcan Air-Operated Valves | 3/14/89 | All holders of OLs or CPs for nuclear power reactors. |

OL = Operating License
CP = Construction Permit

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

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

Technical Contacts: Rick Kendall, NRR
(301) 492-3140

Yueh-Li Li, NRR
(301) 492-0915

Attachments:
1. Figure 1 - ANO High Pressure Injection System Flow Path to the Reactor Coolant System (Simplified Diagram)
2. List of Recently Issued NRC Information Notices

*SEE PREVIOUS CONCURRENCE

| OFC | :*EAB:NRR | :*EAB:NRR | :*TECH:ED | :*C:EMEB:DEST | :*C:EAB:NRR | :*C:OGCB:NRR | :D:DOEA:NRR |
|---|---|---|---|---|---|---|---|
| NAME | :RKendall:db | :RLobel | : | :TMarsh | :WDLanning | :CHBerlinger | :CERossi |
| DATE | :3/16/89 | :3/22/89 | : 3/16/89 | :3/24/89 | :3/29/89 | :3/29 /89 | :3/29/89 |

OFFICIAL RECORD COPY

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

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

Technical Contacts: Rick Kendall, NRR
(301) 492-3140

Yueh-Li Li, NRR
(301) 492-0915

Attachments:
1. Figure 1 - ANO High Pressure Injection System Flow Path to the Reactor Coolant System (Simplified Diagram)
2. List of Recently Issued NRC Information Notices

*SEE PREVIOUS CONCURRENCE

| OFC | :EAB:NRR | :EAB:NRR | :*TECH:ED | :C:EMEB:DEST | :C:EAB:NRR | :C:OGCB:NRR | :D:DOEA:NRR |
|---|---|---|---|---|---|---|---|
| NAME | :RKendall:db | :RLobel | : | :TNarsh | :WDLanning | :CHBerlinger | :CERossi |
| DATE | :03/16/89 | :3/22/89 | : 1 /89 | :3/24/89 | :3/29/89 | :3/29/89 | : 1 /89 |

OFFICIAL RECORD COPY