

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

October 19, 1989

NRC INFORMATION NOTICE NO. 89-71: DIVERSION OF THE RESIDUAL HEAT REMOVAL
PUMP SEAL COOLING WATER FLOW DURING
RECIRCULATION OPERATION FOLLOWING A
LOSS-OF-COOLANT ACCIDENT

Addressees:

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

Purpose:

This information notice is intended to alert addressees to a potential problem resulting from a design deficiency that may affect the operability of the residual heat removal (RHR) pumps during recirculation operation following a loss-of-coolant accident (LOCA). The problem, which can occur as a result of a single failure can cause a diversion of the cooling water flow from the RHR pump seal coolers, resulting in inadequate seal cooling and the potential for ultimate failure of the RHR pumps. 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:

During a probabilistic risk assessment (PRA) study of the emergency core cooling system at Haddam Neck, the licensee discovered that a single failure in response to a LOCA could disable both RHR pumps. The single failure would cause the diversion of the cooling water flow from the RHR pump seal coolers resulting in inadequate seal cooling and possible pump failure.

As indicated in Attachment 1, cooling water for the RHR pump seal coolers comes from the cooling water inlet lines to each RHR heat exchanger. During normal operation, the component cooling water system provides cooling to the RHR heat exchangers and pump seal coolers. However, during a LOCA condition, component cooling water is isolated, and service water is used to provide cooling to the RHR components. Because the RHR pump seal cooler water supply line is cross-connected to both the component cooling and service water systems, a failure of one of the service water motor-operated valves to open following a LOCA would result in only one branch of service water being available to provide cooling to both RHR heat exchangers and the seal water coolers.

8910130014

ZA

EDR-11C

Under these conditions, the RHR seal water coolers would receive inadequate flow, with the potential for ultimately causing the failure of both RHR pumps. The licensee corrected this problem by installing check valves in the seal water cooling piping (shown in Attachment 2) to preclude one branch of service water from feeding two RHR heat exchangers.

Discussion of Safety Significance:

The design deficiency described above was identified in a plant that switches cooling water systems during a LOCA. However, the problem could occur in any auxiliary cooling water system that provides sizably different cooling needs for different redundant components such as RHR heat exchangers and seal coolers. The important feature in the system is the interconnecting piping between the auxiliary cooling water system branches and the piping to the individual components.

In the situation described in this notice, a single failure of a valve to open would cause one branch of auxiliary cooling water to service multiple redundant components, thereby reducing flow below design requirements. Licensees may wish to review their auxiliary cooling water system designs for similar deficiencies. Several other flow design problems that affect operation while in the recirculation mode following a LOCA have been previously identified in IN 87-63, "Inadequate Net Positive Suction Head in Low Pressure Safety Systems," and IN 88-74, "Potentially Inadequate Performance of ECCS in PWRs During Recirculation Operation Following a LOCA." It is important to note that a flow balance analysis would determine the impact of asymmetric flow balances caused by single failures in these systems. A simple review of piping diagrams may be sufficient to identify systems with potential flow problems, but hydraulic analyses are necessary to confirm suspected problems.

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 NRR project manager.


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

Technical Contacts: S. Israel, AEOD
(301) 492-4437

D. Prochnow, NRR
(301) 492-1166

Attachments:

1. Diagram of Haddam Neck's Original RHR Cooling Water System
2. Diagram of Haddam Neck's Modified RHR Cooling Water System
3. List of Recently Issued NRC Information Notices

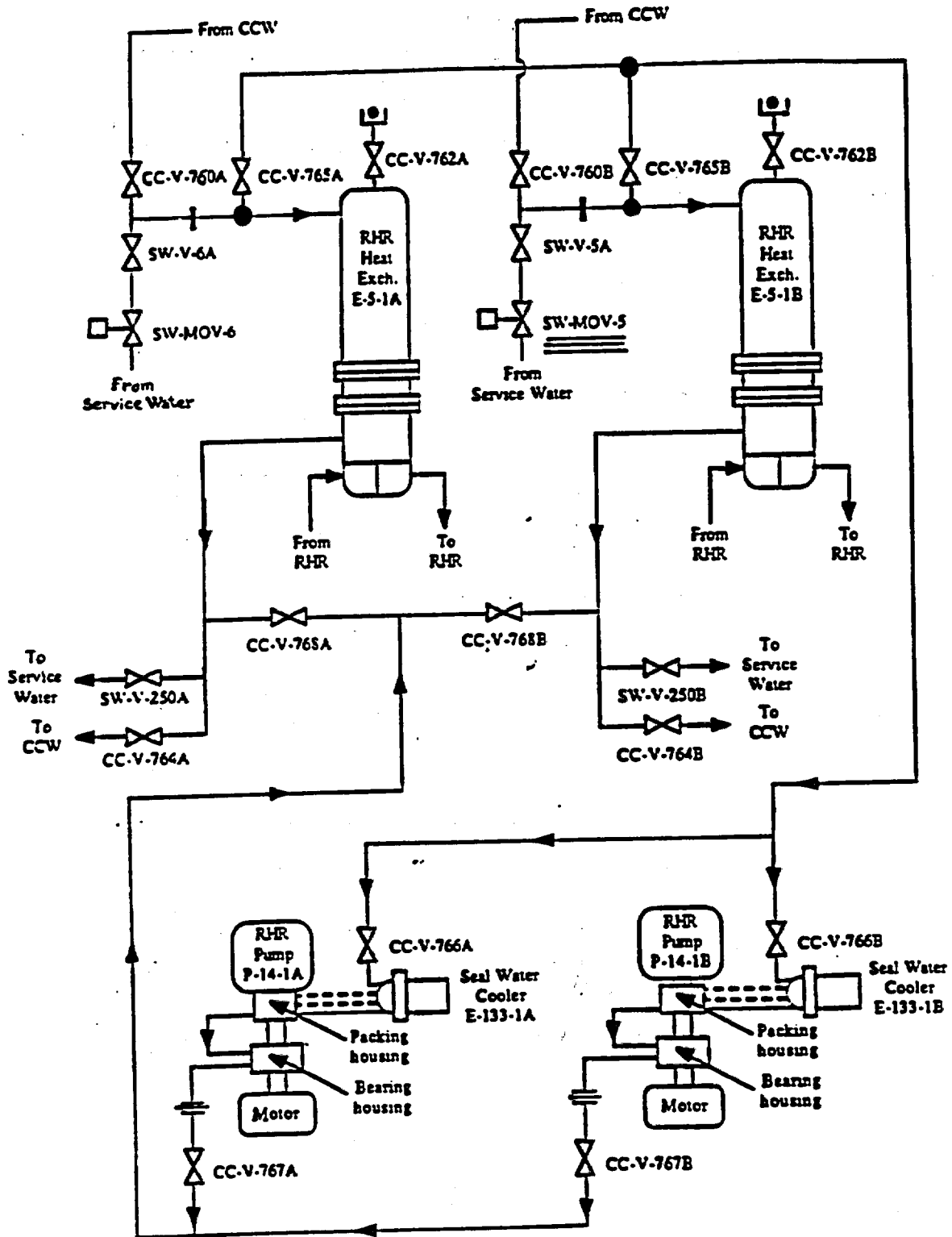


Diagram of Haddam Neck's Original RHR Cooling Water System

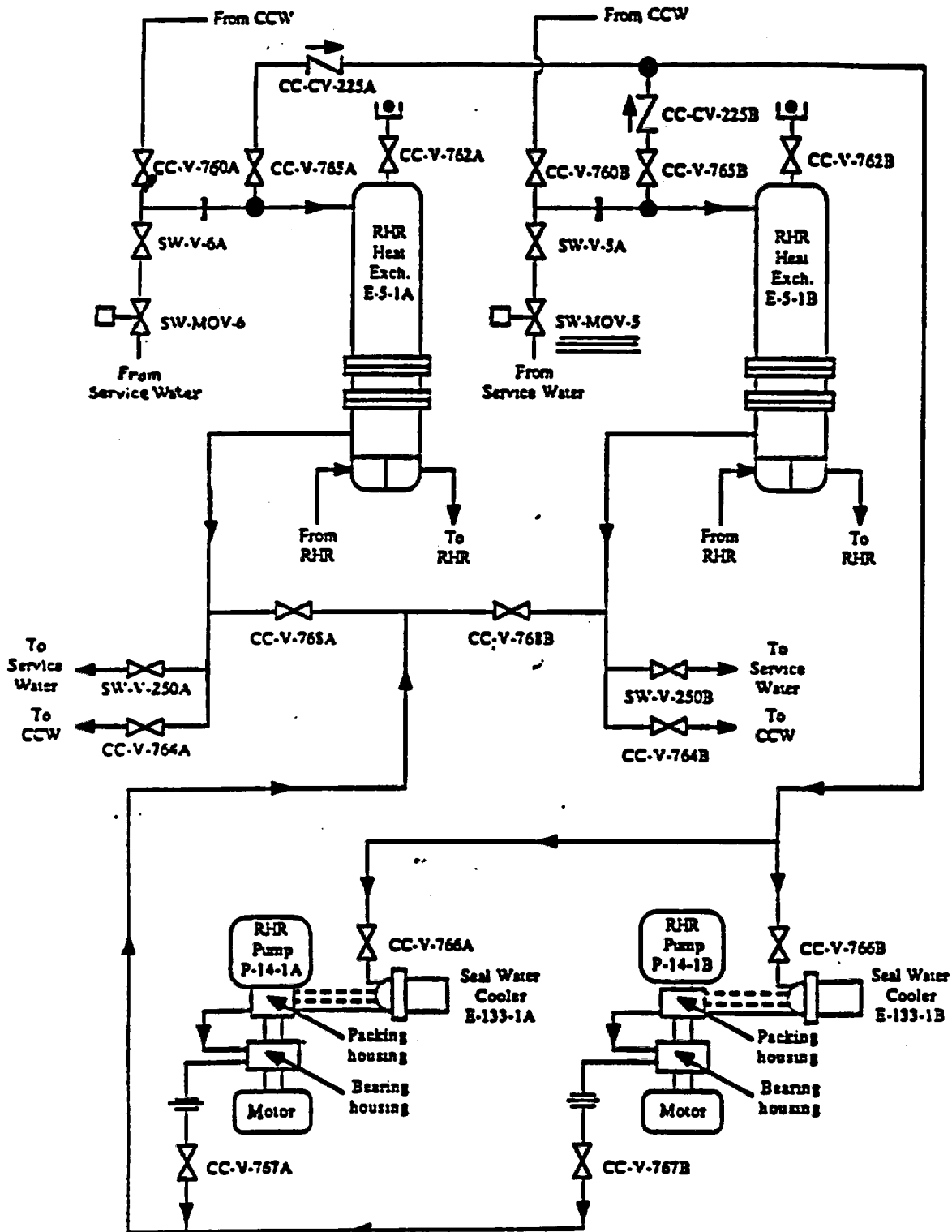


Diagram of Laddam Neck's Modified RHR Cooling Water System

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
89-70	Possible Indications of Misrepresented Vendor Products	10/11/89	All holders of OLS or CPs for nuclear power reactors.
89-69	Loss of Thermal Margin Caused by Channel Box Bow	9/29/89	All holders of OLS or CPs for BWRs.
89-68	Evaluation of Instrument Setpoints During Modifications	9/25/89	All holders of OLS or CPs for nuclear power reactors.
89-67	Loss of Residual Heat Removal Caused by Accumulator Nitrogen Injection	9/13/89	All holders of OLS or CPs for PWRs.
89-66	Qualification Life of Solenoid Valves	9/11/89	All holders of OLS or CPs for nuclear power reactors.
88-46, Supp. 4	Licensee Report of Defective Refurbished Circuit Breakers	9/11/89	All holders of OLS or CPs for nuclear power reactors.
89-65	Potential for Stress Corrosion Cracking in Steam Generator Tube Plugs Supplied by Babcock and Wilcox	9/8/89	All holders of OLS or CPs for PWRs.
89-64	Electrical Bus Bar Failures	9/7/89	All holders of OLS or CPs for nuclear power reactors.
89-63	Possible Submergence of Electrical Circuits Located Above the Flood Level Because of Water Intrusion and Lack of Drainage	9/5/89	All holders of OLS or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

Under these conditions, the RHR seal water coolers would receive inadequate flow, with the potential for ultimately causing the failure of both RHR pumps. The licensee corrected this problem by installing check valves in the seal water cooling piping (shown in Attachment 2) to preclude one branch of service water from feeding two RHR heat exchangers.

Discussion of Safety Significance:

The design deficiency described above was identified in a plant that switches cooling water systems during a LOCA. However, the problem could occur in any auxiliary cooling water system that provides sizably different cooling needs for different redundant components such as RHR heat exchangers and seal coolers. The important feature in the system is the interconnecting piping between the auxiliary cooling water system branches and the piping to the individual components.

In the situation described in this notice, a single failure of a valve to open would cause one branch of auxiliary cooling water to service multiple redundant components, thereby reducing flow below design requirements. Licensees may wish to review their auxiliary cooling water system designs for similar deficiencies. Several other flow design problems that affect operation while in the recirculation mode following a LOCA have been previously identified in IN 87-63, "Inadequate Net Positive Suction Head in Low Pressure Safety Systems," and IN 88-74, "Potentially Inadequate Performance of ECCS in PWRs During Recirculation Operation Following a LOCA." It is important to note that a flow balance analysis would determine the impact of asymmetric flow balances caused by single failures in these systems. A simple review of piping diagrams may be sufficient to identify systems with potential flow problems, but hydraulic analyses are necessary to confirm suspected problems.

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 NRR project manager.

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

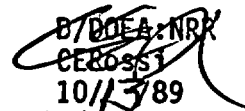
Technical Contacts: S. Israel, AEOD
(301) 492-4437
D. Prochnow, NRR
(301) 492-1166

Attachments:

1. Diagram of Haddam Neck's Original RHR Cooling Water System
2. Diagram of Haddam Neck's Modified RHR Cooling Water System
3. List of Recently Issued NRC Information Notices

Document Name: DIVERSION OF SEAL FLOW
*SEE PREVIOUS CONCURRENCES

*OGCB:DOEA:NRR*ROAB:DSP:AEOD *C/SRXB:DEST:NRR
DProchnow SIsrael MWHodges
10/02/89 10/02/89 10/05/89


B/DOEA:NRR
CER653
10/13/89
*D/DST:NRR
ATHadani
10/05/89

*C/OGCB:DOEA:NRR
CHBerlinger
10/11/89
RPB:ARM
TechEd
10/ /89

Under these conditions, the RHR seal water coolers would receive inadequate flow, ultimately causing the failure of both RHR pumps. The licensee corrected this problem by installing check valves in the seal water cooling piping (shown in Attachment 2) to preclude one branch of service water from feeding two RHR heat exchangers.

Discussion of Safety Significance:

The design deficiency described above was identified in a plant that switches cooling water systems during a LOCA. However, the problem could occur in any auxiliary cooling water system that provides sizably different cooling needs for different redundant components such as RHR heat exchangers and seal coolers. The important feature in the system is the interconnecting piping between the auxiliary cooling water system branches and the piping to the individual components.

In the event described in this notice, a single failure of a valve to open caused one branch of auxiliary cooling water to service multiple redundant components, thereby reducing flow below design requirements. Licensees may wish to review their auxiliary cooling water system designs for similar deficiencies. Several other flow design problems that affect recirculation operation following a LOCA have been previously identified in IN 87-63 and IN 88-74. It is important to note that a flow balance analysis must be performed to determine the impact of asymmetric flow balances caused by single failures in these systems. It is also important to note that a simple review of piping diagrams may be sufficient to identify systems with potential flow problems, but hydraulic analyses are necessary to confirm suspected problems.

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 NRR project manager.

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

Technical Contacts: S. Israel, AEOD
(301) 492-4437

D. Prochnow, NRR
(301) 492-1166

Attachments:

1. Diagram of Haddam Neck's Original RHR Cooling Water System
2. Diagram of Haddam Neck's Modified RHR Cooling Water System
3. List of Recently Issued NRC Information Notices

Document Name: DIVERSION OF SEAL FLOW
*SEE PREVIOUS CONCURRENCES

*OGCB:DOEA:NRR*ROAB:DSP:AEOD *C/SRXB:DEST:NRR
DProchnow SIsrael MWHodges
10/02/89 10/02/89 10/05/89

D/DOEA:NRR
CERossi
10/ /89
*D/DST:NRR
ATHadani
10/05/89

With Noted Changes
C/OGCB:DOEA:NRR
CHBerlinger
10/11/89
RPB:ARM
TechEd
10/3/89

The licensee corrected this problem by installing check valves in the seal water cooling piping (shown in Attachment 2) to preclude one branch of service water from feeding two RHR heat exchangers.

Discussion of Safety Significance:

The design deficiency described above was identified in a plant that switches cooling water systems during a LOCA. However, the problem could occur in any auxiliary cooling water system that provides sizably different cooling needs for different redundant components such as RHR heat exchangers and seal coolers. The important feature in the system is the interconnecting piping between the auxiliary cooling water system branches and the piping to the individual components.

In the event described in this notice, a single failure of a valve to open caused one branch of auxiliary cooling water to service multiple redundant components, thereby reducing flow below design requirements. Licensees may wish to review their auxiliary cooling water system designs for similar deficiencies. Several other flow design problems that affect recirculation operation following a LOCA have been previously identified in IN 87-63 and IN 88-74. It is important to note that a flow balance analysis must be performed to determine the impact of asymmetric flow balances caused by single failures in these systems. It is also important to note that a simple review of piping diagrams may be sufficient to identify systems with potential flow problems, but hydraulic analyses are necessary to confirm suspected problems.

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 NRR project manager.

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

Technical Contacts: S. Israel, AEOD
(301) 492-4437

D. Prochnow, NRR
(301) 492-1166

Attachments:

1. Diagram of Haddam Neck's Original RHR Cooling Water System
2. Diagram of Haddam Neck's Modified RHR Cooling Water System
3. List of Recently Issued NRC Information Notices

Document Name: DIVERSION OF SEAL FLOW

<i>ep</i>		D/DOEA:NRR	C/OGCB:DOEA:NRR	RPB:ARM
		CERossi	CHBerlinger	TechEd
		10/ /89	10/ /89	10/3/89
OGCB:DOEA:NRR	ROAB:DSP:AEOD	C/SRXB:DEST:NRR	D/DEST:NRR	D/DEST:NRR
DProchnow	SIsrael	MWHodges	ATHadani	JERichardson
10/2/89	10/1/89	10/5/89	10/ /89	10/ /89