

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

January 11, 1994

**NRC INFORMATION NOTICE 94-03: DEFICIENCIES IDENTIFIED DURING SERVICE WATER
SYSTEM OPERATIONAL PERFORMANCE INSPECTIONS**

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 the addressees to deficiencies identified by the NRC during service water system operational performance inspections that were recently performed. 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

Design and operational concerns associated with service water systems have been identified in licensee event reports and during NRC inspection activities. To address these concerns, the NRC issued Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment," on July 18, 1989. This generic letter requested that licensees and applicants perform actions to ensure that their service water systems are in compliance with 10 CFR Part 50 (Appendix A, General Design Criteria 44, 45, and 46 and Appendix B, Section XI). The NRC conducted four workshops on Generic Letter 89-13 and issued information developed from the transcripts of these workshops as Supplement 1 to the generic letter on April 4, 1990.

Because problems continued to be experienced with service water systems, the NRC developed the service water system operational performance inspection to assess licensee actions in response to Generic Letter 89-13 and to evaluate such aspects of the service water system as design, operations, maintenance, surveillance/testing, and quality assurance/corrective actions. These inspections are performed in accordance with Temporary Instruction 2515/118, Revision 1, "Service Water System Operational Performance Inspection (SWSOPI)," contained in the NRC Inspection Manual. As indicated in the temporary instruction, these inspections will generally be conducted at plants licensed before 1979, as well as at newer plants that are perceived to have service water system problems or more general maintenance, engineering, and technical support problems.

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Discussion

During the initial seven service water system operational performance inspections, deficiencies and weaknesses were found in the evaluation of heat transfer requirements and in the development of testing programs and procedures. In addition, the results of these inspections indicated that, in general, licensees have not taken all actions requested by Generic Letter 89-13 in a completely effective manner.

Some examples of the deficiencies and weaknesses that were identified during the initial inspections are summarized in this section.

(1) Evaluation of Heat Transfer Requirements

The findings in this area pertain to inadequacies in analyses of the heat loads to be removed by the service water systems, evaluations of the performance of the heat exchangers and room coolers, and verification of hydraulic analyses. For example, the following deficiencies were identified:

- The calculated heat load in a compartment containing safety-related pumps exceeded the rated room cooler capacity. Also, initial calculations failed to include heat loads from auxiliary motors located in the compartment. During the inspection, the licensee performed a new calculation and determined that equilibrium room temperature would be higher than the existing analyzed temperature in the compartment. Additional evaluations were performed to verify that the electrical equipment in these areas could operate at the higher room temperature. (Quad Cities)
- A calculation to demonstrate the heat removal capacity of a safety-related room cooler failed to consider that the actual flow through the room cooler was less than design flow. (Monticello)

(2) Testing Programs and Procedures

The findings in this area are related to failure to include safety-related service water system valves in the inservice testing (IST) program, failure to perform required tests in accordance with the IST program, failure to test the service water system components to verify their functional capabilities, and failure to use appropriate test acceptance criteria. For example, the following deficiencies were identified:

- Various safety-related valves were omitted from the IST programs at several plants. In one case, many manual valves in the service water system that perform specific functions in shutting down the reactor were not included in the IST program. In another case,

manual valves and check valves that perform safety functions in aligning the emergency backwash lines to the essential service water strainers were not included in the IST program. Also, power-operated flow-control valves that are normally closed, but perform a safety function in opening to admit service water flow, were not included in the IST program. (Monticello, South Texas, Quad Cities)

- Periodic testing of valves as required by the IST program was not performed. The service water system valves in the control room heating, ventilation, and air conditioning system were not tested quarterly, as required by the plant's IST program. (Quad Cities)
- Deficiencies were noted in IST programs for the service water system pumps. The service water pump curves were used in testing the pumps instead of specific reference values as required by Section XI of the ASME Boiler and Pressure Vessel Code (ASME Code) without obtaining NRC staff approval for relief from the provisions of the Code. Flow instruments that were not in compliance with the instrument accuracy requirements specified by Section XI of the ASME Code were used in the testing of essential cooling water pumps without obtaining relief from the Code requirements. (Monticello, South Texas)
- The preoperational test results of the service water system had not been reconciled with the current system configuration and operation. For example: (a) the system was tested with the nonsafety-related portions isolated, although the existing operation of the system did not isolate these portions on a safety injection signal alone, (b) the system was not tested with two pumps operating to verify system performance under post-accident recirculation conditions, and (c) the system flow balance was established on the basis of three-pump operation instead of the limiting case of one-pump operation supplying all the loads. (Ginna)

(3) Weaknesses in the Implementation of Generic Letter 89-13

In addition to the specific deficiencies discussed above, weaknesses were noted in the implementation of Generic Letter 89-13 actions. Significant weaknesses in the implementation of Actions II and III of Generic Letter 89-13 are discussed below.

Action II of Generic Letter 89-13 requested that licensees establish a test program to periodically verify the heat transfer capability of all safety-related heat exchangers cooled by service water. The total test program was to consist of an initial test program and a periodic retest program. The following examples illustrate some of the implementation weaknesses found at one or more plants for this action item:

- Several safety-related room coolers were not tested in accordance with commitments in the licensee response to the generic letter.

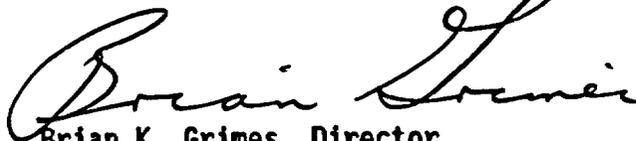
- No baseline testing was done to verify that minimum flow to each component was achieved.
- Where the periodic maintenance method was chosen in lieu of heat transfer performance testing of heat exchangers and room coolers, no sound technical basis for inspection and preventive maintenance frequencies was established.
- The design temperature difference across a heat exchanger was used as an acceptance criterion without correcting for the actual test conditions where the test heat load was substantially less than the design value.

Action III of Generic Letter 89-13 requested that licensees establish a routine inspection and maintenance program for open-cycle service water system piping and components to ensure that corrosion, erosion, protective coating failure, silting, and biofouling would not degrade the performance of the safety-related systems supplied by service water. The following examples illustrate some of the implementation weaknesses found at one or more plants for this action item:

- Adequate training or guidance was not provided for personnel to evaluate potentially degraded conditions of service water system components.
- Maintenance and inspection programs did not provide assurance that critical instrument lines and small-bore piping would not become clogged or degraded.
- Actions were not taken within a reasonable time period to inspect and clean room coolers in the second unit when similar coolers in the first unit were found to be significantly degraded.
- Nonsafety-related service water system piping in the discharge path from safety-related components was not included in an inspection and maintenance program.

The findings of these inspections illustrate the importance of systematic engineering analyses, testing, inspection, and maintenance of service water systems.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact the technical contacts listed below or the appropriate NRR project manager.



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

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(301) 504-2963

S. R. Jones, NRR
(301) 504-2833

Attachments:

1. List of SWSOPI Reports
2. List of Recently Issued NRC Information Notices

List of SWSOPI Inspections

The following seven SWSOPI reports were reviewed to identify the types of deficiencies and weaknesses that are discussed in this information notice:

1. 50-237/93008(DRS); 50-249/93008(DRS) (Dresden Nuclear Power Station)
2. 50-244/91-201 (Ginna Nuclear Power Station)
3. 50-335/91-201; 50-389/91-201 (St. Lucie Plant)
4. 50-263/92010 (Monticello Nuclear Generating Plant)
5. 50-254/92-201; 50-265/92-201 (Quad Cities Nuclear Power Station)
6. 50-498/92-201; 50-499/92-201 (South Texas Project)
7. 50-397/93-201 (Washington Nuclear Plant, Unit 2)

**LIST OF RECENTLY ISSUED
 NRC INFORMATION NOTICES**

Information Notice No.	Subject	Date of Issuance	Issued to
94-02	Inoperability of General Electric Magne-Blast Breaker Because of Misalignment of Close-Latch Spring	01/07/94	All holders of OLs or CPs for nuclear power reactors.
94-01	Turbine Blade Failures Caused by Torsional Excitation from Electrical System Disturbance	01/07/94	All holders of OLs or CPs for nuclear power reactors.
93-101	Jet Pump Hold-Down Beam Failure	12/17/93	All holders of OLs or CPs for boiling-water reactors.
93-100	Reporting Requirements for Bankruptcy	12/22/93	All U.S. Nuclear Regulatory Commission licensees.
91-29, Supp. 2	Potential Deficiencies Found During Electrical Distribution System Functional Inspections	12/22/93	All holders of OLs or CPs for nuclear power reactors.
93-99	Undervoltage Relay and Thermal Overload Setpoint Problems	12/21/93	All holders of OLs and CPs for nuclear power reactors.
93-98	Motor Brakes on Valve Actuator Motors	12/20/93	All holders of OLs and CPs for nuclear power reactors.
93-97	Failures of Yokes Installed on Walworth Gate and Globe Valves	12/17/93	All holders of OLs or CPs for nuclear power reactors.
93-96	Improper Reset Causes Emergency Diesel Generator Failures	12/14/93	All holders of OLs or CPs for nuclear power reactors.
93-95	Storm-Related Loss of Offsite Power Events due to Salt Buildup on Switchyard Insulators	12/13/93	All holders of OLs or CPs for nuclear power reactors located close to a large body of salt water.

OL = Operating License
 CP = Construction Permit

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Original signed by
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*See previous concurrences

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DSSA:NRR* ATHadani 11/06/93	OGCB:DORS* TJKim 11/23/93	Tech Ed* RSanders 11/09/93	OGCB:DORS* GHMarcus 11/24/93	DORS:NRR BKGrimes 01/7/94

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