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IN 86-96

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

November 20, 1986

IE INFORMATION NOTICE NO. 86-96: HEAT EXCHANGER FOULING CAN CAUSE INADEQUATE OPERABILITY OF SERVICE WATER SYSTEMS

Addressees:

All nuclear power reactor facilities holding an operating license or a construction permit.

Purpose:

This notice is provided to alert recipients to the potential for fouling in heat exchangers in raw water systems. The result of this fouling could affect the facility's ability to reject heat to the ultimate heat sink, which could be adverse under accident and post-accident conditions. It is suggested that recipients review the information for applicability to their facilities and consider actions, if appropriate, to preclude these conditions at their facilities. However, suggestions contained in this information notice do not constitute requirements; therefore, no specific action or written response is required.

Description of Circumstances:

Over an extended time period, the nuclear service water (NSW) system at McGuire Nuclear Station was degraded by mud and silt buildup and corrosion. This degraded the pathway to the ultimate heat sink (UHS), composed of Lake Norman and its backup source, the standby nuclear service water pond. Therefore, the heat removal capability assumed in the accident analysis could no longer be satisfied.

The intake screens are too large to filter out the suspended solids and silt from the lake. Over the years, a combination of organic and inorganic compounds fouled a number of heat exchangers, including the containment spray, component cooling water, and control room chiller heat exchangers. Adequate performance of these heat exchangers is crucial for safely operating a unit in accident and post-accident conditions and for bringing it to cold shutdown during normal operation or following an accident.

NRC inspections conducted at McGuire in 1985 and 1986 revealed significant fouling problems with NSW system heat exchangers, indications of degraded NSW flow, and inadequate flow balance tests to ensure system capability under design accident conditions.

Additionally, the licensee notified the NRC that prior to January 27, 1986, the NSW systems for Units 1 and 2 had not been tested under the most limiting design basis accident configuration. Specifically, the system had never been verified to supply the required flow concurrently to essential headers for both units with the system taking suction solely from the common standby nuclear service water pond rather than Lake Norman.

At Farley 1 on August 1, 1986, the licensee discovered that silt in the service water system had caused overheating of gearboxes on two of three charging pumps while the third pump was out of service for maintenance. In addition to their normal function, these pumps function as part of the emergency core cooling system. Service water is used to cool the lube oil coolers for the charging pump gearboxes. One of the pumps was taken out of service when its gearbox temperature exceeded 155°F. The temperature of the gearbox on the other pump was 148°F and increasing. The vendor recommends operating the pumps with caution above 140°F and not operating the pumps above 155°F. The lube oil coolers were flushed to reduce the temperature of the gearbox lube oil below 140°F.

Discussion:

Service water systems are designed to meet General Design Criteria 44, 45, and 46 of 10 CFR 50, Appendix A. By these criteria, plant designs provide the ability (1) to transfer heat from safety-related components under normal and accident conditions to an ultimate heat sink; (2) to conduct periodic inspections of the system to ensure integrity and capability; and (3) to test the system under conditions as close to design as practical.

Fouling of service water systems has been recognized for some time as having the potential for compromising system operability. IE Information Notice 81-21 and IE Bulletin 81-03 addressed the potential for fouling of safety-related heat exchangers by Asiatic clams, mussels, and debris from other shell fish. Duke Power Company responded with a program designed to monitor fouling of several typical NSW supplied heat exchangers. Through this program and other mechanisms the licensee identified numerous affected heat exchangers. However, because these data were not adequately evaluated to identify adverse trends, these programs were not totally effective. The affected heat exchangers included containment spray, containment ventilation, control room air conditioning, reactor coolant pump motor coolers, and component cooling water. In 1986 the licensee identified several individual components, including containment spray heat exchangers, which were not capable of meeting FSAR-specified performance requirements. The containment spray heat exchangers were of particular concern since they are normally inactive and gradual degradation from fouling can go unnoticed.

As noted above, the licensee at Farley 1 determined that charging pump gearbox lube oil coolers are also important heat exchangers that can be affected by silting.

To ensure minimum NSW component flows, including adequate flow to the containment spray heat exchangers during design LOCA conditions, the normally throttled valves associated with each NSW component were set during preoperational

testing of the NSW system. These throttled positions were to be incorporated into operating and surveillance procedures for future operations. In some cases, the throttled valve positions listed in the licensee's NSW operating procedures and locked valve verification procedures were not consistent with earlier preoperational "as left" data. Flow balance tests of the system had not been performed from the initial preoperational test in 1982 until December 1985, even though the positions of established throttle valves were changed and some heat exchangers exhibited fouling problems. The test conducted in 1985 revealed that flow rates through several safety-related heat exchangers were below FSAR values.

IE Bulletin 81-03 does not by itself provide a high degree of assurance that a long-term resolution has been achieved. The NRC also is formally studying this subject under Generic Issue 51, "Proposed Requirements for Improving Reliability of Open Cycle Service Water Systems." This project depends on a research program now well under way. Task 1 (of 4), determining the applicability of documented biofouling surveillance and control methods to open cycle water systems in nuclear power plants, is complete (NUREG/CR-4626, Vol. 1)*. The resulting recommendations of Task 1 include: (1) a thorough system evaluation to focus surveillance and control efforts for the best return on plant safety and efficient operation, (2) revision of plant technical specifications to reflect improved procedures, (3) monitoring the effectiveness of control procedures as part of the surveillance program, and (4) including biofouling surveillance in the routine maintenance program.

No specific action or written response is required by this information notice. If you need any additional information regarding this matter, please contact the Regional Administrator of the appropriate regional office or the technical contact listed below.

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

Technical Contacts: C. Vernon Hodge, IE
(301)492-7275

Frank Jape, Region II
(404)331-4182

Attachment: List of Recently Issued IE Information Notices

*A copy of this document is available in the NRC Public Document Room, 1717 H Street N.W., Washington, DC 20555 for inspection and copying.

Attachment 1
IN 86-96
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LIST OF RECENTLY ISSUED
IE INFORMATION NOTICES

Information Notice No.	Subject	Date of Issue	Issued to
86-95	Leak Testing Iodine-125 Sealed Sources In Lixi, Inc. Imaging Devices and Bone Mineral Analyzers	11/14/86	All NRC licensees authorized to use Lixi, Inc. imaging devices
86-94	Hilti Contrete Expansion Anchor Bolts	11/6/86	All power reactor facilities holding an OL or CP
86-93	IEB 85-03 Evaluation Of Motor-Operators Identifies Improper Torque Switch Settings	11/3/86	All power reactor facilities holding an OL or CP
86-82 Rev. 1	Failures Of Scram Discharge Volume Vent And Drain Valves	11/4/86	All power reactor facilities holding an OL or CP
86-92	Pressurizer Safety Valve Reliability	11/4/86	All PWR facilities holding an OL or CP
86-91	Limiting Access Authorizations	11/3/86	All power reactor facilities holding an OL or CP; fuel fabrication and processing facilities
86-90	Requests To Dispose Of Very Low-Level Radioactive Waste Pursuant to 10 CFR 20.302	11/3/86	All power reactor facilities holding an OL or CP
86-89	Uncontrolled Rod Withdrawal Because Of A Single Failure	10/16/86	All BWR facilities holding an OL or CP
86-05 Sup. 1	Main Steam Safety Valve Test Failures And Ring Setting Adjustments	10/16/86	All power reactor facilities holding an OL or CP
86-25 Sup. 1	Traceability And Material Control of Material And Equipment, Particularly Fasteners	10/15/86	All power reactor facilities holding an OL or CP

OL = Operating License
CP = Construction Permit

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