

# LIS ORIGINAL

SSINS No.: 6835  
IN 86-74

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF INSPECTION AND ENFORCEMENT  
WASHINGTON, DC 20555

August 20, 1986

IE INFORMATION NOTICE NO. 86-74: REDUCTION OF REACTOR COOLANT INVENTORY  
BECAUSE OF MISALIGNMENT OF RHR VALVES

Addressees:

All boiling water reactor facilities holding an operating license or a construction permit.

Purpose:

This notice is provided to inform recipients of NRC's continuing concern with the potential for draining the reactor coolant system because of residual heat removal system (RHR) valve misalignment. This is a recurring situation previously addressed in Information Notice (IN) 84-81 and General Electric Company's (GE's) Service Information Letter (SIL) 388. This notice is considered an interim action pending further review of this problem.

Suggestions contained in this notice do not constitute NRC requirements; therefore, no specific action or written response is required. It is expected, however, that recipients will carefully review the information for applicability to their facilities and consider actions to preclude similar problems from occurring at their facilities.

Description of Circumstances:

A number of events involving reduction of reactor coolant inventory because of RHR valve misalignment have occurred since the issuance of IN 84-81. Six events that occurred in 1985 have been selected for inclusion in this notice. A seventh case was included since RHR was intentionally used to drain water from the reactor cavity. (Refer to Attachment 1 for diagram and definition of pathways.)

SUSQUEHANNA 2, 04/27/85

While attempting to align B-loop RHR in the shutdown cooling mode, a portion of the RHR piping was inadvertently drained to the main condenser during the warmup process. When the operator opened the heat exchanger bypass valve F0488, water drained rapidly from the vessel, refilling the RHR piping, and waterhammer occurred. The reactor vessel level decreased 35 inches. Reactor scram and primary containment isolation system (PCIS) actuation\* occurred on the reactor low-level signal. (Pathway 5)

\*Typical scram and PCIS actuation set point is +12.5 inches or 162 inches above active fuel.

WNP-2, 05/07/85

While shifting from shutdown cooling to low pressure coolant injection (LPCI) lineup, suppression pool suction valve F004 was opened before shutdown cooling suction valve F006 was shut (valves F008 & F009 were open). The operator did not allow for the stroke times of the valves. Water level rapidly fell to the scram and PCIS actuation set point. The final water level was +5 inches. (Pathway 1)

SUSQUEHANNA 1, 05/16/85

The minimum flow bypass valve F064A failed open while starting C-pump for shutdown cooling with valves F008A and F009A open. (Pathway 3)

SUSQUEHANNA 1, 05/20/85

The minimum flow bypass valve F064A failed open while starting A-pump for shutdown cooling with valves F008A and F009A open. (Pathway 3)

SHOREHAM, 07/26/85

While shifting from shutdown cooling to LPCI lineup, the F004 valve was opened before the F006 valve shut (valves F008 & F009 were open). Approximately 7500 gallons of reactor inventory was drained to the suppression pool. The incident was terminated by PCIS actuation on the low reactor water level signal. The final water level was -10 inches as opposed to the normal level of about +39 inches. (Pathway 1)

PEACH BOTTOM 2, 09/24/85

The 2A RHR pump was being realigned from shutdown cooling to the full flow test mode. With valves F008A, F009A and F006C open, the discharge valve to the suppression pool F024A was opened in the 2A line, allowing reactor water to flow to the torus. On reaching the reactor water low-level set point, the reactor scrammed and PCIS actuated to terminate the event. The final water level was -10 inches. (Pathway 2)

VERMONT YANKEE, 05/22/86

During refueling operations, the equipment pool, cavity and reactor, and spent fuel pool were communicating. With no one on the refueling floor to observe level and less control room attention than necessary to prevent the event, water level increased to the point that water was flowing into the ventilation ducts. To lower water level, operators aligned shutdown cooling to the torus. Although effective in this case to stop the overflow, use of the RHR pump and valves to drain the cavity is not recommended in GE SIL 388.

Discussion:

The RHR system has several modes of operation including the shutdown cooling mode. Shutdown cooling makes use of the same piping, valves, pumps, and heat exchangers that the LPCI function uses. The misalignment of shutdown cooling valves with its potential for RHR system damage and draining of the reactor coolant system is of regulatory concern.

Generic Letter 83-28, dated July 8, 1983, Required Action 2.2: "Equipment Qualification and Vendor Interface," paragraph 2, states that "licensees and applicants shall establish, implement and maintain a continuing program to ensure that vendor information for safety-related components is complete, current and controlled throughout the life of their plants, and appropriately referenced or incorporated in plant instructions and procedures." A relevant vendor communication is GE SIL 388 which states that shutdown cooling "is entirely controlled by manual operator actions and is, therefore, subject to operator error which could result in hydraulic and thermal conditions not specifically considered in the design process." It recommends review and upgrading of operating procedures and operator training programs to minimize operator error during operation of the shutdown cooling mode of RHR.


Possible operator errors identified in SIL 388 include the opening of the F004 valve before the F006 valve is shut, intentional use of shutdown cooling for vessel level reduction, opening of the minimum flow bypass line, use of the test return line, and opening of the upper containment pool return line (BWR/6). This latter possibility is designated pathway 4 in Attachment 1. Also, GE cautions against the use of RHR shutdown cooling to drain the cavity because of possible thermal and hydraulic conditions not explicitly considered in the design process and possible equipment damage.

Since the RHR pumps each have a capacity of 10,000 gpm, two operating pumps can transfer 20,000 gpm (that is, more than 1,000,000 gallons per hour) from the vessel to the suppression pool. Also, the paths involving gravity flow are through large diameter piping systems with a considerable differential height between the vessel and the suppression pool. The reactor and cavity, the equipment pool, and the spent fuel pool above the bottom of the fuel transfer slot contain around 800,000 gallons of water. Quantities of 5000 to 50,000 gallons have been rapidly drained in previous incidents, usually terminated by the operation of PCIS. PCIS has mitigated several of the events, although technical specifications generally do not require PCIS to be operable in modes where shutdown cooling is required.

Because the problems of draining the vessel through misalignment of the RHR valves continue to occur in spite of GE and NRC communications alerting licensees to them, the NRC is considering what further action should be taken.

IN 86-74  
August 20, 1986  
Page 4 of 4

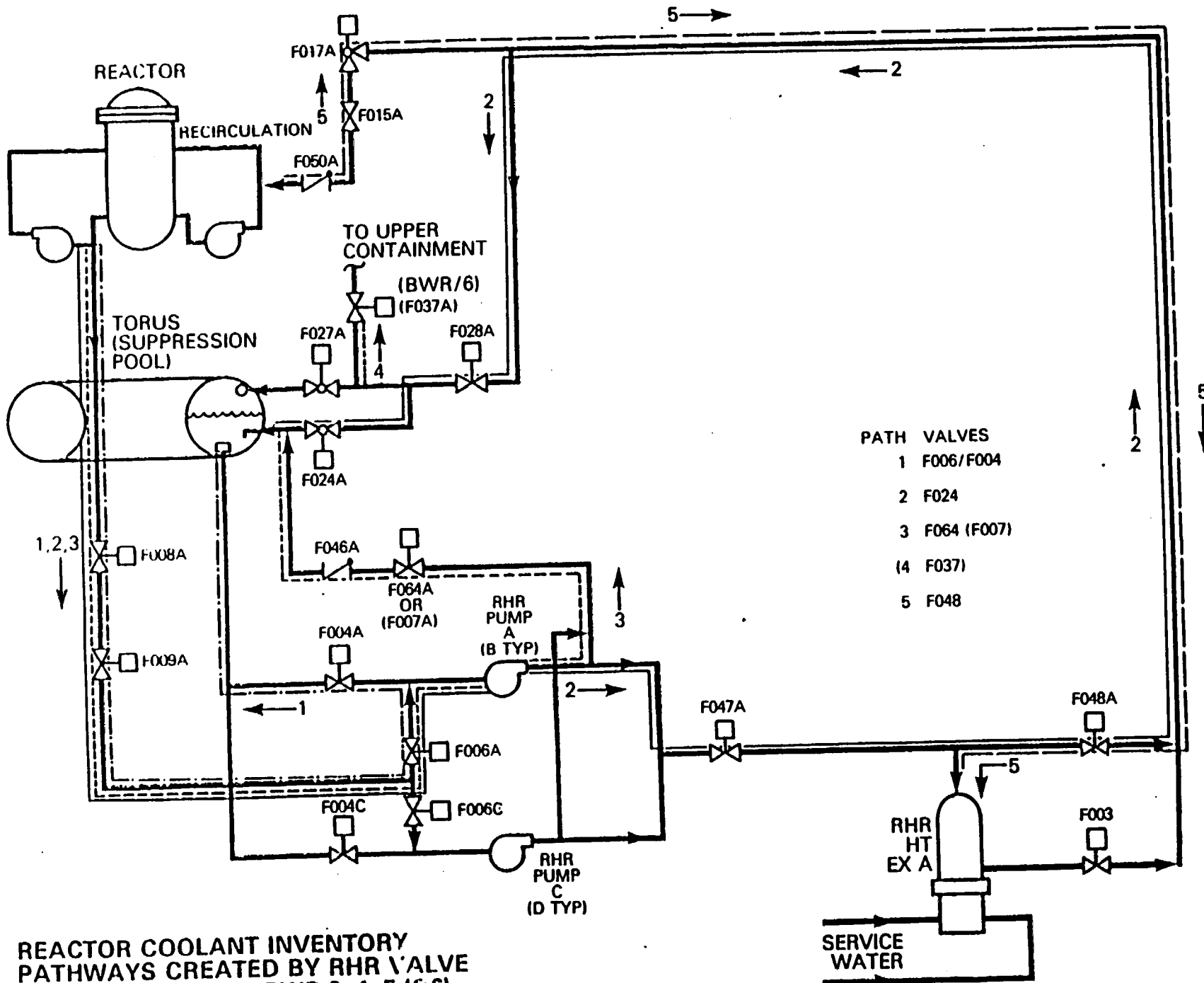
No specific action or written response is required by this information notice. If you have any questions about this matter, please contact the Regional Administrator of the appropriate regional office or this office.

  
Edward L. Jordan, Director  
Division of Emergency Preparedness  
and Engineering Response  
Office of Inspection and Enforcement

Technical Contact: Mary S. Wegner, IE  
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Attachments:

1. Reactor Coolant Inventory Pathways Created by RHR Valve Misalignment
2. List of Recently Issued IE Information Notices



REACTOR COOLANT INVENTORY  
 PATHWAYS CREATED BY RHR VALVE  
 MISALIGNMENT BWR 3, 4, 5 (&6)

LIST OF RECENTLY ISSUED  
 IE INFORMATION NOTICES

Information Notice No.	Subject	Date of Issue	Issued to
86-73	Recent Emergency Diesel Generator Problems	8/20/86	All power reactor facilities holding an OL or CP
86-72	Failure 17-7 PH Stainless Steel Springs In Valcor Valves Due to Hydrogen Embrittlement	8/19/86	All power reactor facilities holding an OL or CP
86-71	Recent Identified Problems With Limitorque Motor Operators	8/19/86	All power reactor facilities holding an OL or CP
86-70	Spurious System Isolation Caused By The Panalarm Model 86 Thermocouple Monitor	8/18/86	All GE BWR facilities holding an OL or CP
86-69	Scram Solenoid Pilot Valve (SSPV) Rebuild Kit Problems	8/18/86	All BWR facilities holding an OL or CP
86-68	Stuck Control Rod	8/15/86	All BWR facilities holding an OL or CP
86-67	Portable Moisture/Density Gauges: Recent Incidents And Common Violations Of Requirements For Use, Transportation, And Storage	8/15/86	All NRC licensees authorized to possess, use, transport, and store sealed sources
86-66	Potential For Failure Of Replacement AC Coils Supplied By The Westinghouse Electric Corporation For Use In Class 1E Motor Starters And Contractors	8/15/86	All power reactor facilities holding an OL or CP
86-65	Malfunctions Of ITT Barton Model 580 Series Switches During Requalification Testing	8/14/86	All power reactor facilities holding an OL or CP

OL = Operating License  
 CP = Construction Permit