

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

June 16, 1993

NRC INFORMATION NOTICE 93-45: DEGRADATION OF SHUTDOWN COOLING
SYSTEM PERFORMANCE

Addressees

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

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to degradation of shutdown cooling system performance at the Oyster Creek Nuclear Generating Station resulting from inadequate operating procedures. 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 are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

On January 23, 1993, the Oyster Creek Nuclear Generating Station was in day 57 of the 14R refueling outage. The plant was in a normal cold-shutdown condition with the primary containment open and the reactor coolant system at about 43° C [110° F]. One reactor recirculation loop was in service, one recirculation loop was open, and the remaining three recirculation loops were either idled or isolated. Two shutdown cooling loops were operating with a combined flow rate of 11,735 liters per minute [3,100 gpm].

In order to support the planned activities, the licensee elected to secure operation of all recirculation pumps and lower reactor water level. This configuration would allow completion, in parallel, of recirculation pump maintenance activities and main steam isolation valve local leak rate testing. When the operators lowered the reactor water level to approximately 419 cm [165 inches] above the top of active fuel and secured the running recirculation pump, the shutdown cooling water took the least resistance path through the open recirculation loop, and the majority of flow bypassed the core (see Attachment 1). During the time that the planned activities were in progress, plant personnel did not realize that shutdown cooling system performance was degraded, allowing unmonitored heatup of the reactor core.

On January 25, 1993, after completing the main steam isolation valve local leak rate testing, an operations engineer discovered that the reactor vessel metal temperature was about 109°C [228°F] at the mid-vessel point. Several

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Technical Specifications prerequisites for exceeding 100° C [212° F] were not met, including the requirement to establish primary containment integrity. After discovery, operators took immediate measures to reduce reactor coolant system water temperature by first maximizing flow in the two operating shutdown cooling loops and then placing a third shutdown cooling loop in service. Additionally, the reactor water level was raised to approximately 508 cm [200 inches] above the top of active fuel and a recirculation pump was started.

The immediate cause of the event was determined to be plant conditions established by a temporary procedure change to the shutdown cooling operating procedure that failed to provide sufficient forced flow through the reactor core to prevent thermal stratification. The temporary procedure change had been implemented to allow shutdown operations with all recirculation pumps secured and the nominal reactor water level less than the level at which spillover from the core region to the annulus is assured (approximately 470 cm [185 inches] above the top of active fuel). The change had been developed from a draft engineering evaluation, but did not include a requirement (stated in the body of the evaluation) to maintain a specified shutdown cooling flow of 22,712 liters per minute [6,000 gpm]. Instead, the usual shutdown cooling flow of about 11,735 liters per minute [3,100 gpm] was maintained which, due to the specified configuration, allowed the inadvertent reactor heatup.

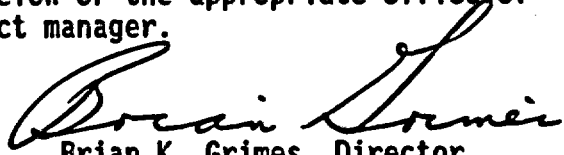
Further details can be found in Licensee Event Report 50-219/93-002 and NRC Augmented Inspection Team Inspection Report No. 50-219/93-80.

Discussion

This event at Oyster Creek indicated that the temporary procedure change represented a significant procedure revision and that the review process did not identify deficiencies in the procedure before it was implemented. The temporary procedure change had been developed from a draft engineering evaluation which concluded that two shutdown cooling loops in operation would adequately cool the core. An additional assumption in the body of the evaluation was that each loop of shutdown cooling would be operating at its design flow rate of 11,356 liters per minute [3,000 gpm], for a total flow rate of 22,712 liters per minute [6,000 gpm]. This flow rate would be adequate to induce spillover from the core region to the annulus at the reduced nominal water level. The temporary procedure change that implemented the engineering evaluation did not require a minimum flow rate of 22,712 liters per minute [6,000 gpm]. As a result, the operators following the deficient temporary procedure change placed two shutdown cooling loops in operation, but did not provide sufficient shutdown cooling water to the reactor core to maintain reactor vessel temperatures. In addition, the temporary procedure change contained no provision or guidance for monitoring available instruments to ensure that decay heat was being adequately removed from the reactor core.

As part of the licensee corrective actions, the licensee reviewed the effectiveness of its safety review process concerning temporary changes and provided training on the subject of this event to all site personnel who perform technical and safety reviews.

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 Office of Nuclear Reactor Regulation (NRR) project manager.



Brian K. Grimes, Director
Division of Operating Reactor
Support
Office of Nuclear Reactor Regulation

Technical contacts: James S. Stewart, RI
(215) 337-5240

Peter C. Wen, NRR
(301) 504-2832

Attachments:

1. Figure 1, "Oyster Creek Shutdown Cooling System Flow With Open Recirculation Loop"
2. List of Recently Issued NRC Information Notices

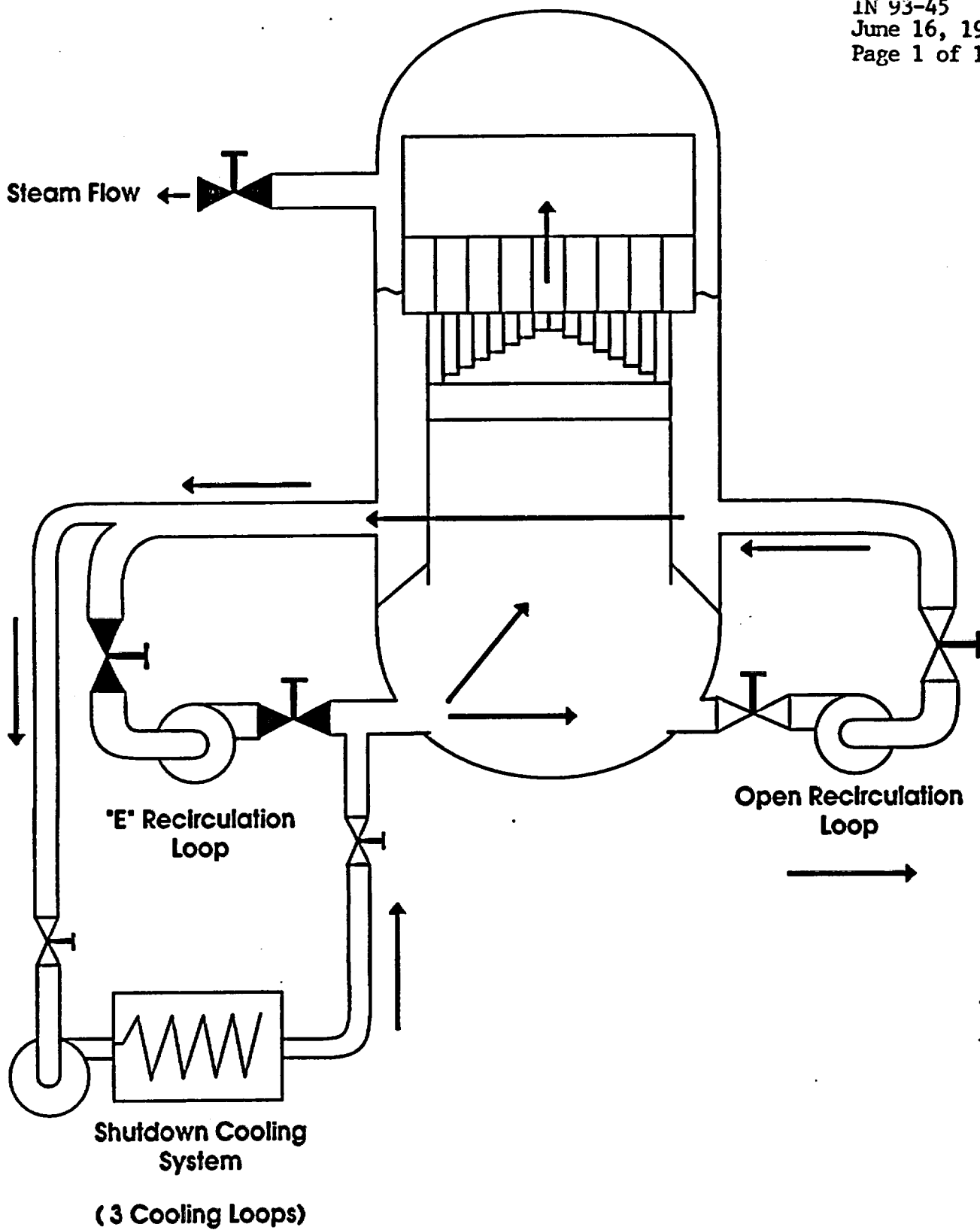


Figure 1

Oyster Creek Shutdown Cooling System Flow With Open Recirculation Loop

LIST OF RECENTLY ISSUED
 NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
93-44	Operational Challenges During A Dual-Unit Transient	06/15/93	All holders of OLs or CPs for nuclear power reactors.
93-43	Use of Inappropriate Lubrication Oils in Safety-Related Applications	06/10/93	All holders of OLs or CPs for nuclear power reactors.
93-42	Failure of Anti-Rotation Keys in Motor-Operated Valves Manufactured by Velan	06/09/93	All holders of OLs or CPs for nuclear power reactors.
93-41	One Hour Fire Endurance Test Results for Thermal Ceramics Kaowool, 3M Company FS-195 and 3M Company Interam E-50 Barrier Systems	05/28/93	All holders of OLs or CPs for nuclear power reactors.
93-40	Fire Endurance Test Results for Thermal Ceramics FP-60 Fire Barrier Material	05/26/93	All holders of OLs or CPs for nuclear power reactors.
93-39	Radiation Beams from Power Reactor Biological Shields	05/25/93	All holders of OLs or CPs for nuclear power reactors.
93-38	Inadequate Testing of Engineered Safety Features Actuation System	05/24/93	All holders of OLs or CPs for nuclear power reactors.
93-37	Eyebolts with Indeterminate Properties Installed in Limitorque Valve Operator Housing Covers	05/19/93	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
 CP = Construction Permit

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Original signed by
 Brian K. Grimes

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 Office of Nuclear Reactor Regulation

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- Attachments: *(See accordion folders)*
1. Figure 1, "Oyster Creek Shutdown Cooling System Flow With Open Recirculation Loop"
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***SEE PREVIOUS CONCURRENCE**

OFFICE	*OGCB:DORS	*DRS:RI	**SC:DRS:RI	**BC:DRS:RI	**D:DRS:RI
NAME	PCWen/vsb	JSSewart	PKEapen	JPDurr	MWHodges
DATE	04/29/93	05/03/93	03/19/93	03/19/93	03/19/93
*Tech Ed.	*C:OGCB:DORS	*D:DSSA:NRR	D:DORS:NRR		
RSanders	GHEarcus	ACThadani	BKGrimes		
04/29/93	05/10/93	05/24/93	06/10/93		

DOCUMENT NAME: 93-45.IN

**SEE MEMO FROM M.W. HODGES TO B.K. GRIMES DATED 3/19/93
 PM (A. Dromerick), EAB (J. Carter) and AIT Team Leader (J. Beall) were consulted during the development of this IN.

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NAME	PCWen/vsb	^{JW} JStewart	PKEapen	JPDurr	MWHodges
DATE	04/29/93	05/3/93	05/19/93	05/19/93	05/19/93

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