UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555-0001

July 17, 1997

NRC INFORMATION NOTICE 97-52: INADVERTENT LOSS OF CAPABILITY FOR EMERGENCY CORE COOLING SYSTEM MOTORS

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 loss of cooling capability for the motor of a safety injection pump as a result of improper gasket installation and improper reassembly of the motor cooler following corrective maintenance. 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 October 15, 1996, the licensee for Vogtle Electric Generating Plant noted that there was no cooling water flow to the inboard heat exchanger for the Unit 1, train B safety injection pump (SIP) motor cooler. The licensee also found that the cooling water flow to the motor cooler's outboard heat exchanger was significantly reduced. With the reduction in motor cooling capacity, the train B SIP would have been unable to perform its intended safety function during a postulated design-basis accident [medium break loss-of-coolant accident (LOCA)]. Insufficient motor cooling would likely result in motor bearing failure.

Discussion

The train B SIP, including its motor and cooler, was supplied by the Westinghouse Corporation and consists of a 3-inch, 11-stage pump, model JHF, manufactured by Pacific Pumps, and a 450-HP, 3547-RPM, 4000-V ac, 3-phase electric motor manufactured by Westinghouse Electric Corporation. The motor cooler consists of two three-pass, cross-counterflow, finned-tube, heat exchangers supplied by Sentry Equipment Corporation. Figure I is a diagram of the typical motor-cooler configuration. Each heat exchanger has an inlet and an outlet plenum. The plenums have internal baffles that are oriented to create a cross-counterflow flowpath. Figure II is an end view of a typical heat exchanger. The licensee determined that the plenum gaskets were installed backwards in the inboard heat exchanger.

The solid cover plate to plenum gasket was installed in place of the plenum to tube sheet gasket (with holes).

This incorrect installation blocked the cooling water flowpath. While reinstalling the gaskets correctly, the licensee recognized that it was possible to install the plenum incorrectly, e.g., rotated 180 degrees around the axis of the inlet/outlet fitting. This orientation would cause the cooling water flowpath to be altered from a three-pass, cross-counterflow flowpath to a single-pass, once-through flowpath. As a result the available surface area for heat transfer would be decreased by two-thirds per heat exchanger. Figure III shows top views of heat exchangers with plenums configured for three-pass operation and one-pass operation. In the absence of "match marks" or some other position indicator, an improperly oriented plenum could remain visually undetected.

On October 24, 1996, the licensee identified two examples of heat exchanger plenums that were incorrectly installed: the other Unit 1 SIP train B heat exchanger and a heat exchanger in the Unit 2 containment spray pump train A motor cooler. Because both Unit 1 train B SIP motor cooler heat exchanger flowpaths were affected — the error completely blocked one flowpath and reduced the heat transfer capability in the other — an engineering evaluation was performed to determine the safety consequences to the plant. On the basis of the evaluation, the licensee determined that, with the SIP assumed to respond for approximately 24 hours following a medium-break LOCA, the motor bearings would have operated at elevated temperatures that could have led to bearing failure within the first two hours. Therefore, the pump would have been unable to perform its intended safety function for that postulated design-basis accident. The engineering evaluation also contained a statement that operating the SIP in the reduced-cooling flowpath condition could reduce qualified life of the motor; the extent of reduction was not quantified.

It was concluded that the heat exchanger plenums and gaskets were installed incorrectly because of inadequate maintenance procedural guidance and insufficient knowledge of cooler component configuration. The preventive maintenance (PM) checklist provided with the work orders was generic in nature. The PM checklist for inspecting the motor coolers did not contain specific instructions for proper plenum and gasket orientation or note the importance of proper orientation and the possible effect of improper orientation on plant equipment performance.

The licensee addressed this issue with corrective actions that included development of a maintenance procedure to disassemble and reassemble motor coolers. The procedure includes checklists of precautions regarding orientation of motor cooler gaskets and plenums; checklists to include taking temperature readings of the plenums; steps for measurement of individual motor cooler flows; and directions to "match-mark" cooler components to prevent incorrect orientation at the conclusion of maintenance work.

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.

Seymour H. Weiss for

Marylee M. Slosson, Acting Director
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Attachments:
1. Figure 1 - Typical Motor Cooler
2. Figure 2 - End View of Heat Exchanger Assembly
3. Figure 3 - Top View Heat Exchanger Assembly
4. List of Recently Issued NRC Information Notices

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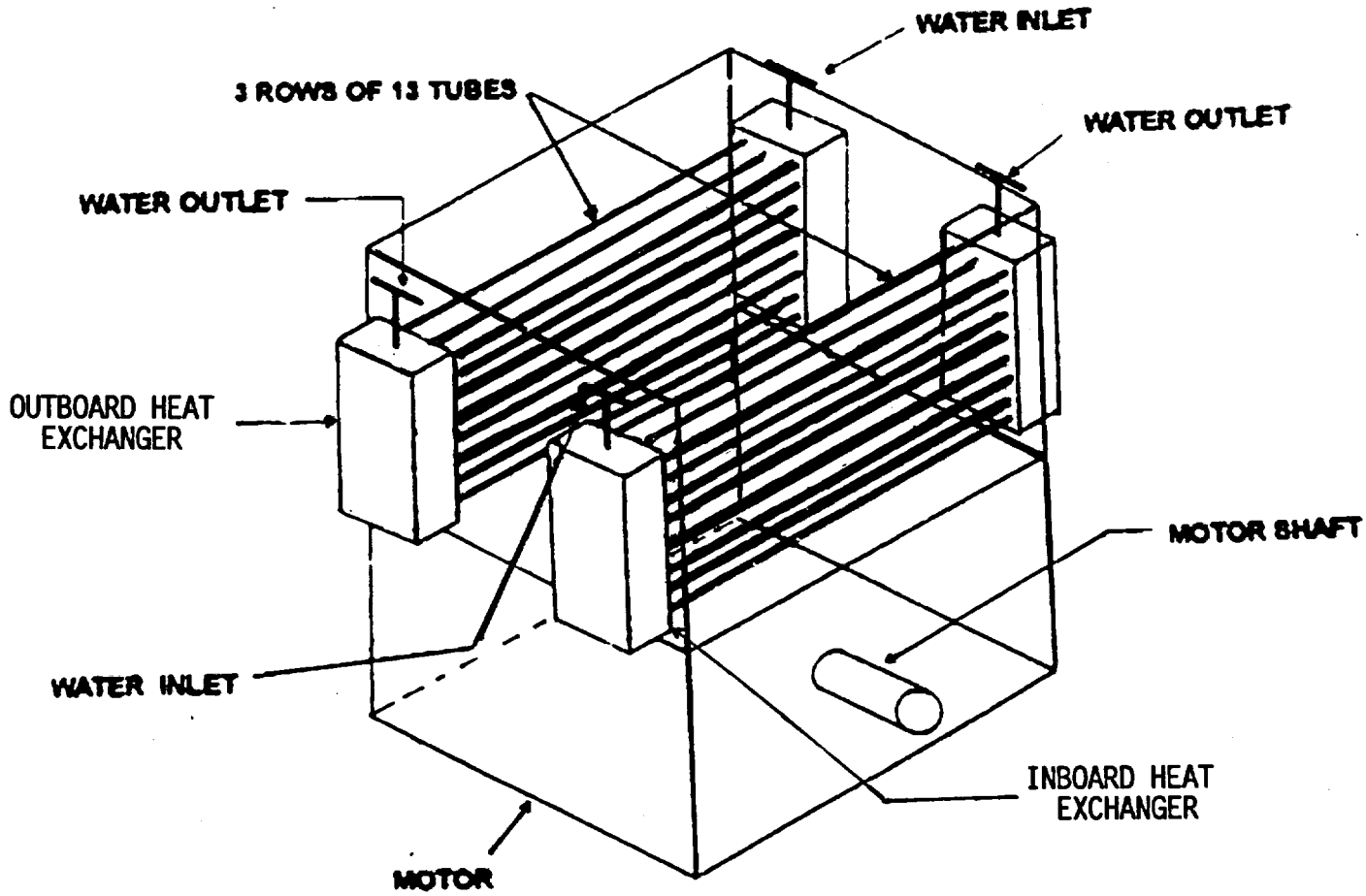


FIGURE I - TYPICAL MOTOR COOLER

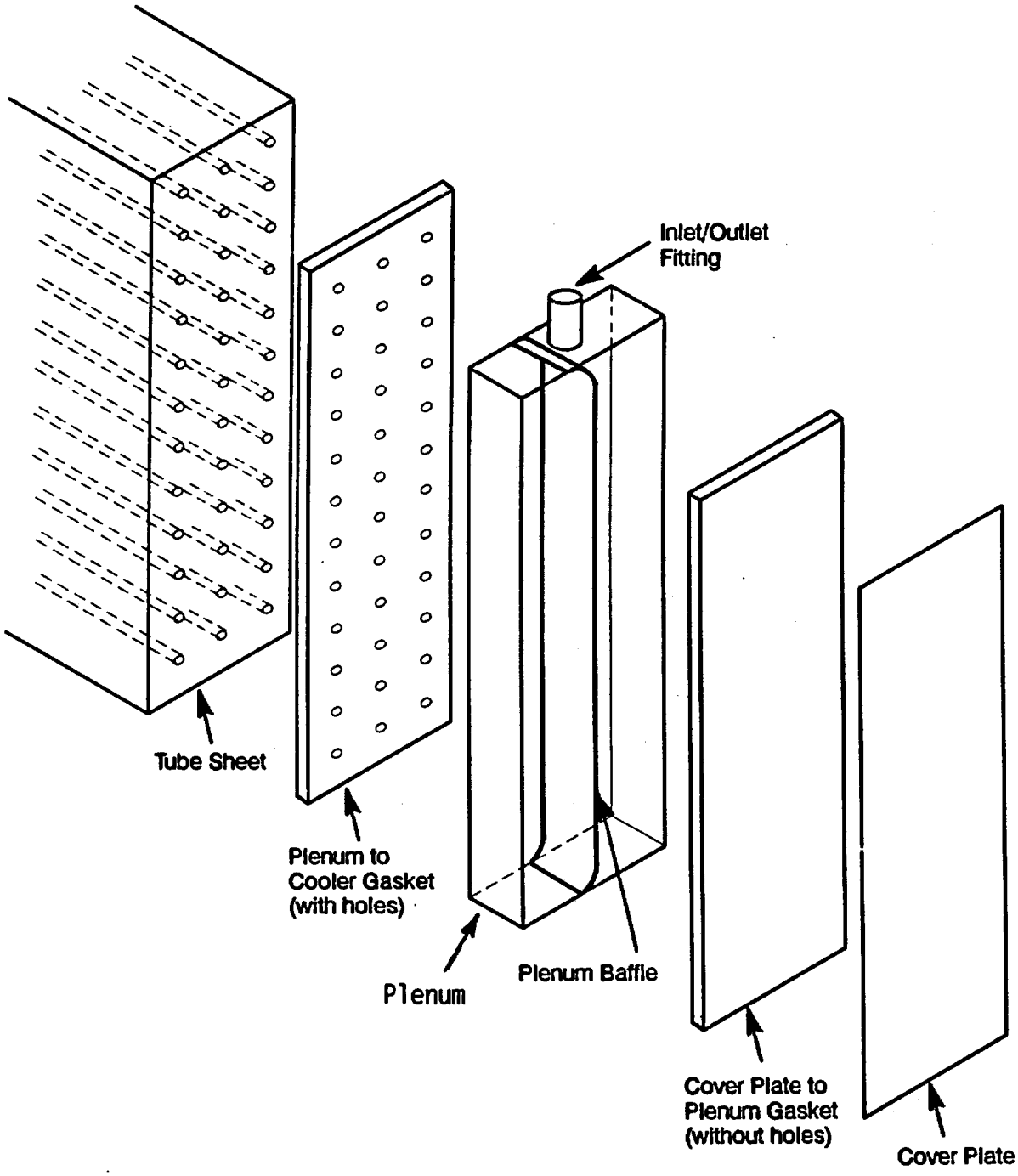
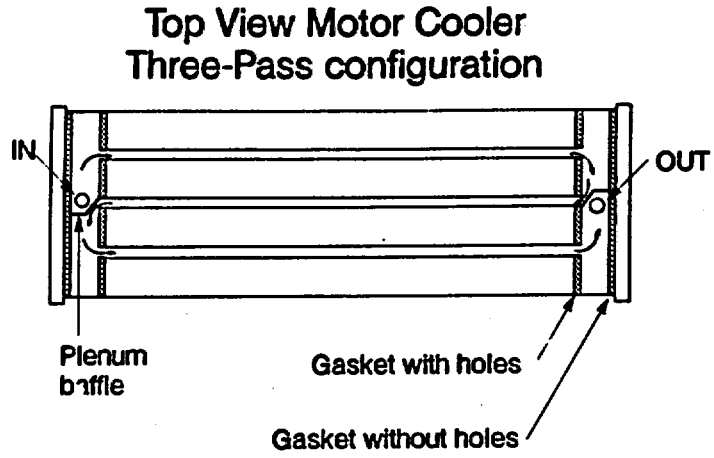


FIGURE II - END VIEW OF HEAT EXCHANGER ASSEMBLY



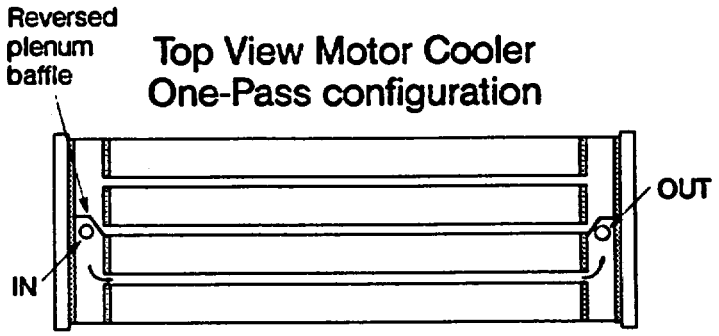


FIGURE III - TOP VIEW HEAT EXCHANGER ASSEMBLY

LIST OF RECENTLY ISSUED NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
91-50, Supp. 1	Water Hammer Events Since 1991	07/17/97	All holders of OLs or CPs for nuclear power reactors
97-51	Problems Experienced with Loading and Unloading Spent Nuclear Fuel Storage and Transportation Casks	07/11/97	All holders of OLs or CPs for nuclear power reactors Designers and fabricators of independent spent fuel storage installations All holders of or applicants for licenses to operate ISFSIs
97-50	Contaminated Lead Products	07/10/97	All U.S. Nuclear Regulatory Commission licensees
97-49	B&W Once-Through Steam Generator Tube Inspection Findings	07/10/97	All holders of OLs or CPs for nuclear power reactors
97-48	Inadequate or Inappropriate Interim Fire Protection Compensatory Measures	07/09/97	All holders of OLs or CPs for nuclear power reactors
97-47	Inadequate Puncture Tests for Type B Packages Under 10 CFR 71.73(c)(3)	06/27/97	All "users and fabricators" of type B transportation packages [as defined in 10 CFR 171.16(10)(B)]
97-46	Unisolable Crack in High-Pressure Injection Piping	07/09/97	All holders of OLs or CPs for nuclear power reactors

OL = Operating License
CP = Construction Permit

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original signed by S.H. Weiss for

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Tech Editor has reviewed and concurred on 3/27/97

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flowpath to a single-pass, once-through flowpath. This orientation would decrease the available surface area for heat transfer by two-thirds per motor cooler. In the absence of "match marks" or some other position indicator, an improperly oriented plenum could remain visually undetected.

On October 24, 1996, the licensee identified two examples of motor cooler plenums that were incorrectly installed: the other Unit 1 SIP train B motor cooler and the Unit 2 containment spray pump train A motor cooler. Because both Unit 1 train B SIP motor cooler flowpaths were affected — the error completely blocked one flowpath and reduced the heat transfer capability in the other — an engineering evaluation was performed to determine the safety consequences to the plant. On the basis of the evaluation, the licensee determined that, with the SIP assumed to respond for approximately 24 hours following a medium-break LOCA, the motor bearings would have operated at elevated temperatures that could have led to bearing failure within the first two hours. Therefore, the pump would have been unable to perform its intended safety function for that postulated design-basis accident. The engineering evaluation also contained a statement that operating the SIP in the reduced-cooling flowpath condition could reduce qualified life of the motor; the extent of reduction was not quantified.

It was concluded that the motor cooler plenums and gaskets were installed incorrectly because of inadequate maintenance procedural guidance and insufficient knowledge of cooler component configuration. The preventive maintenance (PM) checklist provided with the work orders was generic in nature. The PM checklist for inspecting the motor coolers did not contain specific instructions for proper plenum and gasket orientation or note the importance of proper orientation and the possible effect of improper orientation on plant equipment performance.

The licensee addressed this issue with corrective actions that included revising the PM checklists to include precautions regarding orientation of motor cooler gaskets and plenums; revising PM checklists to include taking temperature readings of the plenums; measuring individual motor cooler flows; and "match-marking" coolers to prevent incorrect orientation at the conclusion of maintenance work.

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On October 24, 1996, the licensee identified two examples of motor cooler plenums that were incorrectly installed: the other Unit 1 SIP train B motor cooler and the Unit 2 containment spray pump train A motor cooler. Because both Unit 1 train B SIP motor cooler flowpaths were affected — the error completely blocked one flowpath and reduced the heat transfer capability in the other — an engineering evaluation was performed to determine the safety consequences to the plant. On the basis of the evaluation, the licensee determined that, with the SIP assumed to respond for approximately 24 hours following a medium-break LOCA, the motor bearings would have operated at elevated temperatures that could have led to bearing failure within the first two hours. Therefore, the pump would have been unable to perform its intended safety function for that postulated design-basis accident. The engineering evaluation also contained a statement that operating the SIP in the reduced-cooling flowpath condition could reduce qualified life of the motor; the extent of reduction was not quantified.

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On October 24, 1996, the licensee identified two examples of motor cooler plenums that were incorrectly installed: the other Unit 1 SIP train B motor cooler and the Unit 2 containment spray pump train A motor cooler. Because both Unit 1 SIP train B SIP motor cooler flowpaths were affected — the error completely blocked one flowpath and reduced the heat transfer capability in the other — an engineering evaluation was performed to determine the safety consequences to the plant. On the basis of the evaluation, the licensee determined that, with the SIP assumed to respond for approximately 24 hours following a medium-break LOCA, the motor bearings would have operated at elevated temperatures that could have led to bearing failure within the first two hours. Therefore, the pump would have been unable to perform its intended safety function for that postulated design-basis accident. The engineering evaluation also contained a statement that operating the SIP in the reduced-cooling flowpath condition could reduce qualified life of the motor; the extent of reduction was not quantified.

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