NIAGARA MOHAWK POWER CORPORATION
QUALITY ASSURANCE AUDIT REPORT

DATE: June 10, 1993

AUDIT NUMBER: 93007

AUDIT TITLE: Unit 1 Service Water System (GL 89-13)

ORGANIZATIONS AUDITED:

Unit 1 Operations	1GD	Unit 1 Nuclear Engineering	1EA
Unit 1 Chemistry	1GF	Licensing	3SA
Unit 1 Technical Support	1GG	Unit 1 Maintenance	1GE
Procurement	8SA	Training	5SA

DATES OF AUDIT: May 3, 1993 through May 28, 1993

AUDIT TEAM:

D. Young	- Team Leader
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F. Carr	- Consultant
T. Syrell	- ISEG Specialist
J. Burgess	- Auditor
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AUDIT TEAM LEADER: David H Young

AUDIT SUPERVISOR: [signature]

NUCLEAR QUALITY ASSURANCE
NIAGARA MOHAWK
AUDITS/SERVICES

AUDIT REPORT
93007

Executive Summary

Service Water System Operational Performance Audit

NINE MILE POINT UNIT 1

An audit was conducted of the Nine Mile Point Unit 1 Service Water System (including Emergency Service Water, Reactor Building Closed Loop Cooling, Emergency Diesel Generator Cooling Water, and Containment Spray Raw Water Cooling) from May 3, 1993 to May 28, 1993. The audit covered aspects of system design, operation, maintenance, testing, and various regulatory commitments such as heat exchanger performance (Generic Letter 89-13), and check valve monitoring (INPO SOER 86-03).

The audit resulted in issuance of 8 Deviation Event Reports. In addition, disposition of 11 previously issued DERs affecting the audited systems were also reviewed. The DERs are listed beginning on page 6 of this report.

The team found the NMP-1 Service Water System, including Emergency Diesel Cooling Water and Containment Spray Raw Water Systems, are sufficiently designed, operated, tested, and maintained to assure performance of design safety functions under postulated design basis accident conditions, including the most limiting single active failure, postulated natural phenomena, or hazardous system interactions.

Based upon reviews, responses to questions or concerns, and the experience of team consultants at other nuclear plants, the following areas were determined to be strengths:

- System Design Basis Documents
- Inherent Design Reliability
- Erosion/Corrosion and MIC Control Programs
- Heat Exchanger Cleaning Commitments
- Design Engineering/Site Organization Coordination
- Tube Plugging Allowances
- Dedicated IST Technicians

Areas needing improvement or management attention include:

- Integration of generic letter 89-13 actions
- Installation of heat exchanger monitoring instruments
- Correction of P&ID discrepancies

NINE MILE POINT UNIT 1
Service Water System Operational Performance Audit

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NINE MILE POINT UNIT 1
Service Water System Operational Performance Audit

1.0 Purpose and Scope

An audit of the Nine Mile Point Unit 1 Service Water System (SWS) [including Emergency Service Water (ESW), Emergency Diesel Generator (EDG) Cooling Water, Containment Spray Raw Water (CSRW) Cooling and Reactor Building Closed Loop Cooling (RBCLC)] was performed from May 3, 1993 to May 28, 1993. The audit covered system design and operation, including maintenance, testing, and various regulatory commitments such as heat exchanger performance (Generic Letter 89-13), and check valve monitoring (INPO SOER 86-03).

The purpose of the audit was to determine if the above raw water cooling systems are designed, operated, tested, and maintained to assure performance of design safety functions under postulated accident conditions, including most limiting single failures, postulated natural phenomena, and hazardous system interactions.

The audit team was comprised of NMPC personnel, and technical consultants from Ogden Environmental and Energy Services Company. A team of NMPC personnel from Design Engineering, Operations, and Maintenance provided full time technical support throughout the audit. The results of the audit, with conclusions and recommendations, are contained in this report.

2.0 Audit Results

2.1 Strengths

2.1.1 System Design Basis Documents

The Audit Team found the ESW, EDG Cooling Water, Containment Spray Raw Water, and Reactor Building Closed Loop Cooling (RBCLC) System Design Basis Documents (SDBD) exceptionally well organized, informative, and comprehensive. Stating the functional requirement and then explaining the basis for the requirement is a good practice and is consistent with the Design Basis definition in 10CFR50. The SDBDs strike a good balance between functional requirements and design details and are therefore useful to a wide range of plant personnel in areas such a modifications, safety evaluations, maintenance, operations, and training. Inclusion of the Open Items list within the SDBDs enabled the Audit Team to focus on undiscovered issues after verifying that potential issues had already been identified and were being tracked to closure.

2.1.2 Inherent Design Reliability

Raw water systems at NMP-1 are inherently reliable because of their design simplicity, reliance on manual actions, and relatively low heat loads. Emergency Service Water, for example, is manually initiated on loss of normal Service Water, is aligned only to the RBCLC heat exchangers, and must remove a relatively low heat load (e.g. control room chillers and fuel pool coolers). Similarly, containment spray raw water is manually initiated and contains one pump for each heat exchanger. These systems are connected only where they return to the discharge tunnel. The Emergency Diesel Systems also contain dedicated cooling pumps for each engine.

2.1.3 Design Engineering/Site Organization Coordination

Coordination and cooperation between Design Engineering personnel and the various site organizations was considered particularly strong. All groups appear highly dedicated to achieving common objectives through team-work and communication. In addition, the ability of design engineering to promptly resolve audit questions was considered a strength.

2.1.4 Heat Exchanger Cleaning Commitments

The Team was impressed with NMP1's commitment to clean and leak-test the tubes in each RBCLC heat exchanger at least once per year (ref: N1-MPM-070-409 Revision 00). In conjunction with the RBCLC heat exchanger differential pressure Performance Monitoring Program (ref: N1-TTP-09 Revision 1), this provides adequate assurance that the RBCLC coolers will be able to perform their safety function when called upon. Similar assurance is provided for the Emergency Diesel Generator Cooling Water Heat Exchangers by the annual cleaning performed under N1-MPM-079-A412, and for the Containment Spray Heat Exchangers by the dry layup requirement specified in N1-OP-14 during normal operation.

2.1.5 Tube Plugging Allowances

In reviewing N1-MMP-070-406 Revision 00, "RBCLC Hx Maintenance Procedure," the Team observed that a limit of 242 (10%) had been specified as the maximum number of tubes allowed to be plugged in any one RBCLC cooler. The Team considers it good practice to establish controls over this parameter within the maintenance procedures. Although it was found that the basis of the 10% value had not been sufficiently established, calculations were performed to provide a basis for this during the audit.

2.1.6 Erosion/Corrosion Program

The Erosion/Corrosion Program is particularly well organized, structured, and administered. Similarly, the team considers the aggressive approach being taken with regard to control of microbiologically induced corrosion to be a strong feature of the response to G.L. 89-13.

2.1.7 Dedicated IST Technicians

The IST functional group has two I&C technicians assigned on a full time basis. This practice was deemed a strength because vibration analysis, thermography, and non-intrusive testing are extremely operator dependent. With two technicians performing exams on a regular basis, a strong expertise is achieved in test methods and documentation.

2.2 Deviation Event Reports

2.2.1 The following DERs were issued during this audit:

Number	Subject
1-93-1231	Pump not declared inoperable on IST failure
1-93-1235	Design calculations use less than 10 psig for ESW strainer d/p
1-93-1261	Zebra mussel mortality rate
1-93-1274	Impact ESW pump strainer d/p on pump operability testing
1-93-1284	P&ID discrepancies
1-93-1285	P&ID discrepancies
1-93-1295	Inadequate Technical Procedure Control
1-93-1296	Long Turn-around time for distribution of Critical Drawings

2.2.2 The following previously issued DERs were reviewed or referenced by the audit team:

Number	Subject
1-91-0076	Resolution of SOER-86-03
1-91-0669	Internal check valve problem (72-68R)
1-92-0207	DGCW pump performance below design basis
1-92-0385	Mud and smearable contamination in line
1-92-0390	Loss of service water

Number	Subject
1-92-4123	Requirement for 10 psi overpressure at CSRW heat exchangers
1-92-4263	Tech Spec LCO applicability to CSRW check valves
1-93-0209	Required inspections not performed #SCI-0028-91
1-93-0583	Dead zebra mussels and excessive rust in CSRW
1-93-0778	Failed surveillance test N1-STP-29
1-93-0924	Difficulty in achieving test results N1-ST-Q19

2.3 Overall Conclusions

The team found the NMP-1 Service Water System, including Emergency Service Water, Emergency Diesel Cooling Water, Reactor Building Closed Loop Cooling and Containment Spray Raw Water systems, are sufficiently designed, operated, tested, and maintained to assure performance of design safety functions under postulated design basis accident conditions, including the most limiting single active failure, postulated natural phenomena, or hazardous system interactions.

The team found the systems to be inherently reliable through both simplicity of design, manual initiation, and relatively low accident heat loads. These systems are also well operated and maintained, in large part because of excellent cooperation and coordination between design engineering personnel and site operations and technical support personnel.

3.0 Methodology

In preparing the audit plan, NMPC QA reviewed 18 NRC inspection reports pertaining to service water (6 ESW special team inspections, 5 SWS SSFIs, 3 SWOPIs, and 4 other). From this review, a matrix was prepared to identify individual findings, violations, weaknesses, or areas of concern which were common to a number of the reports. The matrix indicated some 16 items which appeared in at least 3 reports, some as many as 10 times. These items were included in the audit plan and were reviewed and evaluated during the audit.

The Audit Team employed deep vertical-slice and interactive techniques originally developed by the USNRC's safety system functional inspection program. Specifically, the Service Water System was reviewed in technical depth in order to evaluate system design and modification processes, and to evaluate implementation of the design in operations, maintenance, testing, training, and administrative controls programs. Team interaction was accomplished through daily meetings in which team members and audit support personnel from the responsible organizations, representing a spectrum of technical disciplines, discussed findings, concerns, or observations.

Written questions were issued where concerns or needs for additional information were identified. Upon evaluation of question responses from responsible organizations, items were closed, continued for further evaluation or corrective action, or, where appropriate, Deviation/Event Reports (DERs) were issued. A complete list of the questions, with the disposition status of each, is provided in Appendix A. The audit plan, questions, responses, and lists of personnel interviewed and documents reviewed are on file with NMPC Quality Assurance.

4.0 Personnel

4.1 Audit Team

The audit team was comprised of NMPC QA personnel, supported by technical consultants and other technical specialists, as shown below.

Name	Organization	Audit Function
D. Young	NMPC, QA	Team Leader
T. DelGaizo	OGDEN/MLEA	Mechanical Design
F. Carr	OGDEN	Mechanical Design
C. Widay	NMPC, QA	Testing
D. Downs	NMPC, QA	Testing
R. Delaney	NMPC, QA	IST
J. Burgess	NMPC, QA	Operations
T. Syrell	ISEG Specialist	G.L. 89-13

4.2 Interface Personnel

Key personnel supporting this audit are listed below.

Name	Organization	Function
M. Annett	Design Engineering	Mechanical Design
A. Chaudhary	Design Engineering	Mechanical Design
J. DeFabio	Technical Support	System Engineer
J. Forderkonz	Operations	Operations Specialist
B. Holloway	Chemistry	Chemistry Specialist
T. Lee	Design Engineering	Mechanical Design
R. Magnant	Licensing	Licensing Support

Name	Organization	Function
E. McCaffrey	Mech. Maintenance	Maintenance Specialist
J. Raby	Technical Support	SWS System Engineer
G. Shelling	Operations	Operations Specialist

5.0 Audit Details

5.1 Service Water Design

The team reviewed a variety of Service Water Design documents including those listed below. Documents were reviewed for content, completeness, and consistency with related information.

UFSAR/Tech. Specs./Tech. Spec. Interpretations
System Design Basis Documents
Electrical Distribution Safety Functional Inspection Report
Design Calculations
Design Analyses
P&IDs
Equipment Specifications
Preoperational Tests
Vendor Information
Operating and Test Procedures
Deviation/Event Reports (DERs)

System Design Basis Documents, prepared in conjunction with the Unit 1 Design Basis Reconstitution (DBR) program, were of great value in conducting this audit. These documents are thorough and comprehensive and provide an excellent road-map to the systems, including modification status, references, component data, and the status of open items.

5.1.1 Safety Related Check Valves (Question 2)

For design and design analysis purposes, all NMP-1 safety-related check valves are classified as passive devices, based upon a 1977 USNRC letter (SECY letter 77-439 dated 8-17-77), which described single failure criteria as related to staff review of license applications. The letter states that active failures are postulated where a credible chance of failure exists, and lists check valve failure as an example of passive failure. Because of this philosophy, NMP-1 safety systems, which are designed to withstand a single active failure, are not necessarily designed to withstand a single check valve failure.

In recent years, documented check valve failures throughout the industry have indicated check valve reliability to be below that anticipated by the 1977 letter. Consequently, for purposes of plant operations, testing, maintenance, and surveillance programs, check valves are treated as active if required to move in order to perform their safety function. While this distinction between design requirements and operational considerations is reconcilable, it has caused some problems, such as determination of proper limiting conditions of operation when a check valve fails its surveillance test. Specific examples are cited below.

1. Service water/emergency service water isolation check valves (72-21 and 72-22) are passive valves for design purposes (i.e. no analysis exists to indicate the system operates in spite of valve failure) but are periodically tested as active valves.

2. Previously issued DER-1-92-4263 requests clarification of the applicable LCO should CS raw water intertie check valves fail. The interim resolution states these valves are active components. Final resolution is based upon completion of an action plan scheduled for 6/30/93.

3. The plant Q-list identifies a large number of check valves as active.

In response to this concern, Corporate Licensing prepared Safety Class Determination 93-43 which determined that valves 72-21 and 72-22 were safety related active, even though their failure is not a required single failure consideration. This is consistent with the safety related active classifications in the Q-list. DER-1-92-4263 will be resolved in accordance with the normal process on completion of the action plan in June 1993. Consequently, the team concludes that resolution of the DER will fully resolve this concern, and no additional actions are required.

At the same time, the team discussed and reached agreement with Nuclear Licensing and Design Engineering that questions relative to the ability of a safety system to cope with single failure of an active check valves be evaluated on a case-by-case basis to assure coping mechanisms exist (procedural, administrative, or otherwise). Where the ability to cope may be unacceptable, additional remedies should be considered notwithstanding the 1977 passive definition. In the case of 72-21 and 72-22, for example, procedures could direct shutting manual blocking valves 72-23 and 72-24, either as a normal step in manually initiating ESW flow or in case pump pressure is abnormally low.

5.1.2 C.S. Raw Water Heat Exchanger Pressure Differential (Question 24)

The Containment Spray Raw Water System was designed to maintain a higher pressure at the heat exchanger than the spray (shell) side to prevent possible spread of radioactive contamination in case of tube leakage. This is stated in both the FSAR (pg. VII-16) and the technical specification bases (3.3.7).

In view of the above, the team questioned system operating procedures which start the raw water pumps in an accident 15 minutes after spray pump start. The team also noted that DER-1-92-4123 indicates that under certain conditions (e.g. torus cooling mode during a small break LOCA), the 10 psi differential pressure is not assured and in some cases, torus pressure may exceed raw water pressure.

Preliminary disposition of this DER notes that any leakage would be detected by heat exchanger radiation monitors, allowing operators an opportunity to isolate any radioactive leakage. However, the team also reviewed a proposed plant modification which would remove these detectors because they lack sensitivity to detect normal leakage and would be saturated (by background) under LOCA conditions.

In reply, Design Engineering stated the delay between (automatic) spray initiation and (manual) raw water start is a containment spray design basis which was reviewed and accepted by the USNRC. Also, the plant change request to remove radiation monitors has not yet been reviewed or accepted. Similarly, the DER remains open pending completion of an engineering evaluation. Questions of radiation monitor effectiveness and 10 psi differential pressure limits will be resolved as part of the normal modification and DER resolution processes.

The team found this response acceptable and closed the issue because the matter will receive adequate review and evaluation as the modification is processed and the DER is resolved. However, the team noted that unless the 10 psi differential is to be maintained, changes to the FSAR and technical specification bases will be required.

5.1.3 ESW Pump Strainer Differential Pressure (Question 18)

Duplex basket strainers are provided on the discharge of the ESW pump. Differential pressure across each strainer is sensed by a differential pressure (d/p) switch which actuates a Control Room alarm at a nominal 10.0 psid. No other d/p indication is provided. The Team could not find an ESW system analysis demonstrating adequate performance at differential pressure greater than 2.5 psid. Therefore, the Team was concerned that the ESW system might enter a design basis event with a strainer clogged

just below the alarm point, jeopardizing the ability to deliver design flow to the RBCLC heat exchanger. Design Engineering was unable to locate documentation justifying the 10.0 psid setpoint, and subsequently wrote DER 1-93-1235 to identify this condition.

5.1.4 ESW Pump Operability Test (Question 42)

A quarterly test is conducted under N1-ST-Q13 to verify ESW Pump Technical Specification operability as well as to trend pump performance. The test is performed by diverting pump flow through a 4-inch recirculation line which returns flow to the Discharge Tunnel. Flow is not measured during this test although it is measured during the N1-ST-R16 test conducted every refueling outage. Instead, the test apparently assumes that resistance is fixed and that flowrate will remain constant each time the test is repeated. However, the recirculation line connects to the ESW pump discharge piping downstream of the ESW strainers, and no instrumentation is installed to measure strainer differential pressure, although a high delta P alarm nominally set at 10.0 psid has been provided.

Therefore, the Team was concerned that the strainers could be clogged to just below the alarm point during the test. The effect would be to shift the system resistance curve such that pump degradation would be approximately 15% before the $0.9P_r$ low alert limit was reached. In reviewing the design basis calculations, the Team found that ESW system performance had been evaluated only to a pump degradation of 10% (ref: Calculation S13.4-70-HX06).

In addition, even with a clean strainer, pump degradation would be approximately 13% before the 0.9 P_r value is reached due to the effect of the system resistance curve in lowering the test flowrate as degradation increases.

The Surveillance Test Group and Design Engineering concurred that the possibility exists that pump degradation might exceed 10% with the current N1-ST-Q13 test procedure. DER-1-93-1235 documents the concern as related to strainer clogging, and DER-1-93-1274 addresses the shift in test flow rate when the strainer is clean. The impact of the identified concerns on N1-ST-Q13 will be evaluated in the response to these DERs, and the need for a periodic strainer cleaning procedure or differential pressure monitoring instrument will be considered under DER-1-93-1235.

Past experience with the ESW strainers indicates little likelihood that they would be measurably clogged during the quarterly pump test, although this had not been formally trended. Review of N1-ST-Q13 test results found no pump degraded more than 1.7%. Therefore, no operability concern currently exists.

5.1.5 C.S. Raw Water Heat Exchanger Relief Protection (Questions 12 and 25)

Containment spray raw water heat exchangers do not contain pressure relief valves. Tube side discharge valves are interlocked to assure a discharge path is always aligned. In response, Design Engineering demonstrated that a discharge path is available in spite of failures, such as electric power or service air.

During a review of alarm response procedures, the team noted that operator actions on a high radiation alarm include heat exchanger isolation. In view of the above, the team also questioned the acceptability of this procedure. In this case, any heat input would be through ambient convection (both sides of the HX are isolated) and therefore heat exchanger vents (which are constantly open) would provide relief protection. Operations initiated a PCE to modify the procedure to assure vents remain open if a heat exchanger is isolated. The team found this response acceptable and the item was closed.

5.1.6 Containment Spray Water Seal (Question 17)

In lieu of Appendix J, Type C local leak rate testing, a water seal is provided for containment spray isolation valves. By analysis, two spray pumps are required to assure spray pressure remains above peak containment accident pressure. The team was concerned that in a design basis LOCA with failure of one emergency diesel (i.e. two of four spray pumps unavailable), the water seal may be lost if operators have to secure one of the running spray pumps to make room on the diesel generator for a raw water pump. Design Engineering replied that the water seal is provided only in the spray mode and not in the torus cooling mode, as documented in safety evaluation 89-013 which has been reviewed by the USNRC. Engineering further stated that when a raw water pump is run during a DBA with one EDG, the containment spray pump is in the torus cooling mode of operation. The system is never configured with one spray pump spraying, and one raw water pump running.

The team reviewed safety evaluation 89-013 and confirmed that it clearly indicates that the water seal is only employed when the containment spray system is in the spray mode with at least two pumps running. Hence, when sprays are shifted to torus cooling at approximately 15 minutes into a DBA, safety evaluation 89-013 is satisfied. The team found this answer acceptable and the issue was closed.

5.2 Generic Letter 89-13

Appendix B to this report provides a detailed summary of the integrated program initiated to achieve G.L. 89-13 commitments. The team found this program to be sufficiently achieving its objectives. The program could benefit from an integrated program document, identifying all activities required to meet specified commitments. Nonetheless, the program is effective and in several cases is considered particularly strong. For example, the commitments to regular heat exchanger cleaning, the aggressive actions taken to control microbiologically induced corrosion, and the erosion/corrosion control programs are considered strengths.

QA surveillance report 93-10122 and the assistance of its author, was of great value in conducting this audit. The surveillance report provides a detailed review of documentation to support the G.L. 89-13 commitments as controlled by the nuclear commitment tracking system (NCTS).

5.2.1 Heat Exchanger Monitoring

Heat exchangers to be monitored under G.L. 89-13 commitments include the RBCLC heat exchangers, EDG jacket water coolers, and containment spray raw water heat exchangers as portions of different systems with different configurations. The Team found G.L. 89-13 commitments are being satisfied as described below and further discussed in Appendix B:

RBCLC/ESW

RBCLC heat exchangers were tested to demonstrate design basis during power ascension. These heat exchangers are cleaned on an annual basis. Until improved instrumentation is installed, heat exchanger degradation will be measured between scheduled cleaning through frequent differential-pressure monitoring and trending.

EDG Coolers

One (of 4) EDG coolers will be opened and cleaned on a quarterly basis such that each cooler will be cleaned at least annually. Additional instrumentation will be installed by 1995 to permit direct cooler monitoring. In the interim, trending of lube oil and jacket water temperatures will indicate possible degradation in raw water cooling.

Containment Spray Raw Water

CSRW heat exchangers have been cleaned to bare metal and are maintained in dry lay-up, except when they are filled for periodic surveillance testing. Since they are maintained clean and dry, there is no need for periodic monitoring.

Two CS raw water heat exchangers (nos. 111 and 121) were tested for thermal performance during power ascension. Even after cleaning, one of the two (no. 111) failed to indicate the required heat load (57 x 10^6 Btu/hr compared to the required 60 x 10^6 Btu/hr). Both heat exchangers were found acceptable, however, based upon the following:

1. The heat exchangers were cleaned to bare metal, hence were effectively in the manufacturer's as-delivered condition. In this case, the manufacturers guaranteed heat transfer rate was considered more valid than the recent test results because of location and accuracy of instruments (slight changes in temperature or flow readings would account for the below rated heat load results) and because testing can not simulate actual design basis conditions (i.e. testing was performed in an off-design condition.

2. Testing was performed at off-design conditions (actual heat load of approximately 23 x 10^6 Btu/hr). An as-tested fouling factor was calculated from the test data and then, holding the fouling factor constant, a heat transfer rate was calculated under design basis heat load conditions (i.e. design basis flows and temperatures). While the analytical techniques are considered valid, they involve a number of empirical expressions which must result in some inaccuracy, particularly with test heat loads below 50% of heat exchanger capacity.

In summary, the team found the above approach acceptable in meeting G.L. 89-13 requirements. The team believes the focus on heat exchanger cleaning, with some monitoring to anticipate potential needs for additional cleaning to be fully responsive to the Generic Letter. This approach should serve NMP-1 well in achieving design basis heat removal rates under accident conditions.

5.2.2 Zebra mussel control (Question 22)

During the recent 1993 refueling outage, a Clam-Trol CT-1 treatment for control of zebra mussels was applied in the forebay structure. The zebra mussel mortality rate was determined to be 98.4%. However, in May 1993, a Containment Spray raw water pump was pulled from the forebay for maintenance. The pump housing was covered (externally) by a large colony of live zebra mussels. The number of live mussels on the pump raised questions as to the actual effectiveness of the treatment. DER-1-93-1261 was prepared to address the concern and evaluate the zebra mussel treatments.

5.2.3 Microbiologically Induced Corrosion

Microbiologically induced corrosion (MIC) is being addressed in an aggressive manner. A modification is being installed to reduce the potential for MIC. It includes the installation of a 3 pump skid for injection of sodium hypochlorite and sodium bromide to the service water system, installation of total residual oxygen monitors, and changing the fire protection jockey pump make-up water supply from service water to city water.

Additionally, extensive inspection, sampling, and analyses of the service water supplied equipment is accomplished during routine preventive maintenance.

5.3 <u>Testing</u>

5.3.1 IST Testing

A review was performed of the NMP-1 Inservice Testing (IST) program established in accordance with ASME, Section XI, and Technical Specifications 3.2.6 and 3.2.7. The review primarily focused on IST program components associated with the following systems; Service Water System, Emergency Diesel Generator Cooling Water, Containment Spray Raw Water, and Reactor Building Closed Loop Cooling. The review included interviews with the Site IST supervisor and his staff.

The team concluded the NMP-1 pump and valve second ten-year Inservice Testing Program Plan is well developed and implemented. The IST program plan was found to be concise, technically sound, and coherent. Program responsibilities are clear and well defined.

A sample of pumps and valves were reviewed to ascertain their testing history for adverse trends, documentation availability, and compliance with associated procedures. Approximately 32 IST components and 361 test results were reviewed, from March 1990 to the present. Documentation was well organized and retrievable.

A review was performed on 7 previously issued DERs. A sample was pulled of both closed and open DERs associated with IST and surveillance testing. No adverse trends were observed. Closed DERs were observed to have satisfactory corrective action. Open DERs were reviewed and found to contain proposed corrective actions with satisfactory implementation due dates.

5.3.1a Pump Inoperability Determination (Question 14)

Procedure N1-ST-R16, performed 2-27-92, documents that emergency service water pump 12 was found in the required-action range for pump flow rate above the normal flow rate. Per the requirement of the procedure and ASME Section XI, IWP-3230(b), when deviations fall within the required-action range, the pump shall be declared inoperative. Review of the procedure and the S.S.S. log for 2-27-92 did not reveal the pump being declared inoperable. DER-1-93-1231 was issued to document the deviation.

5.3.2 Surveillance Testing (Question 39)

Review of Operations Surveillance Procedures and comparison with P&IDs concluded test paths were consistent with P&ID configuration and were performable as written. Bases for calculations used in Surveillance Test Procedures for determining suction and discharge pressures for the Containment Spray Raw Water, Emergency Service Water and Diesel Generator Cooling pumps were found in historical hydraulic Parameter IST pump data packages. Reviews of completed surveillance test procedures identified that documentation was adequate. An error was identified in the Emergency Service Water inlet elevation value used in the determination of head correction and pressure calculations. Actions were taken to correct calculations contained in N1-ST-Q13 and N1-ST-R16 for suction pressure and differential pressure. It was noted that no procedural requirement exist to address control of calculations to determine these correction factors. DER 1-93-1295 addresses this concern.

5.3.3 Check Valve Testing

A review was also performed on the status of NMP-1 check valve testing program established in accordance with SOER-86-03. The team found the program established and implemented with 32 component exams performed. A review was performed on 16 of the 32 tests that have been performed with no unsatisfactory observations of the actual test data. Interviews were held with the IST Site Supervisor and his assigned I&C technicians. The group was found to be dedicated and committed and had the full support of the supervisor. Having the same technicians perform required tests, expertise has been established with tests and equipment.

5.4 Operations

The following operations items were reviewed:

- Comparison of the safety related portions of the P&IDs to valve lineups for containment spray raw water, service water, reactor building closed loop cooling water, and emergency diesel generator cooling water.

- The audit team performed a complete walkdown of all the safety related portions of service water. A complete walkdown of all service water systems, safety and non-safety was performed in the screen house.

The comparison of P&IDs to valve lineups, and system walkdowns resulted in the identification of several discrepancies. The following are examples of these discrepancies.

- Several instrument root valves were not included on the P&IDs and valve lineups
- Vent valve not included on valve lineup or P&ID
- Valves 72-92R and 72-94 were on two different lineups, OP-14 and OP-18
- Valves 93-83 and 93-85 are called drain valves on the lineup; they are actually vent valves
- Several valve labels were missing.

Because of the number of discrepancies, this item was considered significant. Where possible, the lineup problems were corrected using (4) PCEs. DER-1-93-1284 and 1-93-1285 were initiated to cover the remaining discrepancies.

5.5 Maintenance

5.5.1 Trend Analysis of ESW Work Requests

To identify potential adverse trends in the maintenance area the Audit Team searched the Work Tracking System database and obtained a printout of Service Water System Work Requests completed since January 1, 1990. The database did not distinguish between non-safety-related and safety-related Essential Service Water entries. Although a total of 301 records were retrieved, most dealt with non-essential SW features.

Focusing on corrective rather than preventive maintenance items, it was found that remarkably few WRs were written on ESW components. No single component had more than one WR against it during this period. The types of problems were categorized as follows:

External Leakage	3 WRs
Pluggage	4 WRs
Insulation Damage	1 WR
Bent Valve Stem	1 WR

There was no evidence of a chronic problem and no indication that the frequency of occurrence was increasing in any of these categories.

In the non-essential SW system, the predominant problems were in the areas of external leakage and operational failures, although no unusual trends were evident. Seven WRs dealt with the Radiation Monitors in the SW discharge header, all of which occurred within a seven month period. No corrective maintenance WRs have been written on components of the SW Radiation Monitor for over two years.

No adverse maintenance trends were apparent in the SW/ESW system.

5.5.2 RBCLC Heat Exhcanger Tube Plugging (Question 28)

In reviewing N1-MMP-070-406 Revision 00, "RBCLC Hx Maintenance Procedure," the Team observed that a limit of 242 (10%) had been specified as the maximum number of tubes allowed to be plugged in any one RBCLC cooler. Although the Team considers it commendable to include this type of information in the procedure, design documentation did not exist to support the specified value.

Design Engineering surmised that the 10% limit had been obtained in verbal communications with the heat exchanger vendor or other informal means. Design Engineering subsequently analyzed RBCLC Hx performance under worst case accident conditions and concluded that design limits could be maintained with 10% of the tubes plugged. These analyses were documented in calculations S13.4-70-HX02 Revision 2 and S13.4-70-HX06 Revision 1. No further action was deemed necessary, and the question was closed.

5.6 Administrative Controls

5.6.1 Drawing Distribution (Question 34)

Review of Unit 1 Operations controlled red-lined critical P&ID drawings and comparison with CDS (Controlled Document System) identified (10) ten P&IDs that were not the current revision. The current revisions were found to have been distributed to Salina Meadows holders and site Document Control but not to the Unit 1 Operations holder.

In response the Document Control Supervisor indicated that the target turnaround time for critical drawings is 7 days from receipt at Salina Meadows to distribution to site holders; however, the target of 7 days has not been met by Document Control. Typical turnaround time is approximately 12 days. Four of the above drawings were identified as having been backlogged approximately 1 month from time of issue as a result of an inadvertent placement of drawings (out of chronological order) while in reproduction.

Corrective actions were taken to distribute the identified drawings. Discussion held with the Unit 1 Operations Manager indicated that the actual turnaround time for distribution of critical controlled drawings was not consistent with his expectation. Although Unit 1 Operations controlled critical drawings are redlined a potential exists for operational or configurational problems when delays occur in distribution of revised documents. DER 1-93-1296 was issued to address this concern.

APPENDIX A

STATUS OF QUESTIONS/CONCERNS

No.	Subject	Class	Status	Action
1	ESW Design Pressure	Minor	Closed	
2	Single Check Valve Failure	Significant	Closed	DER-1-92-4263
3	EDG Cooling Design Pressure	No Problem	Closed	
4	Partial Loss of Off-Site Power	No Problem	Closed	
5	Calculation Discrepancies	Minor	Closed	
6	Inconsistent Use of Elevations	Minor	Closed	
7	40°F RBCLC Temperature	No Problem	Closed	
8	ESW Accident Flow Rate	Minor	Closed	DBD/DCR
9	No Min. Submergence Value	Minor	Closed	Calc./DCR
10	Use of Choke Flow Questioned	Minor	Closed	Calc. Cancelled
11	RBCLCHX Capability	No Problem	Closed	
12	CSRWHX Relief Protection	Minor	Closed	PCE
13	Min. Lake Level Inconsistencies	Minor	Closed	
14	Pump IST Failure Not Inoperable	Significant	DER	DER-1-93-1231
15	Equip. Calibration Prior to IST	No Problem	Closed	
16	Full Stroke Exercise Tests	No Problem	Closed	
17	C.S. Water Seal Requirements	Minor	Closed	
18	RBCLC Strainer d/p Value	Significant	DER	DER-1-93-1235
19	Procedure Final Valve Position	Minor	Closed	PCE
20	VOID	N/A	N/A	
21	47% Clamtrol Mortality	Minor	Closed	
22	Zebra mussels on CSRW Pump	Significant	DER	DER-1-93-1261
23	Intake Structure Inspection	Minor	Closed	PCE
24	CSRWHX 10 psig Overpressure	Significant	DER	DER-1-92-4123
25	CSRWHX Relief Protection	Minor	Closed	PCE
26	CSHX Procedure Inconsistencies	Minor	Closed	PCE
27	SDBD Mod. Description	Minor	Closed	DCR
28	Basis for 10% Tube Plugging	Significant	Closed	Calc. Prepared
29	P&ID Discrepancies	Significant	DER	DER-1-93-1285
30	Valve Line-up Discrepancies	Significant	DER	DER-1-93-1284
31	EDGHXs Not in G.L. 89-13	Minor	Closed	
32	HX Cleaning Commitments	No Problem	Closed	

No.	Subject	Class	Status	Action
33	Check Valve Acceptance Criteria	Minor	Closed	PCE
34	Doc. Control Turn-Around	Significant	DER	DER-1-93-1296
35	EDGHX Initial Perf. Test	Minor	Closed	
36	EDG Trending at 81°F	No Problem	Closed	
37	P&ID Discrepancies (NSR)	Minor	DER	DER-1-93-1285
38	Valve Line-up Problems (NSR)	Minor	DER	DER-1-93-1284
39	ST Procedure Data Corrections	Significant	DER	DER-1-93-1295
40	ST Procedure Questions	Minor	Closed	
41	HEATXP Calculation	No Problem	Closed	
42	ESW Pump Operability/Strainer	Significant	DER	DER-1-93-1235 DER-1-93-1274
43	Diesel Fire Pump Spool Pieces	Minor	Closed	

APPENDIX B

COMMITMENTS TO GENERIC LETTER 89-13 FROM THE DECEMBER 10, 1993 LETTER ANSWERING THE GENERIC LETTER

GL 89-13 RECOMMENDATION I

FOR OPEN-CYCLE SERVICE WATER SYSTEMS, IMPLEMENT AND MAINTAIN AN ONGOING PROGRAM OF SURVEILLANCE AND CONTROL TECHNIQUES TO SIGNIFICANTLY REDUCE THE INCIDENCE OF FLOW BLOCKAGE PROBLEMS AS A RESULT OF BIOFOULING.

*NMPC Response * 1 ** Niagara Mohawk established a monitoring program for Asiatic Clams in response to NRC IE Bulletin 81-03. This program included inspection, sampling, and microbiological analysis activities for both the service water and circulating water systems. This program recently been updated to include Zebra Mussels.

*Audit Team Assessment * 1 ** The audit team reviewed the results of veliger sampling and video tape inspections of the forebay and a service water pipe inspection. Maintenance procedures as well as Chemistry Technical Procedure S-CTP-V632, Inspection, Sampling and Analysis of Water Systems for Corrosion were reviewed. The audit team had a question regarding the inspection of the intake structure which was resolved during the audit by the issuance of a Procedure Change Evaluation (PCE) to proceduralize this inspection.

Microbiological Induced Corrosion (MIC) is being addressed in an aggressive manner. A modification is being installed to reduce the potential for MIC. It includes the installation of a system to inject sodium hypochlorite and sodium bromide to the Service Water system, installation of Total Residual Oxygen monitors and the changing of the Fire Protection Jockey pump make-up water supply from service water to city water. Extensive inspection, sampling and analysis is conducted by the Chemistry Department during inspection and cleaning activities conducted by the Mechanical Maintenance Department.

*NMPC Response * 2 ** A separate Zebra Mussel Task Force was established to resolve this issue.

*Audit Team Assessment * 2 ** The Zebra Mussel Task Force was formed to focus efforts on resolution of Zebra Mussel infestation concerns. The current Task Force leader is the Service Water System Engineer.

NMPC Response * 3 * A procedure for zebra mussel control has been drafted and is currently in review.

Audit Team Assessment * 3 * The audit team reviewed the procedures currently in place to provide for zebra mussel Control. They include:

- N1-CTP-900 , Rev 0 & 1, Zebra Mussel Treatment
- N1-CTP-V930, Rev 0, Zebra Mussel Forebay Treatment

These procedures provide for a controlled application of the chemical biocide, Clam-Trol CT-1 for the treatment of Zebra Mussel infestation of the plant raw water system. These procedures also control the detoxification of the Clam-Trol CT-1 with injection of bentonite clay. N1-CTP-900 is currently being canceled and will be rewritten for future use.

NMPC Response * 4 * Initial biocidal treatment to prevent zebra mussel infestation of the Unit 1 Service Water System will be completed prior to August 31, 1991.

Audit Team Assessment * 4 * The initial application of Clam-Trol CT-1 for the control of zebra mussels was completed in January 1991. This application had a limited success of 47% mortality. Subsequent applications have been more successful. In the recent 1993 Refueling outage, Clam-Trol CT-1 was applied in the Forebay Structure. While the reported mortality was 98.4%, a large colony of live Zebra Mussels was discovered on a Containment Spray Raw Water Pump housing during maintenance work during the period of the audit. The audit team questioned the effectiveness of the Clam-Trol CT-1 treatments considering the 98.4% mortality reported in the procedure. Deviation/Event Report (DER) 1-93-1261 was issued by the Chemistry Department to resolve this issue. This concern is discussed in more detail in the body of the audit report.

GL 89-13 RECOMMENDATION II

CONDUCT A TEST PROGRAM TO VERIFY THE HEAT TRANSFER CAPABILITY OF ALL SAFETY-RELATED HEAT EXCHANGERS COOLED BY SERVICE WATER.

*NMPC Response * 5 ** The Service Water Task Force has been assigned to evaluate heat exchanger performance monitoring requirements in order to establish a heat exchanger performance monitoring program. This evaluation will include:

- Determining the adequacy of currently installed instrumentation for performance monitoring
- Determining the possible use of additional equipment
- Determining the need to develop and implement performance monitoring procedures
- Conducting performance monitoring through trending heat exchanger test and surveillance results

*Audit Team Assessment * 5 ** The audit team reviewed various documentation pertaining to heat exchanger performance monitoring. Power Ascension Test Procedure N1-PAT-11-1, Reactor Building Closed Loop Cooling Water Heat Exchangers was conducted to determine the Reactor Building Closed Loop Cooling (RBCLC) Heat Exchangers heat transfer capabilities verses the design requirements. The PEPSE model software was unable to provide the desired results due to problems with the test results. Engineering provided an evaluation (ref. memo SM1-M90-0332) and additional calculation (#S13.4-70-HX07) to confirm that the RBCLC heat exchangers meet their heat transfer design requirements. A Modification Request N1-88-122 was initiated to upgrade flow instrumentation for the RBCLC Heat Exchangers. This Modification Request is still open and is considered a low priority based on the current practice of cleaning and inspecting each heat exchanger annually coupled with performance monitoring and trending activities. Performance monitoring and trending activities are performed in accordance to Technical Support Procedure N1-TTP-09, Reactor Building Closed Loop Cooling Thermal Performance Monitoring and Technical Department Instruction N1-TDI-9, System Performance Monitoring Program for Nine Mile Point Unit 1.

Power Ascension Tests N1-PAT-7, and N1-STP-15, Containment Spray Raw Water Heat Exchangers were conducted to determine the Containment Spray Raw Water Heat Exchangers capabilities verses design requirements. These tests indicated insufficient heat transfer capacity. Engineering evaluation concluded that the heat exchangers would perform as designed with proper maintenance (ref. memo NMP81573). Administrative changes were made to drain the heat exchangers after operation and maintain them empty and in the standby mode to minimize biofouling in place of performance monitoring and trending. Each heat exchanger will be cleaned and inspected annually.

The Diesel Generator Heat Exchangers were not mentioned in the response to GL 89-13 however, performance monitoring and trending is being conducted in accordance with N1-TDI-9. Each heat exchanger will be cleaned and inspected annually.

*NMPC Response * 6 ** The Nine Mile Point Unit 1 Power Ascension Test Program includes testing of the Reactor Building Closed Loop Cooling (RBCLC) and Containment Spray heat exchangers. Power Ascension Test N1-PAT-11-1 (RBCLC Test) verified that the RBCLC heat exchangers meet or exceed design requirements. Power Ascension Test N1-PAT-7 (Containment Spray Test) will be performed prior to the 1992 refueling outage to verify the Containment Spray heat exchanger capacity while in the torus cooling mode.

*Audit Team Assessment * 6 ** The audit team reviewed initial Thermal Performance Monitoring test results for the Reactor Building Closed Loop Cooling (RBCLC) System (N1-PAT-11-1) and the Containment Spray Heat Exchangers (N1-PAT-7 & N1-STP-15). No initial test was committed to or conducted on the Diesel Generator Heat Exchangers. While initial test data was not completely successful in determining the thermal performance of the heat exchangers, Engineering evaluated the test results and provided justification as to the ability of the RBCLC and Containment Spray Heat Exchangers to meet design requirements. Also, all heat exchangers are cleaned and inspected by Mechanical Maintenance annually in accordance with the appropriate Preventative Maintenance (PM) procedure. Included in the PM are requirements for the Chemistry Department to inspect for mollusk shells (such as Zebra Mussels) and Microbiologically Induced Corrosion (MIC).

GL 89-13 RECOMMENDATION III

ENSURE, BY ESTABLISHING A ROUTINE INSPECTION AND MAINTENANCE PROGRAM FOR OPEN-CYCLE SERVICE WATER SYSTEM PIPING AND COMPONENTS, THAT CORROSION, EROSION, PROTECTIVE COATING FAILURE, SILTING AND BIOFOULING CANNOT DEGRADE THE PERFORMANCE OF THE SAFETY-RELATED SYSTEMS SUPPLIED BY SERVICE WATER.

*NMPC Response * 7 ** The Service Water Task Force has been assigned to evaluate the requirements for establishing an inspection and maintenance program that will satisfy this Generic Letter recommendation. Actions under evaluation include determining the need for additional service water piping and heat exchanger inspections, use of radiography during inspections in the erosion/corrosion program, establishing a heat exchanger flushing program and the use of chemical cleaning.

Audit Team Assessment * 7 * The Service Water Task Force reviewed the need for additional water piping and heat exchanger inspections, use of radiography during Erosion/Corrosion inspections as well as heat exchanger flushing and chemical cleaning. This review resulted in only one additional action and was documented in file memo NMP87684. The Erosion/Corrosion program provides details regarding the inspections required under the program and the method of examinations to be used. An annual inspection and cleaning PM was initiated for all RBCLC, Containment Spray, and Diesel Generator Heat Exchangers.

NMPC Response * 8 * Present maintenance practice already includes a unit cooler fin cleaning program.

Audit Team Response * 8 * The audit team reviewed Mechanical Maintenance procedure N1-MPM-202-553, Reactor Building Area Coolers - Preventive Maintenance. This procedure outlines the methodology of the periodic unit cooler fin cleaning and cooler flushing and includes inspections for mollusk shells (such as Zebra Mussels and MIC by the Chemistry Department.

NMPC Response * 9 * Niagara Mohawk has recently approved a procedure (S-CTP-V632) defining the inspection and analysis of water systems for the presence of corrosion, debris, biofouling and other detrimental conditions.

Audit Team Assessment * 9 * Chemistry Technical Procedure S-CTP-V632, Inspection, Sampling and Analysis of Water Systems for Corrosion is in place for inspections and analysis of water systems.

NMPC Response * 10 * A Erosion/Corrosion program addressing the Service Water System has been developed and will be implemented prior to start-up from the 1992 refueling outage. Actions addressing this Generic Letter recommendation will be completed and an inspection and maintenance program will be in place prior to start-up from the 1992 refueling outage.

Audit Team Assessment * 10 * The audit team reviewed the Erosion/Corrosion program documentation. The Erosion/Corrosion Program Piping Review Plan provides the results of the determinations made for piping inspections and the type of examination methods to be used for components identified in the plan. The examinations recommended by this program were performed during the recent refuel outage. The final report on the results of these examination activities is being prepared at this time. Future examinations will be determined based on the examination results and system performance observed in the future. It is the opinion of the audit team that the Erosion/Corrosion program will prove to be effective in meeting the program purpose of preventing material failure, personal injury, and loss of generation.

GL 89-13 RECOMMENDATION IV

CONFIRM THAT THE SERVICE WATER SYSTEM WILL PERFORM ITS INTENDED FUNCTION IN ACCORDANCE WITH THE LICENSING BASIS FOR THE PLANT.

*NMPC Response * 11 ** Design reviews were performed for the safety-related Raw Water Systems (Emergency Service Water, Containment Spray Raw Water and Emergency Diesel Generator Cooling Water during the Unit 1 Extended Outage. These systems were analyzed and verified to be capable of fulfilling their respective Safety Functions in accordance with the licensing basis for the plant. In addition, Niagara Mohawk has initiated a Plant Design Basis Reconstitution (DBR) Program for Unit 1. The DBR program will evaluate the existing Service Water System configuration against the original system design and licensing basis. The Service Water Task Force will pursue prioritizing the Service Water portion of the DBR to ensure that it will be completed prior to start-up from the 1992 refueling outage.

*Audit Team Assessment * 11 ** The Service Water portion of the DBR effort was completed on 12/31/91 with the issuance of Service Water System Design Basis Document SDBD-502. A consultant was contracted to perform a Service Water System thermo-hydraulic analysis. This analysis has been completed and is currently under review by NMPC Engineering. Additional design reviews have been performed during this audit by audit team members. Any findings will be further discussed in the audit report.

GL 89-13 RECOMMENDATION V

CONFIRM THAT MAINTENANCE PRACTICES, OPERATING AND EMERGENCY PROCEDURES, AND TRAINING THAT INVOLVE THE SERVICE WATER SYSTEM ARE ADEQUATE TO ENSURE THAT SAFETY-RELATED EQUIPMENT COOLED BY THE SERVICE WATER SYSTEM WILL FUNCTION AS INTENDED AND THAT OPERATORS OF THIS EQUIPMENT WILL PERFORM EFFECTIVELY.

*NMPC Response * 12 ** Niagara Mohawk is currently evaluation several actions to address this recommendation. these actions include:

- Review of procedures and training associated with the Service Water System,
- Providing additional training to Chemistry Technicians on microbiologically-induced corrosion, corrosion, and inspection practices,
- Incorporating Generic Letter 89-13 concerns into training programs for Operation, Chemistry, and Maintenance personnel.

<u>*Audit Team Assessment * 12 **</u> The audit team reviewed a memo to file (ref. memo 88520) documenting a review and initiation of changes to procedures to incorporate GL 89-13 issues in the procedures. A sample of the procedures discussed in the memo were reviewed during the performance of this audit which confirmed that the GL 89-13 issues were properly addressed in the procedures identified in memo 88520.

A review of Lesson Plans for Operations personnel were found to include discussion topics on GL 89-13 and associated issues. Maintenance Training personnel initiated a Training Change Order (TCO# MM-93-005) on 3/17/93 to incorporate GL 89-13 into the appropriate Mechanical Maintenance Lesson Plans that include Service Water. A review of Lesson Plans for Chemistry Technicians and personnel indicated extensive training was received on MIC. Training on Zebra Mussels was last documented in the records in 1990. Training on the use of test equipment and procedural requirements for Chemistry Technical Procedure S-CTP-V632, <u>Inspection, Sampling and Analysis of Water Systems for Corrosion</u> was also noted in the records. Technical Staff Continued Training discussing GL 89-13 specifically Zebra Mussels is planned for completion in 1993 for Unit 1 Technical Staff personnel.