U. S. NUCLEAR REGULATORY COMMISSION
REGION I

DOCKET/REPORT NO: 50-336/95-29

LICENSEE: Northeast Utilities Services Company
Waterford, CT 06385

FACILITY: Millstone Unit 2
Waterford, Connecticut

DATES: September 25-26, 1995; October 3-5, 1995;
October 17-20, 1995 and March 14, 1996

INSPECTORS: B. Welling, Division of Reactor Projects
L. Prividy, Division of Reactor Safety

L. J. Prividy 4/23/96
L. J. Prividy, Sr. Reactor Engineer Date
Systems Engineering Branch
Division of Reactor Safety

APPROVED BY: William H. Ruland 4-27-96
Eugene M. Kelly, Chief Date
Systems Engineering Branch
Division of Reactor Safety

Summary

The inspector observed the Millstone Unit 2 service water system operational performance inspection (SWSOPI) self-assessment conducted by Northeast Utilities and concluded the following:

- NU attention is warranted concerning the control of design information. Increased emphasis should be placed on the maintenance and surveillance/testing to assure that the SW system continues to meet its design basis capability.

- All elements of Temporary Inspection (TI) 2515/118 were satisfactorily accomplished. The NU team was fully staffed, members were technically competent, and were committed full-time to the inspection. The team's scope and depth were appropriately focused, and the team maintained objectivity and independence. The NU line organization's response to the team's findings was acceptable, and operability/reportability considerations were appropriately addressed.

- Service water (SW) system design margins were verified by detailed review of calculations and periodic system flow testing. However, heat exchanger (HX) performance testing had not been successful in verifying fouling factor assumptions used in HX thermal performance calculations. Frequent mechanical maintenance of the HXs, consisting of inspecting the SW side and hydrolasing the tubes, was being used to assure adequate HX thermal performance. However, no technical basis, such as thermal performance testing, had been used to define the current HX maintenance quarterly frequency.

- Substantive findings in the area of design included an inadequate interfacing systems design review with examples such as: (1) decrease in reactor building component cooling water flow to containment coolers during the injection phase of a LOCA with a loss of normal power due to failed open air-operated valves to the shutdown cooling heat exchangers, and (2) rupture of fire protection piping in vital electrical switchgear room could cause auto-closure of SW system valves and render room cooling inoperable.

- The SW system engineer demonstrated strong ownership of the system design and its associated problems and limitations. However, the licensee failed to implement several commitments made to the NRC in response to GL 89-13. For example, HX data was to be trended to compute the actual heat transfer coefficient and compare it to the theoretical value; however, NU had not implemented this commitment.

DETAILS

1.0 INTRODUCTION

On June 30, 1995, the NRC informed Northeast Utilities (NU) that their self-assessment plan was acceptable for meeting the requirements to perform their own Service Water Operational Performance Inspection (SWSOPI) at Millstone 2 in accordance with NRC Temporary Instruction (TI) 2515/118, "Service Water System Operational Performance Inspection (SWSOPI)." Advance preparation by the licensee's inspection team was accomplished prior to the inspection and included team assignments, an orientation meeting with participants, a plant walkdown, and initial review of reference materials. The assessment team and a dedicated NU (line organization) response team began their inspection with an entrance meeting on September 25, 1995. This was followed by two full weeks of on-site inspection, an off-site week of documentation and a final week of on-site inspection. The team conducted an exit meeting on October 20, 1995.

The inspection on site was monitored by inspectors from Region 1 to evaluate NU's assessment effort. The inspectors observed the scope and depth of the self-assessment including: the team's objectivity and independence, the commitment of personnel to the effort, the process for operability determinations, the corrective action process, management meetings, and a review of the final NU SWSOPI report subsequently issued on November 30, 1995.

2.0 SCOPE AND DEPTH

The scope and depth of the SW self-assessment were clearly defined prior to the on-site activities. Internal licensee guidance contained instructions on how to conduct the assessment, including the assignments for each team member. Tasks were broken down into areas of review that corresponded to TI 2515/118 requirements. These areas were then assigned to specific responsible team members for execution.

The assessment team was able to address all the inspection requirements of TI 2515/118 in detail to assure themselves of adequate assessment in the areas of design and configuration control, operations, maintenance, surveillance and testing, and quality assurance and corrective action. The team determined that NU had fully complied with Generic Letter (GL) 89-13, "Service Water System Problems Affecting Safety Related Equipment." A checklist of inspection attributes for each of these areas was used to facilitate this comprehensive review that involved over 1200 inspection hours.

The response team was staffed with personnel to correspond to the assessment areas that were separated from their normal duty assignments. The response team was led by the SW system engineer who was knowledgeable concerning the system design requirements. By attending the daily team meetings, listening to their dialogue, reviewing the assessment team's progress with the team leader, and reviewing specific assessment team findings, the inspector confirmed the team's execution of TI 2515/118.

The assessment team performed document reviews, interviewed plant personnel, and examined plant equipment and systems. When questions arose that could not be resolved quickly or when weaknesses were perceived, formal questions were generated by the team. One hundred sixty-eight (168) of these formal questions were generated, and 42 of the 168 were developed into "concerns". Additionally, the team recommended many areas for improvement compared to identifying notable strengths, as discussed below in Section 6.0 of this report.

3.0 OBJECTIVITY AND INDEPENDENCE

The inspector observed the SWSOPI team to evaluate objectivity and independence in their dealings with the NU staff.

- Objectivity Yankee Atomic personnel comprised most of the self assessment team which included a well organized team leader and capable engineers in all the technical disciplines. The team also included an experienced mechanical engineer from another engineering company, the Unit 3 SW system engineer, and a corporate NU engineer responsible for SW program coordination at all NU plants. The SW system engineer played a key role in the well directed response team efforts. He demonstrated strong ownership of the SW system and its associated design basis, problems, and limitations. A good questioning attitude was maintained, and the team leader was effective in directing the assessment team efforts. Each individual question and observation identified by team members was reviewed by the entire team during a meeting in the afternoon each working day. The findings were discussed in detail, then accepted by the team and the team leader.

- Independence The plant personnel assigned to the assessment team were separated from ties to their normal (permanent) assignment. The NU members, while maintaining their objectivity and independence were very beneficial in using their site specific knowledge to aid the other team members in efficiently and effectively performing self-assessment activities and to obtain the documentation necessary to independently confirm the NU team members' information. The inspector observed professionalism and independence equivalent to an NRC team inspection.

The inspector concluded that the assessment team maintained a high degree of objectivity and independence throughout the observed period.

4.0 OPERABILITY/REPORTABILITY

The issues identified by the assessment team were assessed for operability/reportability during their team meetings. The response team also assessed the items, and those issues involving potential operability determinations were entered into the licensee's normal problem reporting system, namely adverse condition reports (ACRs). Based on observations of assessment team meetings where the operability/reportability of the identified issues was discussed, and through the review of several issues where ACRs were generated by the

response team, the inspector concluded that operability/reportability considerations were appropriate, prompt, and in accordance with established procedures.

5.0 MANAGEMENT OVERSIGHT

During the on-site performance of the self-assessment, SW issues identified by the team were appropriately integrated into plant activities due primarily to effective communications and meetings between the assessment team leader and the response team. An example observed by the inspector involved prompt communication given to alert all control room operators regarding the potential for decreased RBCCW flow to the containment coolers during the injection phase of a LOCA with a loss of normal power due to failed air-operated valves to the shutdown cooling HXs. Also, the inspector attended two of the Unit Director's morning meetings with the plant staff and observed that the "real time" status of the SWSOPI team activities was being monitored by plant management.

The self-assessment team had substantive findings as discussed in Section 6.0 of this report. The inspector concluded from this information that a weak GL 89-13 program regarding SW activities had persisted for some time.

6.0 FINAL SW SELF-ASSESSMENT TEAM REPORT

The inspector reviewed the team's final report, issued on November 30, 1995, and compared the documented findings to previous observations at the site. The report was found to be comprehensive and well organized. Overall, the self-assessment team found that the SW system was capable of performing its safety functions on demand. No operability issues were identified by the assessment team; however, there were substantive findings, particularly in the design area where approximately 70% of the questions/concerns involved design control or information.

The team concluded that: (1) the SW system had been operated consistent with its design basis, and (2) flow testing of the SW system during each refueling outage had verified adequate flow to safety related components. Although the self assessment was comprehensive, the findings indicated a weak GL 89-13 program with 3 of the 5 GL actions incomplete, NU's failure to adequately implement commitments made to the NRC in response to GL 89-13, and poor control of design basis information (i.e., the team had difficulty in determining the calculations of record for evaluating the performance of various SW system HXs).

Specific insights regarding the GL 89-13 weaknesses were:

- GL 89-13, Action II, HX Testing, was incomplete in that such testing had not been successful in verifying fouling factor assumptions assumed in HX performance calculations.

- GL 89-13, Action III, Maintenance was incomplete since a maintenance and inspection program for SW system components and piping had not been developed. Also, frequent mechanical maintenance of the HXs, consisting of inspecting the SW side and hydrolasing the tubes, was being implemented as the method for assuring adequate HX thermal performance. No technical basis, such as thermal performance testing, had been established to define the current HX maintenance quarterly frequency.

- GL 89-13, Action IV, Design Review, was incomplete since NU had not performed a single failure analysis of the RBCCW system.

To address the various findings, the team recommended the following general areas for improvement: (1) design information and controls, (2) commitment management, (3) heat transfer testing of HXs, (4) maintenance controls, (5) formal GL 89-13 program, and (6) permanent sodium hypochlorite injection system.

The inspector considered the overall SW system self-assessment team effort to be effective with good issues pursued, particularly in the design area. The response team performed well as it was significantly challenged to respond to the many issues developed by the self-assessment team.

7.0 CORRECTIVE ACTIONS

NU identified specific action items to address the findings and recommendations from the SWSOPI report that require corrective action. These items have been entered into NU's action item tracking system for scheduling and tracking them to completion.

Some corrective actions, such as the performance of a comprehensive single failure analysis of the RBCCW system, reconciling calculational discrepancies found by the team, and including vital AC switchgear room coolers in the preventive maintenance program have been either initiated or completed. Also, NU is developing a formal GL 89-13 program which will include HX performance testing and a component inspection plan with an associated basis for the inspections. The program will consolidate NU commitments made in response to GL 89-13. During the meeting of March 14, 1996, the NRC indicated the need to periodically meet with NU and review the status of their corrective actions.

The inspector concluded that NU's management of the corrective actions necessary to respond to the self-assessment team's findings has been appropriate.

8.0 MANAGEMENT MEETINGS

The inspector met several times with licensee management during the conduct of the self-assessment to provide feedback on the quality of the assessment team's effort. The NRC lead inspector attended the SW self-assessment team's exit held on si[illegible] October 20, 1995. A management meeting was subsequently held at the sit[illegible] March 14, 1996, to discuss the team's SWSOPI report and

the corrective actions planned, underway, or already implemented. The slides from the licensee's presentation are attached, and the following principals attended this public meeting:

Northeast Utilities Services Company

Paul Collette	SW System Engineer, Unit 2
Carol Coppa	Design Engineering, Unit 2
Bruce Hinkley	Director of Engineering, Yankee Atomic
Ray Necci	Director of Nuclear Engineering, Unit 2
Pete Richardson	Unit 2 Director

U. S. Nuclear Regulatory Commission

Leonard Prividy	Sr. Reactor Engineer, Division of Reactor Safety
Eugene Kelly	Chief, Systems Branch, Division of Reactor Safety
Paul Swetland	Sr. Resident Inspector, Unit 2
James Wiggins	Director, Division of Reactor Safety

Attachment: "Service Water System Operational Performance Inspection (SWSOPI) Self-Assessment"; presentation by NU on March 14, 1996

Millstone Unit No. 2

Service Water System - Self Assessment

March 14, 1996

ATTACHMENT

Northeast
Utilities System

Millstone Unit No. 2
Service Water System - Self Assessment

I. Introduction	R. P. Necci
II. Self Assessment Results	B. E. Hinkley
III. Response To Self Assessment	C. A. Coppa
IV. Corrective Action Plan	C. A. Coppa
V. Summary and Conclusion	R. P. Necci

Northeast
Utilities System

Millstone Unit No. 2
Service Water System - Self Assessment

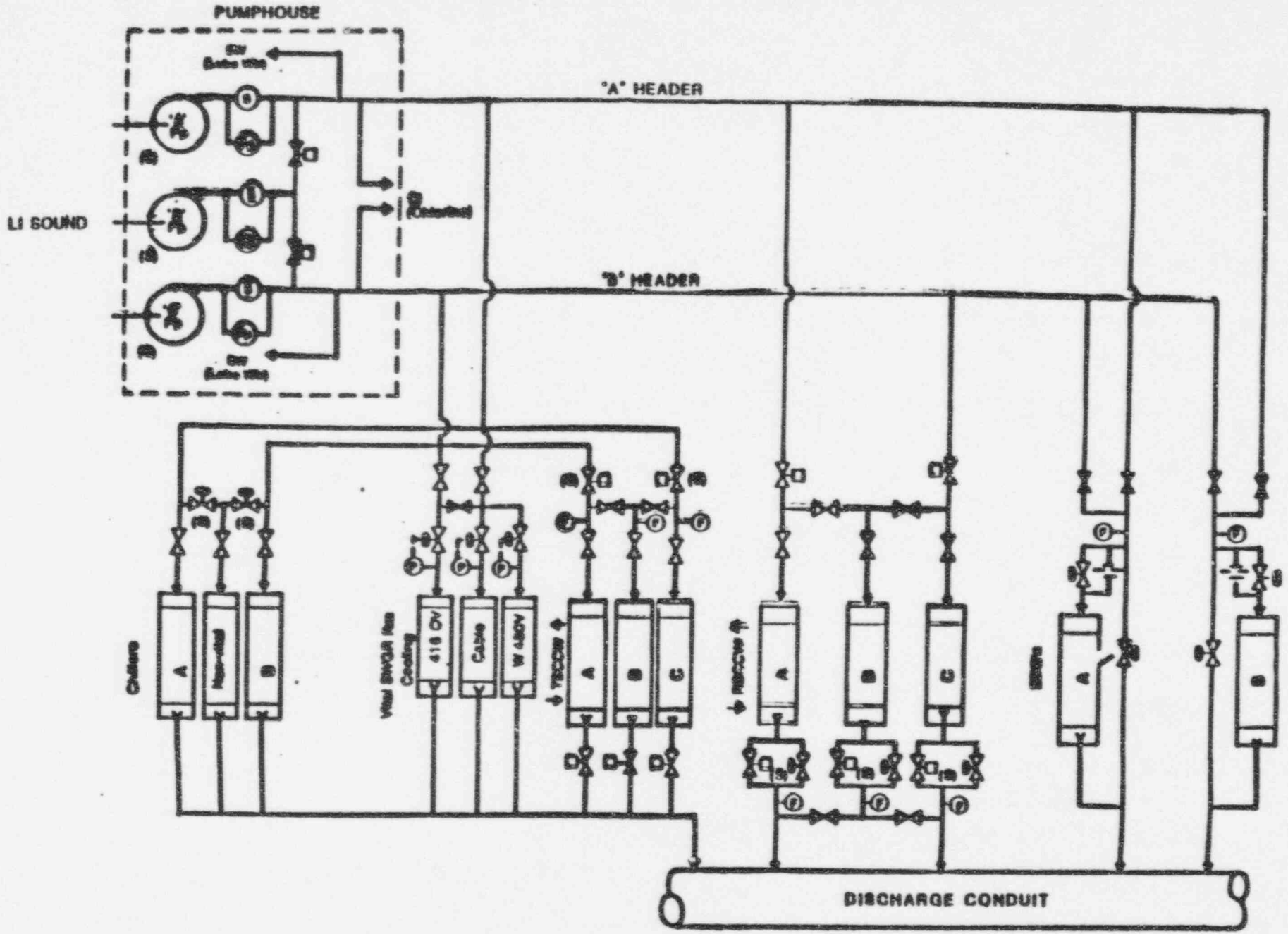
I. Introduction

Purpose of the meeting.

- Review the results of the Service Water System Self Assessment at Millstone Unit No. 2 from September 25,1995, to October 20, 1995
- Describe the corrective action taken/planned as a result

Northeast Utilities System

MILLSTONE UNIT NO. 2
SERVICE WATER SYSTEM — SELF-ASSESSMENT



Millstone Unit No. 2
Service Water System - Self Assessment

II. Self-Assessment Results

- SWSOPI Self-Assessment integral part of overall MP2 GL 89-13 efforts
  - "Pre-SWSOPI" completed 2/95
  - System readiness review completed 8/95
- Full scope of NRC TI 2515/118 Revision 2 evaluated
- Combined team of NU/Yankee/ Consultant personnel

Millstone Unit No. 2
Service Water System - Self Assessment

Summary (10/20/95)

- 168 Formal Questions Documented
- 42 Concerns Issued
- 13 Concerns Closed
- 29 Concern Responses Accepted
- No Outstanding Operability Evaluations

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Utilities System

Millstone Unit No. 2
Service Water System - Self Assessment

Overall Strengths

- Aggressive cooperation from MP2 personnel
- "Ownership" by System Engineer
- Aggressive Inspection Programs
- Self-Assessment Technology Transfer to NU

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Utilities System

Millstone Unit No. 2
Service Water System - Self Assessment

Design/Engineering

- Thermal Calculations Satisfy SWS Design Basis
- Flow Model Consistent with Design Assumptions and Plant Operation
- System Is Flow Balanced to Ensure Proper Flow Distribution During Accident Conditions
- Seismic Analysis Demonstrates that NNS Portions of the SWS Can Be Isolated in Accordance with the Design Basis
- Unit Drawings Reflect As-Built System Design
- Design Changes Satisfy Design Basis with Minor Exceptions (New Design Control Manual)

Millstone Unit No. 2
Service Water System - Self Assessment

Design/Engineering (cont'd)

- RBCCW DBDPs Unclear - self identified by NU ACR 3663
- Design Control Procedures, modifications & calculations not consistently implemented
- Effect of failures of interfacing systems not considered (reference GL 89-13, supplement 1)
- Appendix R Review did not consider Service Water Strainers

Millstone Unit No. 2
Service Water System - Self Assessment

Operations

- Periodic & Post Maintenance SWS alignment ensures the correct position of valves servicing Safety-Related Equipment
- Operators demonstrate adequate knowledge of the SWS under Normal and Emergency Conditions
- Verification of UHS when >70°F does not consider instrument inaccuracy
- Operation of Service Water Strainers following an Intake Structure fire or flooding scenario needs more detailed instructions

Millstone Unit No. 2
Service Water System - Self Assessment

Maintenance

- Maintenance Backlog indicates reliable SWS performance
- Hx Inspection Criteria Form (2701J-96) Is Detailed; however, just recently placed into PM Program for use
- Physical condition of piping, supports and structures (good with some exceptions noted)
- SWS PMs deferred without documented basis or approval
- Drain System Backflow Limiter in Diesel Cubicles and Fire Pump House not in the PM Program
- Maintenance Records lack detail in maintenance performed
- PM Program does not require cleaning & inspection of vital A/C Switchgear Room Coolers

Millstone Unit No. 2
Service Water System - Self Assessment

Surveillance and Testing

- Development of IST Pump and Valve Basis Document; details requirements and basis for testing of applicable IST Component
- Coordination between Ops, Maintenance, and IST ensures appropriate Post-Maintenance Testing
- Test Procedures are detailed enough to effectively test desired parameters; example: flow, pressure, stroke time

Millstone Unit No. 2
Service Water System - Self Assessment

Surveillance and Testing (cont'd)

- Inconclusive testing of Hx Thermal Performance due to instrument inaccuracies and lack of sufficient heat load
- GL 89-13 commitments not met for Hx Testing/ Monitoring/Trending
- Non-Conservative SW Pump Curve errors were identified by the Unit; the Team identified a discrepancy involving head correction differences. MP2's further investigation identified a deficiency in the FSAR degraded SW Pump Curve

Millstone Unit No. 2
Service Water System - Self Assessment

Quality Assurance and Corrective Action

- System Engineer readiness review noted as a "Good Practice"
- System Engineer ownership of SWS a strength
- Quality Assurance coverage of SWS activities satisfactory
- Operability reviews are consistent with GL 91-18
- Tracking and follow-up of Pre-SWSOPI issues incomplete
- Threshold for Causal Factors on ACR process may be too high

Millstone Unit No. 2
Service Water System - Self Assessment

GL 89-13 Actions

- Biofouling Control
  - Intake Structure Inspections
  - Continuous Chlorination/Temporary Modification
  - No stagnant SWS lines
- Heat Transfer Testing
  - Capability of Safety Related Hxs has not been successfully demonstrated due to insufficient heat load and instrument inaccuracies
  - Frequent regular maintenance used without baseline testing to validate intervals between tests

Millstone Unit No. 2
Service Water System - Self Assessment

GL 89-13 Actions (cont'd)

- inspection and Maintenance
  - No formal piping inspection program/reliance on engineering judgment
  - PMs deferred without documented basis
  - PM program does not require cleaning and inspection of Vital A/C switchgear room coolers

Millstone Unit No. 2
Service Water System - Self Assessment

GL 89-13 Actions (cont'd)

- Confirm Licensing Basis
  - SWS review was thorough but should have been extended to RBCCW (reference GL 89-13, supplement 1)
- Practices and Procedures
  - Design information is not consistently translated into unit procedures (Example: PDCRs for EDG monorail and SWS expansion joints)

Millstone Unit No. 2
Service Water System - Self Assessment

Areas for Improvement

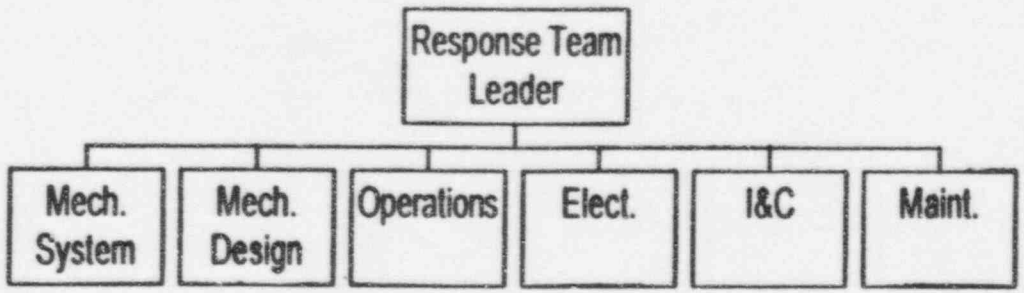
- Design Information and Controls: 65-70% of Comments
- Commitment Management
- Heat Transfer Testing of Hxs
- Maintenance Controls (PM Process)
- Formal GL 89-13 Program
- Permanent Sodium Hypochlorite Injection System

Millstone Unit No. 2
Service Water System - Self Assessment

III. Response to Self-Assessment

- 16 Member Response Team
- Daily meetings with Assessment Team leader and Response Team
- Operability concerns promptly identified to shift manager
- 18 ACRs were generated and five required operability determinations
- One Prompt Notification (Appendix R strainer)
- 37 concerns requiring further action (some had multiple items)
  - 41 total tracking items
  - Over 50% completed to date
- Tracking system in place

MILLSTONE UNIT NO. 2
SERVICE WATER SYSTEM - SELF-ASSESSMENT
RESPONSE TEAM ORGANIZATION



Response Team Support
QA
Chemistry
Environmental
Purchasing
Procurement Engineering

Millstone Unit No. 2
Service Water System - Self Assessment

IV. Corrective Action Plan - Design/Engineering

- Calculation discrepancies are being reconciled
- FSAR changes in process
- Improved design control via Design Control Manual
- Appendix R Compliance Report revised to address Strainer operation guidance
- DBDP and FSAR review will provide an additional verification

Millstone Unit No. 2
Service Water System - Self Assessment

IV. Corrective Action Plan - Operations

- Clarified position on application of instrument uncertainties
- TS change is in progress to raise UHS temperature from 75 to 77 degrees
- Flood protection procedure will reference maintenance procedure for operation of strainer during a DB flood

Millstone Unit No. 2
Service Water System - Self Assessment

IV. Corrective Action Plan - Maintenance

- Procedure in place to evaluate additions or deferrals to PM program
- Floor drains in Turbine, Reactor Building, and EDG cubicles have been tested and added to PM program
- Vital A/C Switchgear room coolers included in PM program

Millstone Unit No. 2
Service Water System - Self Assessment

IV. Corrective Action Plan

GL 89-13 Commitments

- Developing a formal GL 89-13 Program
  - Consolidates GL 89-13 commitments
  - Cross-references internal procedures, evaluations and documents to GL 89-13 commitments
- Program will include:
  - Heat Exchanger Performance and Testing
  - Component and Piping Inspection and Basis

Millstone Unit No. 2
Service Water System - Self Assessment

V. Summary and Conclusion