U. S. NUCLEAR REGULATORY COMMISSION

REGION I

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LICENSEE:	Niagara Mohawk Power Corporation 301 Plainfield Road Syracuse, New York 13212
FACILITIES:	Nine Mile Point Nuclear Power Station, Units 1&2
INSPECTION AT:	Scriba, New York
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EXECUTIVE SUMMARY

The Nuclear Regulatory Commission (NRC) conducted a team inspection at the Nine Mile Point Station, Units 1 & 2 from June 16 to July 16, 1993 to assess the programs developed by the licensee in response to NRC Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment." The generic letter provided recommendations to licensees for the development of adequate programs to ensure operability of their respective service water (SW) systems during postulated design-basis accidents. The affected systems at Unit 1 include the service water/emergency service water (SW/ESW), emergency diesel generator (EDG) cooling water, and containment spray (CS) raw water cooling systems while at Unit 2 there is the SW system. This inspection was accomplished using the guidance in NRC Temporary Instruction 2515/118, Revision 1, "Service Water System Operational Performance Inspection" and an inspection procedure titled "Licensee Self-Assessments." The team reviewed recently completed licensee audits of the Units 1 & 2 SW systems. The Unit 1 review was an indepth evaluation of the licensee SW audit results encompassing all portions of the SW system, comparing the SW audit attributes to the Temporary Instruction 2515/118 inspection requirements, and performing independent inspection in certain areas. The Unit 2 review focused on specific SW system items which involved two unresolved items associated with SW flow degradation problems and reduced unit cooler performance.

For Unit 1, the team independently verified the licensee's audit conclusion that the SW/ESW, EDG cooling water, and CS raw water cooling systems were sufficiently designed, operated, tested, and maintained to assure performance of the design safety functions under postulated accident conditions. The team concluded that the licensee SW audit was well planned, implemented, and documented. It included most of the Temporary Instruction 2515/118 inspection requirements and identified a number of significant findings. The team also verified the licensee SW audit conclusion that an aggressive program was in place to maintain the safety-related heat exchangers by annual inspections and cleanings. Therefore, the team concluded that the licensee SW audit was an acceptable alternative to a full scope NRC inspection conducted using Temporary Instruction 2515/118.

The team independently reviewed a number of areas specified in Temporary Instruction 2515/118 that were beyond the scope or otherwise not included in the licensee SW audit. For example, an extensive review of failure vulnerabilities for the cooling water intake structure and potential common mode failures for essential cooling water systems was performed. The team observed a weakness in the zebra mussel control program since the licensee found a live zebra mussel colony in the intake structure secondary forebay in May 1993. The licensee agreed to review the status of the Unit 1 zebra mussel control program and to discuss this information in a meeting with the NRC later in 1993.

For Unit 2, the team concluded that the licensee's corrective actions to resolve flow degradation problems in the SW system have been adequate. Specifically, the ongoing system analysis and heat exchanger performance testing have demonstrated that the system is capable of removing enough heat under accident conditions to assure a safe shutdown. Based on this information, both unresolved items were closed. However, the licensee agreed to meet with the NRC later in 1993 to share their plans for implementing long term corrective actions to restore the SW system to its full design capability and to assure its continued performance is adequate.

1.0 SERVICE WATER SYSTEM INSPECTION

1.1 Inspection Scope and Objectives

An inspection of the licensee's audit of the Nine Mile Point Units 1 and 2 service water (SW) systems was performed using the guidance in Temporary Instruction 2515/118, Revision 1, "Service Water System Operational Performance Inspection," and an inspection procedure titled "Licensee Self Assessments." The inspection objective was to verify that essential cooling systems at Nine Mile Point Units 1 and 2 were capable of fulfilling their intended safety system functions. The inspection was completed, in part, by evaluating the licensee SW audit, including independent NRC assessment of SW system readiness. The NRC team also verified that the licensee audit for Unit 1 was an acceptable alternative to a full scope NRC inspection conducted using Temporary Instruction 2515/118.

1.2 Introduction

From March 8 to April 2, 1993, the licensee conducted an audit of the Unit 2 SW system and from May 3 to May 28, 1993, the licensee conducted an audit of the Unit 1 service water/emergency service water (SW/ESW), emergency diesel generator (EDG) cooling water, and containment spray (CS) raw water systems. The licensee's audit teams concluded that these systems were 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 detailed findings to support these conclusions were documented in Niagara Mohawk Quality Assurance Audit Reports 93007 for Unit 1 and 93003 for Unit 2 which were submitted to the NRC on July 1, 1993.

NRC inspectors monitored the conduct of the licensee audit activities onsite from May 19-21, 1993, as reported in NRC Inspection Report 50-220/93-10 and found that the licensee team was executing their audit as planned. The NRC observed the licensee's audit team daily review of findings and planned activities. The qualifications of the licensee audit team members were reviewed and the licensee auditors were observed in the field interacting with the assigned support personnel in each of the functional areas. Issues that could not be resolved during the conduct of the audit were documented as "audit questions." Questions were assigned to engineering personnel for resolution. At the completion of the audit, open questions were entered into the licensee "Deviation/Event Report (DER)" system for further review and resolution. Each DER requires internal closeout and provides documentation for future inspection.

The licensee provided a formal presentation of their Unit 1 and 2 SW system audits to the NRC in the Region I office on June 9, 1993. The slides used by the licensee during this presentation are included as Attachment A of this inspection report. During the presentation the licensee discussed the planning, performance, and results of the audits and reviewed the qualifications of the audit team members. The licensee auditors developed 43 "audit questions" and documented 13 DERs to resolve these open questions.

The NRC onsite inspection began on June 16 - 18, 1993 with a review of the SW system design documents, operating procedures, and other technical information. Additional onsite inspection was conducted from June 28 - July 2 and July 12-16, 1993.

2.0 UNIT 1 SERVICE WATER SYSTEM INSPECTION

The NRC team evaluated the licensee's audit and assessed the SW systems at Unit 1 using the Temporary Instruction 2515/118 inspection requirements for each functional area. Most of the Temporary Inspection 2515/118 inspection requirements were incorporated in the licensee's SW audit. However, certain inspection elements were either omitted or not comprehensively reviewed. For example, the reviews of intake canal vulnerabilities for the mechanical systems design review and operations functional areas were not performed in the licensee's audit. The team, therefore, conducted independent inspection of these items. The NRC also assessed licensee commitments to Generic Letter 89-13 and the status of their current actions to implement these commitments.

2.1 Unit 1 Cooling Water Systems

The SW/ESW, EDG cooling water, and CS raw water systems were selected for inspection. Simplified system diagrams are included in Attachment A. Each system uses water drawn from a common intake structure and tunnel that originates roughly one quarter mile out into Lake Ontario. The intake passes into the primary forebay through manually controlled intake gates and then into the secondary forebay by passing through trash racks and travelling screens (See Figure 1). Pump suctions are located throughout the secondary forebay and are stratified, as described in attached Table 1, with the high volume circulating water pumps taking suction below the safety related system pumps. Each system contains a pump, strainer, heat-exchanger, and throttle control valve. All systems discharge into a common discharge canal for heat rejection to Lake Ontario. Emergency diesel generator cooling water automatically starts when EDG operation is initiated while the other systems are manually initiated and controlled.

2.2 Mechanical Systems Design Review

The design review section of Temporary Instruction 2515/118 requires a determination of the design basis for each applicable system and a verification that the system will meet the design requirements. The review is also intended to assess single failure vulnerabilities and the effectiveness of design features provided to mitigate system degradation. The licensee audit focused on SW/ESW, EDG cooling water, and CS raw water with parts of these systems selected for detailed design review by the licensee auditors. From this review, 17 of 43 questions were documented. The licensee audit included many of the Temporary Instruction 2515/118 inspection requirements and the NRC inspectors considered a number of the audit findings to be significant. For example, the licensee audit initiated Deviation Event Report (DER) 1-92-4123 to resolve a potential conflict between the design basis overpressure of CS raw water relative to CS cooling water and the actual operating pressures of the two

systems. Thé potential conflict was that the actual pressure difference may be insufficient to ensure that any heat exchanger leakage will be into the CS system. This finding was considered to be significant as its resolution should enhance plant safety since the design pressure difference was specified to ensure containment of radioactive material in case of a plant event.

The NRC inspectors reviewed the current probablistic risk assessment for Unit 1 and noted that the dominant risk contributor for those systems drawing cooling water from the intake structure was the EDG cooling water system. The NRC team also noted that the loss of intake to the EDG cooling water system was not reviewed during the licensee SW audit since the licensee has implemented comprehensive corrective actions in this area in response to a plant event where all intake gates were inadvertently closed. Therefore, the NRC team reviewed: (1) intake canal vulnerabilities that could create common mode failures and possibly cause loss of safety related cooling systems, (2) interfacing system vulnerabilities, and (3) the reactor building closed loop cooling (RBCLC) heat exchangers as detailed below.

2.3 Intake Canal Vulnerabilities

Loss of intake water is a common mode vulnerability for plant cooling systems. Postulated events affecting the intake structure which could result in the loss of essential cooling systems include the following: icing or clogging of the intake manifold, isolation of the intake by improper operation of the intake gates, clogging of the intake trash racks or travelling screens, or simultaneous clogging of pump suctions, strainers, or heat exchangers by debris that has infiltrated into the secondary forebay. Events of this sort have occurred at operating reactor plants including Nine Mile Point, Unit 1.

A. Intake Manifold Icing and Clogging

With the exception of ice buildup, clogging of the intake manifold by foreign objects is unlikely. The manifold is designed to prevent large debris from entering the intake structure and routine surveillance of the intake manifold is performed to measure and mitigate clogging or biofouling before any operational interference. Icing, or buildup of ice around the intake manifold is a seasonal occurrence which chokes flow to the intake tunnel. Plant procedure N1-OP-19, "Circulating Water System," includes a section to mitigate the effects of icing of the intake manifold. When icing is detected by increasing differential pressure between the intake manifold and the forebay, the N1-OP-19 procedure is entered. The specified actions include reducing station load and establishing reverse flow, where the discharge canal is used as the plant intake and the warm effluent is rejected through the intake tunnel to melt the intake manifold ice.

Icing of the intake manifold is a transient event that has occurred at Unit 1 as a gradual buildup, allowing time for briefing and discussion by operators prior to the conduct of the reverse flow procedure. Discussions with plant operators revealed that the last performance of this procedure occurred during the winter of 1991-1992, and the gradual ice buildup allowed extra operations personnel to be summoned for briefing and preparation. Mitigation of icing includes manual manipulation of the intake gates to establish reverse flow and intermittent establishing of recirculating flow which increases circulating water temperature

and may cause a decrease in main condenser vacuum. The team reviewed the training on this evolution and found detailed discussion concerning its control, including any possible adverse effects during gate manipulation. Operator awareness of the possible problems associated with icing and reverse flow operations was evident when the team discussed the evolution with operations personnel. Although icing mitigation is a complex plant operation, preparations and training for establishing reverse flow and mitigation of icing were effective.

B. Intake Isolation During Intake Gate Manipulation

Because the intake canal can be fully isolated from Lake Ontario during manipulation of the intake gates, each operation of the gates includes the risk that improper operation may cause inadvertent isolation of the plant from the ultimate heat sink. In addition to mitigation of intake manifold icing, intake gates are manipulated for circulating water temperature control and maintenance. Complete isolation of the intake occurred during maintenance, on February 21, 1992, when all gates to the intake structure were simultaneously shut and could not be immediately reopened. Intake level decreased as operating pumps removed inventory and indications of loss of suction head for the service water pumps were evident before restoration of intake flow. Details of this event and corrective actions taken to prevent recurrence were described in NRC Inspection Report 50-220/92-80, Licensee Event Report 50-220/92-05-01, and Niagara Mohawk correspondence NMP1L 0673, dated June 22, 1992.

This NRC team reviewed the event of February 21, 1992, and subsequent licensee corrective actions and found a high level of sensitivity of plant personnel to the potential problems associated with misalignment of the intake control gates. In addition to those corrective actions specified in the licensee correspondence, the NRC team found that plant design change, SDC SC1-0066-92, was being implemented to facilitate better operator control of the gates. The modification includes a bypass for the raise-overload limit switch installation on the gate motors and the installation of an ON-OFF selector switch. The switch will allow an operator to stop gate movement in any intermediate position if mis-operation is suspected. The team considered the licensee corrective actions to be comprehensive in preventing operational occurrences during the manipulation of intake gates.

C. Loss of Intake Due to Clogging

A possibility for the loss of intake exists if simultaneous clogging of the trash racks or travelling water screens occurs. The potential for such operational events was not reviewed as part of the licensee audit. Clogging of travelling screens has occurred at other facilities due to sudden intrusions of grass, seaweed, or schools of fish. The Unit 1 design includes three parallel trash rack/travelling screen sets powered from non-class 1E power supplies. Both systems are monitored for differential pressure and have automatic actuation to clear debris on high differential pressure. The mechanical rakes are automatically actuated to remove debris from the trash racks. Similarly, the travelling screens automatically shift to high speed on high differential pressure, allowing screen wash to clear the screens.

Control room operators are made aware of problems with intake flow by four redundant annunciators: service water header low pressure, screenhouse differential pressure, intake structure icing, and circulating water pump intake low level. Additionally, strip chart

indication of screenhouse differential pressure is available to allow early indication of reduced intake flow. Plant equipment operators make routine checks of screenhouse operations and can make assessments of intrusion events. The NRC team reviewed operating procedures containing corrective actions in response to travelling screen high differential pressure. The actions include verification that the screens have shifted to fast speed and that screen wash pumps are running. Further, Special Operating Procedure 7 was reviewed for operator actions on low intake level caused by various events, such as clogged travelling screens. If the level decrease cannot be immediately mitigated, a circulating water pump is tripped and plant load is rapidly reduced. If level continues to decrease or service water pump header pressure deteriorates, the reactor is scrammed, SW pumps are tripped, and ESW is placed into service. The team found the actions specified for loss of intake due to clogging of trash racks or travelling screens to be adequate.

D. Loss of Redundant Cooling Systems Due to Clogging

A possibility for common cause failure of multiple independent cooling trains exists if simultaneous clogging of independent safety system trains occurs due to debris inside the secondary forebay. Debris could clog essential cooling systems quickly by infiltration into the secondary forebay on failure of a travelling screen during an intrusion event or slowly by infestation and buildup inside the secondary forebay of the intake structure.

Actions specified in Special Operating Procedure 7 for loss of service water provide for supply of the Unit 1 ESW system from the Unit 2 fire pump if intake cannot be restored. This action would provide a diverse supply of cooling water to RBCLC equipment in case of a severe debris intrusion event affecting the secondary forebay. A similar contingency is available for the EDG cooling water system.

2.4 Interfacing System Vulnerabilities

A. Isolation Check Valves

The SW pumps provide cooling water from the intake structure to the reactor and turbine building closed loop cooling (TBCLC) cooling systems, as well as travelling screen spray, off gas, reactor building area coolers, and other systems of lesser importance to safety. On loss of both SW pumps, an ESW pump would be started manually to provide approximately 3000 gpm water flow to the RBCLC and reactor building area cooler loads. The non-essential cooling loads, such as TBCLC, are isolated from the essential loads by check valves 72-21 and 72-22 that are located in the SW and ESW pump discharge header. The reliability and classification of these valves were reviewed during the licensee audit and DER 1-93-4263 was established to clarify the active versus passive classification for these valves. The licensee's review of this matter was considered to be adequate.

B. Instrument Air Interface

A possible common mode failure applicable to only the SW/ESW system involves an interface between instrument air and the temperature control valve, TCV-70-137, located at the common outlet for three RBCLC heat exchangers. The licensee determined in Licensee

Event Report 50-220/90-02 that this valve would not fail in the position required to support safety-related operations. Modification N1-90-030 was completed and installed travel stops on the valve disc to prevent the valve from fully closing in any failure mechanism, thereby eliminating a common mode failure potential. The stop ensures a minimum flow velocity to ensure adequate cooling of emergency loads and prevents silt buildup and fouling of the tubes. The licensee actions to ensure reliability of the instrument air throttle valve were considered to be adequate.

C. Reactor Building Area Coolers

The SW/ESW pump discharge header is safety related and provides cooling water flow to the RBCLC heat exchangers and branch lines to a number of service water supplied area coolers in the reactor building. These coolers are designated non-safety related and remove heat from the 480V safety related power boards, reactor building east and west instrument rooms, RBCLC pump area and other reactor building areas. The licensee audit did not review the performance of these area coolers because of their non-safety related classification. The NRC team discussed with the licensee the non-safety related classification of the area coolers because of the proximity of the coolers to safety related power supplies and instrumentation. It was not apparent to the NRC team if the coolers were required to remove heat from safety related areas during design basis events and thereby maintain equipment within their respective qualification temperatures. If the coolers were required for such events, then the licensee should be monitoring the performance of the area coolers in accordance with Generic Letter 89-13. If not required, the coolers could be isolated when ESW is initiated to ensure maximum capability of the RBCLC system. The licensee stated that a similar issue had been identified during an NRC electrical distribution functional inspection in 1991 which remains open (See Unresolved Item 50-220/91-80-011) and they were reviewing the adequacy of the heating and ventilation systems for resolution.

2.5 RBCLC Heat Exchangers

The NRC reviewed several calculations associated with the performance of the RBCLC heat exchangers. The heat exchangers had been replaced during an outage in 1988-1989 after the original heat exchangers had experienced tube failures due to flow induced vibration.

Licensee Calculation No. S13.4-70-HX02, which evaluated the RBCLC heat exchanger thermal performance assuming the plant in hot standby during a loss of off-site power, was reviewed. This calculation determined the maximum allowable lake water temperature as a function of ESW flow, given the maximum RBCLC system heat load. In conjunction with this calculation, the NRC reviewed Calculation No. S15-72-F004, which determined the ESW flow to the RBCLC heat exchangers for different configurations. The licensee evaluated two cases in Calculation No. S13.4-70-HX02: Case 1 - heat load was to be rejected with one ESW pump, one RBCLC pump and two RBCLC heat exchangers in operation; and Case 2 - heat load to be rejected with one ESW pump, one RBCLC pump and one RBCLC heat exchanger in operation. For both cases, the acceptance criterion was to maintain the RBCLC supply water (RBCLC water exiting the heat exchanger) within the maximum of 95°F while rejecting the required heat load with ESW from Lake Ontario. The current maximum lake temperature for continued operation is 81°F and the limiting RBCLC

temperature is 95°F. In reviewing the calculations, the team found the assumptions and methodology to be adequate as demonstrated by the following examples:

a. Computer program HEATXP was used for the calculation of heat exchanger performance. The heat exchanger performance predicted by this computer program for the bench mark case agreed well with the data on the RBCLC heat exchanger data sheet.

b. The required RBCLC heat exchanger duty under accident conditions was taken to be 17.85 million BTU/hr, the limiting RBCLC heat load for a full-core discharge into the spent fuel pool instead of a normal one third-core refueling.

The conclusions in Calculation No. S13.4-70-HX02 indicated that the calculated maximum ESW temperature to reject the required heat load and not exceed an RBCLC supply temperature of 95°F was at least 5°F above the maximum lake water temperature of 81°F. The NRC team concluded that these results demonstrated a reasonable margin of safety.

2.6 Operations

The NRC Temporary Instruction 2515/118 requires an indepth system walkdown and a review of operating procedures and training for an assessment of the operations aspects of the SW systems. The licensee audit in this functional area consisted primarily of a review of system operating procedures and a detailed walkdown of the safety related portions of the SW/ESW, EDG cooling water, and CS raw water systems. Twelve of the 43 questions listed in the licensee's audit report were in this area. The licensee audit identified many drawing and valve control discrepancies as a result of their walkdowns. These discrepancies were collated and documented in four DERs for review and resolution through the licensee's normal corrective action process. The team discussed with the licensee the need for making immediate red-line updates to drawings and determined that licensee engineering personnel had reviewed the drawings and made updates of control room drawings as required to ensure adequate plant operational control. The identification of these discrepancies was considered a strength of the licensee audit.

As previously noted in Section 2.3 above, the NRC reviewed various alarm response and special operating procedures and discussed these procedures with operations personnel. The NRC did not identify any operations concerns. The NRC team also conducted a walkdown of the service water intake structure and the SW/ESW, EDG cooling water, and CS raw water systems. In general, these systems were being maintained in good material condition and no leaks or material deficiencies were identified.

2.7 Maintenance

The inspection of maintenance specified by Temporary Instruction 2515/118 includes an indepth system walkdown for material condition of the SW systems as well as a review of component maintenance histories. The results of the licensee audit in this functional area indicated that maintenance problems were minimal for equipment in the SW systems. No adverse equipment trends were noted with repeat corrective maintenance. Based on plant

walkdowns, the licensee audit team concluded that the material condition of the SW system components was good. This favorable maintenance picture for the SW system was reflected in the audit report where 4 of the 43 questions were related to maintenance.

The NRC team independently verified the observations and conclusions of the licensee's audit by inspection observations in the selected areas. The NRC team reviewed the erosion/corrosion results for thirty components in the SW/ESW and the CS raw water systems and identified no significant areas of current degradation, leakage, or repair. The NRC team also noted an aggressive program in place to maintain the RBCLC heat exchangers by annual inspections and cleanings. Photographs and monitoring of biofouling condition are completed in conjunction with the maintenance, thereby ensuring maximum capability for the system.

However, the NRC team noted that the licensee's audit was performed in this area such that there was no direct auditor contact with maintenance craft personnel or review of in-plant maintenance activities as required by Temporary Instruction 2515/118. This audit weakness resulted in the failure of the auditors to review several recent SW equipment maintenance issues. For example, an internal inspection of 20-inch SW piping to the #11 RBCLC heat exchanger conducted in March 1993, which detected silt buildup, was not reviewed during the audit. This potentially significant plant problem was reported by the system engineer in DER 1-93-0603. Based on discussions with the system engineer and further review of the video recording of the visual inspection, engineering considered the SW system operable. Additionally, the following corrective actions were defined upon dispositioning the DER:

a. Engineering would perform an analysis to determine the acceptability for allowing operation with both SW header blocking valves (72-23 and 72-24) open.

b. Revise operating procedures to open both blocking valves if the above analysis finds this acceptable. If such operation is not allowable, revise operating procedures to routinely swap SW headers.

c. Engineering would evaluate and schedule a method for flushing the SW piping for the RBCLC heat exchangers.

The NRC team also noted that a water hammer/pressure surge occurred in March 1993 when ESW pumps were started during a test. The pressure surge caused some damage of non-safety related area coolers and was reported on a DER. As corrective action, the ESW operating procedures were revised to eliminate the potential for water hammer during system startup. Although this issue was not reviewed by the licensee audit team, the NRC found the licensee evaluation and corrective actions to be adequate.

2.8 Surveillance and Testing

The team reviewed the findings of the licensee audit in this area and discussed these findings with the various auditors. The NRC also conducted independent inspection to assess the effectiveness of the licensee's audit in meeting the objectives of Temporary Instruction 2515/118. Inspection requirements in this functional area of Temporary Instruction 2515/118 include:

a. Verify that test acceptance criteria are consistent with the design basis to ensure that the SW system adequately demonstrates that the SW system will operate as designed.

b. Review procedures for periodic testing of safety-related heat exchanger heat transfer capability and the trending of such results.

c. Verify that the installed SW system components are tested to ensure the components will perform in accordance with their design basis.

d. Review the implementation of the periodic inspection program to detect flow blockage from biofouling.

Of the 43 questions documented in the licensee's SW system audit report, the NRC found that 14 questions involved the surveillance and testing area. It was apparent that the licensee's audit in this area was predominantly a review of test records. The NRC team noted that these record reviews were comprehensive and included findings for improving the licensee surveillance and testing process. For example, question 14 in the licensee audit report documented a condition of February, 1992, where the licensee had conducted an emergency service water pump surveillance test and had not declared this pump inoperable even though the test results indicated that it was inoperable. A DER was issued to identify this deficiency and to achieve corrective action.

The NRC team concluded that the licensee incorporated most of the Temporary Instruction 2515/118 inspection requirements in their SW system audit. This conclusion was based on inspector observations during the actual conduct of the audit, discussions with several auditors and a review of the audit team records. For example, inspection of the intake manifold by divers is conducted twice a year. Differential pressure is recorded daily for the SW side of each RBCLC heat exchanger and this information is plotted weekly to observe trends for possible fouling and the need for heat exchanger cleaning. However, one Temporary Instruction 2515/118 inspection requirement that the licensee audit team did not include was the actual witnessing of any surveillance or IST of SW system components. The licensee indicated that this omission was intentional, as quality assurance had performed many test witnessing surveillances as part of their normal activities. Hence the licensee took credit for such prior activities in the SW audit planning and considered it more efficient to allocate their audit resources to unknown areas. The NRC team disagreed with this rationale in the licensee's audit planning and concluded that the lack of audit personnel involvement in current in-plant testing activities was an audit weakness. For example, weak interaction was noted between IST and maintenance activities concerning both emergency diesel generator (EDG) cooling water pumps which had been replaced recently (pump 102 - 11/91 and pump

103 - 4/93). EDG cooling water pump 103 failed to meet the acceptance criteria of special test N1-STP-29, performed in April 1993, and required replacement. A DER was issued to identify and correct this pump problem. However, the auditor's review of this DER did not result in pursuing the hardware implications and sharing this information with the audit team maintenance personnel. Consequently, the audit team did not investigate the detailed causes and corrective actions associated with these highly safety significant pumps.

The NRC team reviewed inservice testing (IST) records for the past two years for both EDG cooling water pumps and discussed this information with IST personnel and the system engineer. Pump baseline reference parameters of differential pressure and flow used for test acceptance criteria were appropriately established per the ASME code. The team noted that this information was only changed when warranted, such as during pump replacement or maintenance which could affect the hydraulic characteristics of the pump. The team verified that the licensee auditors had specifically checked this key area during the audit to ensure that pump acceptance criteria was not indiscriminately changed. It was apparent that the quarterly pump information was being monitored for adverse trends as evidenced by the observed degradation for EDG pump 102 in late 1991 prior to replacing it. However, the licensee chose not to apply this EDG pump 102 experience by quickly replacing EDG pump 103 prior to failure. This resulted in EDG pump 103 failing to meet its acceptance criteria during special test N1-STP-29 as noted above. The NRC team considered this to be a weakness in the licensee corrective action process.

In summary, the team verified that the licensee's SW system audit incorporated most of the Temporary Instruction 2515/118 inspection requirements in the surveillance and testing area. Except for an audit weakness concerning the lack of more detailed inspection of EDG cooling water pumps, the team concluded that the audit performance and results in this functional area met the intent of Temporary Instruction 2515/118.

2.9 QA and Corrective Actions

This area was not separately identified in the licensee SW audit report. The NRC team observed that there was low level interaction by the licensee audit team to assess licensee management and program effectiveness in conjunction with various identified DERs. While the licensee audit team identified many safety issues and initiated DERs where appropriate, the applicability of these DERs to other plant equipment and systems was not pursued by the team in all cases. Also, many of these DERs have not been dispositioned since they had just been recently identified. The NRC team also noted that of the many DERs reviewed during this inspection, only two required a root cause evaluation. Root cause evaluation (RCE) is a specific inspection item in Temporary Instruction 2515/118. Although the licensee audit team did not address this item, the NRC team noted that a DER for each Unit had been recently issued to address self identified weaknesses observed in implementing the licensee's RCE procedure. Pending the licensee's disposition of these DERs, this item is unresolved (50-220/93-80-01).

2.10 Generic Letter 89-13 Implementation

One specific objective of Temporary Instruction 2515/118 is to assess planned or completed actions in response to Generic Letter 89-13. The licensee completed an internal quality assurance surveillance in April 1993 and verified that actions committed by Niagara Mohawk in response to the Generic Letter were appropriately addressed and that required continuing programs were established. The licensee notified the NRC of these actions on April 23, 1993, accordingly. Furthermore, the licensee SW audit found programmatic strengths in commitments for regular heat exchanger cleaning, control of microbiological induced corrosion, and overall erosion/corrosion control.

The licensee monitors heat exchanger performance, in part, by measuring the differential pressure of service water across the heat exchanger under controlled conditions. Also, the RBCLC and EDG cooling water heat exchangers are opened, inspected, and cleaned periodically to ensure maintenance of heat transfer capability. The CS raw water heat exchangers have been cleaned to the base metal and are maintained in dry layup. The NRC team therefore considered licensee activities to maintain and monitor heat exchanger performance to be adequate and agreed with the overall conclusions of the audit.

The NRC team found that the licensee did not specifically assess the impacts of zebra mussel infestation from Lake Ontario on SW systems. To minimize the impact of fouling of systems due to zebra mussel infestation, the licensee has established a monitoring program for zebra mussel activity, a routine intake structure inspection program, and has on two occasions performed zebra mussel biocide treatments of the intake canal to minimize live mussel colonies that may be present in the canal. Because of pollution control requirements, the treatments require isolation of the intake structure from Lake Ontario and therefore are predicated on a complete defueling of the core. At the time of the last treatment, in February 1993, the biocide effectiveness (mussel kill rate) was determined to be approximately 95 percent.

The NRC inspectors were on-site at Unit 1 on May 19, 1993, when a live colony of zebra mussels was identified on a containment spray raw water pump housing that had been pulled from the intake structure secondary forebay. The mussels were found in an approximately two to four inch thick layer over the entire pump housing below approximately six feet from the intake water level. The NRC considered this finding to be significant because the colony was downstream of the travelling screens and therefore present the potential for clogging of safety related equipment.

The NRC team reviewed licensee activities related to mitigation of zebra mussel biofouling at Unit 1 and made the following observations:

a. In tandem with a consultant recommendation, the licensee had established a zebra mussel task force. The recommendation suggested that at least one person be dedicated 1/2 time to zebra mussel review, planning, and implementation of programs at each unit. The consultant further observed (1990) that the task force membership had been unstable due to personnel turnover and recommended that the task force membership be stabilized. The licensee SW audit stated that the task force was

established and that the SW team leader was the current task force leader. NRC review of this area determined that the task force had not had a formal meeting in about one and one-half years and essentially had disbanded. The task force had not, as a group, reviewed the biocide treatment effectiveness nor the discovery of live zebra mussel colonies inside the secondary forebay of the intake structure. Similarly, the current effectiveness of tracking and mitigation efforts, such as the use of settlement monitors has not been evaluated by any multi-disciplined team such as would comprise that task force. NRC interviews with different responsible personnel found varying levels of understanding as to the current state of the zebra mussel infestation and the risk imposed by the infestation. Also, no single point of contact for an integrated approach to mussel fouling was identified by the NRC team.

b. The NRC team reviewed a video tape of an inspection of one segment of the intake canal, between a trash rack and travelling screen inspected in March 1993. Below a depth of approximately six feet, zebra mussel colonies were identified on structural materials. Much of the mussel growth identified during the inspection was removed. The licensee audit identified the mussel intrusion but deferred assessment to Deviation Event Report 1-93-1261. The DER was written to specifically address the difference in zebra mortality between the live colony found in the secondary forebay and the mortality identified during the February 1993 treatment. However, the licensee did not extend the scope of the inspection to the other intake canals nor inside the secondary forebay. The discovery of the live colony on the CS raw water pump revealed that the infestation covered a much larger area than the isolated canal. No specific review had been conducted of the potential for breakoff of clumps of mussels from the live colonies and the possible impact of these colonies on the operability or operational readiness of safety related equipment.

c. Following a biocide treatment of the intake forebay, no action was taken to rid the forebay structures of zebra mussel colonies or shells. An evaluation of the clogging potential of the dead mussel shells following biocide treatments had not been completed. The NRC noted that Generic Letter 89-13 performance trending assumes a gradual, linear like buildup of silt/mussels so that routine monitoring will identify the fouling before operational limitations are exceeded. Specific breakoff of large mussel clumps with the potential for creating instantaneous changes in heat exchanger performance had not specifically been evaluated by the licensee even though the live mussel colonies and the biocide treatments have increased the likelihood of this occurrence.

d. A design modification was currently being completed to allow injection of chemical treatments to the service water suction bay with the specific intent to minimize microbiological growth in this specific system. A specific review of the effect of these treatments on live mussel colonies in the service water intake bays had not been completed even though the potential for break-away of clumps of mussels or shells may be increased when the chemical treatments are commenced.

In light of these observations, the licensee agreed to review the status of the Unit 1 zebra mussel control programs and to meet with the NRC later in 1993 for a discussion concerning their actions in this regard.

In summary, although the licensee has taken extensive actions to plan for and mitigate the intrusion of zebra mussels in cooling systems using Lake Ontario water, live mussel colonies presently exist inside the secondary forebay of Unit 1 and could provide a clogging hazard to safety related equipment. The licensee's monitoring of heat exchanger performance was considered to be adequate to detect and mitigate a gradual buildup of mussel clogging but may not be sufficient to prevent immediate system degradation that could occur if the mussel colonies inside the secondary forebay suddenly breakup into clumps.

2.11 Unit 1 Conclusions

Niagara Mohawk performed an audit of essential cooling water systems at Unit 1 with the intent to meet the objectives of Temporary Instruction 2515/118. The licensee concluded that the SW/ESW, EDG cooling water, and CS raw water systems were sufficiently designed, operated, tested, and maintained to assure performance of the design safety functions under postulated accident conditions. The NRC team verified that the licensee SW audit included most of the Temporary Instruction 2515/118 inspection requirements and independently verified the licensee's overall conclusion. The NRC also concluded that the licensee SW audit was an acceptable alternative to a full scope NRC inspection conducted using Temporary Instruction 2515/118. The licensee identified a number of significant issues that were being resolved in the DER system.

The NRC team independently reviewed a number of areas specified in Temporary Instruction 2515/118 that were beyond the scope or otherwise not included in the licensee SW audit. No significant weaknesses in system design, operation, testing or maintenance were identified in the Temporary Instruction 2515/118 areas that were omitted from the licensee's Unit 1 SW audit. An extensive review of failure vulnerabilities for the cooling water intake structure and potential common cause failures for essential cooling water systems was included in the NRC assessment. A weakness in the licensee program to monitor and control zebra mussel activity in the intake canal was identified when a live zebra mussel colony was found by the licensee in the intake structure secondary forebay. The existence of this infestation presents the possibility of clogging of safety systems during plant operation. No such clogging has been experienced at Nine Mile Point Unit 1 and the licensee has initiated a DER to take corrective actions regarding this mussel infestation. A meeting later in 1993 between Niagara Mohawk and the NRC is being scheduled to discuss the licensee activities for controlling and monitoring zebra mussels at Nine Mile Point Unit 1.

3.0 UNIT 2 SERVICE WATER SYSTEM INSPECTION

Nine Mile Point Unit 2 was licensed after 1979. As such, the NRC inspection using Temporary Instruction 2515/118 is not required to be performed at this unit. However, past service water (SW) system problems, in part, required an assessment of the overall reliability of the system. Thus, a limited scope inspection was undertaken to review the adequacy of the Unit 2 SW system using the licensee's self assessment as a basis. This inspection

[illegible]

[illegible]

focused on two previous unresolved items and addressed all subject areas of the temporary instruction. Both unresolved concerns were related to a significant reduction in the functional capability of SW system heat exchangers and the licensee's actions to demonstrate that the SW system is operated, maintained, and tested in a manner that demonstrates its capability to perform its design basis function under accident conditions. The area of mechanical system engineering design was addressed in URI 50-410/91-12-04 in the review of design basis calculations for post-LOCA containment heat loads and the related SW system heat exchanger's cooling capabilities. SW system maintenance and surveillance testing were addressed in URI 50-410/91-12-04 during the review of flushing and testing of safety-related heat exchangers. SW system operations was addressed in URI 50-410/93-01-06 by reviewing the licensee's Technical Specification requirements and interpretations on heat exchanger operability. Corrective actions were reviewed for both unresolved items. The NRC team reviewed the adequacy of root cause analyses and corrective actions for the deficiency reports in these areas. Also, a review of the licensee's long term corrective actions to address the ongoing SW system degradation will continue through a new unresolved item to evaluate the licensee's plans to restore the system to its original design capability.

3.1 Unit 2 SW System Description

The Unit 2 SW system supplies cooling water from Lake Ontario to various safety and non-safety plant components by way of a once-through flow network separated into two principal equipment trains. Each train is supplied with an independent source of electrical power (Divisions I and II). In addition to its normal cooling function, the SW system was designed to provide safe shutdown cooling under all design basis accident conditions following one single active failure. The safety-related portions of the system were designed to meet Safety Class 3 requirements of the ASME Boiler and Pressure Vessel Code, Section III.

Lake water enters the system through two offshore intake structures that deliver water to six SW system pumps located in a screenwell bay inside the plant. The service water is then pumped to a common header that cross connects the two major flow trains. Automatic MOVs in this header can isolate both trains if conditions warrant, e.g., after a loss of normal offsite power. The non-safety heat loads will also isolate automatically from the SW system in response to an accident signal.

To a large extent, the Unit 2 SW system is an extensive network of parallel flow paths that provide general area cooling in the containment building through numerous air-to-water heat exchangers. Space cooling is also provided in individual safety equipment compartments such as ECCS pump rooms and MCC switchgear rooms through multiple air-to-water unit coolers. The RHR heat exchangers and the control building closed loop chilled water condensers are also cooled directly by service water as are the three emergency diesel generators.

All service water is returned to Lake Ontario (ultimate heat sink) by way of two discharge headers. The six SW system pumps are provided to deliver sufficient flow for all modes of operation. By design, only two SW system pumps in one flow train are needed to provide

the minimum cooling requirements for safe shutdown following a design basis LOCA. The two flow trains are not equal in total heat removal capacity. The cooling capacity provided by the Division I equipment is lower and provides minimum cooling for the worst-case heat loads analyzed for the plant.

The Unit 2 SW system has been in operation since 1985. The system was originally designed for a maximum lake water inlet temperature of 77°F; however, recent high lake temperatures caused the licensee to reanalyze and demonstrate the capability of the system for a maximum lake temperature of 82°F. Additional operating constraints were required to maintain an adequate difference between SW system inlet temperature and secondary containment bulk air temperature.

3.2 URI 50-410/91-12-04 (Closed): Buildup of Silt/Corrosion Products in Unit 2 Service Water Unit Coolers

This concern was initiated in 1991 when special maintenance and testing performed under Generic Letter (GL) 89-13 identified significant flow degradation in the SW system heat exchangers and unit coolers. The Unit 2 SW system has experienced unexpected and premature silt buildup, internal piping corrosion, biofouling, and flow blockage that caused significant reductions in thermal performance capabilities of the system's coolers. This problem has received considerable attention from the NRC in past inspections because the service water system is relied upon to provide sufficient cooling for long term post-LOCA heat removal from the reactor building (secondary containment) to the ultimate heat sink. The licensee's secondary containment drawdown analysis has concluded that the containment air can be drawn down to its required negative differential pressure (-0.25 psid) within six minutes after a LOCA with the assistance of coolers in the SW system. However, degradation of the thermal capacity of SW system coolers has raised concerns over the ability of the SW system to provide adequate cooling beyond the first six minutes of post-LOCA containment heatup. This issue also raised concerns regarding the licensee's SW system modeling and hydraulic analysis, and their understanding of SW system performance capability during the worst case events postulated for the SW system.

The drawdown analysis uses calculated LOCA heat loads in secondary containment and analyzes temperature profiles to the point where containment temperatures stabilize. In an effort to confirm safe shutdown cooling capability, the licensee analyzed individual cooler performance in parallel with their GL 89-13 test program and collected thermal performance data on all safety-related unit coolers. In addition, coolers are backflushed to reduce siltation, and their discharge throttle valves are adjusted to restore the service water flows to their original values.

For more than a year, the licensee has pursued actions on this unresolved item and the GL 89-13 maintenance and test program on unit coolers. The licensee's earlier evaluations of cooler performance concluded that the total average SW system heat removal capability was degraded by 30% under worst case system conditions. Later evaluations indicated less overall degradation. However, some general area coolers are still experiencing degradation of more than 40% of their original design capacity. Multiple tests on individual coolers over the past year have not produced consistent results. Instrumentation used early in the test

program provided inconsistent or unreliable data. Test results indicated that back flushing did not always cause an improvement in the thermal capacity of some unit coolers. The data suggest that some coolers have actually experienced a reduction in capacity as a result of flushing. Other general area coolers recently tested in Division II have continued to show thermal capacities that are degraded by more than 40% of their design capacity for accident conditions. Approximately 42 of the 57 GL 89-13 unit coolers have been tested at least once.

A. Mechanical Systems Engineering Design Review

The team reviewed selected portions of the mechanical design of the Unit 2 SW system to determine whether the system is capable of meeting the thermal and hydraulic performance requirements during abnormal and accident conditions. This included a review of the system design basis, design assumptions, calculations, analyses, and the hydraulic model for the system.

The team's focus for the mechanical system engineering design review was the performance of the unit coolers under accident conditions. The team reviewed the hydraulic calculations, heat load calculations and the licensee's methodology for predicting the performance of safety-related unit coolers under accident conditions.

B. Hydraulic Calculations

The original hydraulic calculations were performed in 1983 using a detailed hydraulic model of the SW system that considered 23 modes of operation. In late 1992, the licensee identified that their hydraulic model for the SW system was out of date and did not reflect the as-built system. Deviation/Event Report (DER) 2-92-3883 was initiated to revise the SW system hydraulic model and the calculations based upon it. Late in the original construction of the SW system, system changes and modifications were made to mitigate the effects of potential waterhammer. Recognizing waterhammer concerns, the licensee performed waterhammer analyses in 1984 and implemented several physical changes in the SW system. These changes included the addition of several check valves on the supply-side of system coolers and heat exchangers, the addition of a stand pipe on the line to the discharge bay, the addition of fast acting valves on the lines to the circulating water system, and the removal of pressure control valves and MOVs on the discharge line to the discharge bay.

Waterhammer modifications did change various local differential pressures and flows in the SW system, but the licensee did not revise the original hydraulic model to take into account the waterhammer-related changes. In 1987, secondary containment drawdown concerns caused changes in the SW system's normal configuration, e.g., some heat exchangers were removed from the system's normal lineup. Before 1993, the hydraulic model was based upon 1983 system design calculations and not the as-built system. The inspectors considered that the continued use of old design calculations did not reflect good design control practices by the licensee. However, the licensee's current design controls require that after five changes to any calculation, a comprehensive review must be made of all affected and referenced design basis documents to evaluate the impact of a revision on all related calculations.

The SW system hydraulic model was used primarily during the original design and analysis of the system to assure that the new system flow balance was properly achieved. The model was initially used to analyze multiple operational modes and to adjust heat exchanger and cooler throttle valves to achieve the necessary differential pressures throughout the system. The hydraulic model was not extensively used before implementation of the GL 89-13 program. The principal calculation used for the worst case accident sequence for the SW system is No. A10.1-N-91, Rev. 1. This calculation represents a design basis LOCA with four SW system pumps operating, no concurrent loss of offsite power, and loss of a single 600 Volt MCC bus that provides power to all Division II equipment in the SW system. With the one single failure, other Division II equipment continues to operate (and generate heat), but only the Division I SW system cooling equipment is available for heat rejection from the containment. The revised calculations were completed in preliminary form at the time of this inspection, but they had not yet received final validation and approval. The revised calculations did predict that the accident flows would be higher than the flows predicted by the 1983 calculations.

The increased flow was due primarily to the elimination of pressure control valves and a reduction in strainer backwash flow, which more than compensated for the other waterhammer-related changes. The 1993 hydraulic calculations are based on the present configuration of the SW system (i.e., taking into account waterhammer-related changes as well as decreased SW system strainer backwash flow from 500 gpm to 360 gpm per pump). In addition to the above reason, the LOCA flows also increased from the elimination (isolation) of non-safety heat loads that were assumed in the original calculation, e.g., one residual heat removal system heat exchanger and one residual heat removal system pump. These preliminary calculations showed generally higher flows to the coolers and the heat exchangers under LOCA conditions, as well as normal power generation. The licensee issued a DER to assure that the updated hydraulic calculations would be validated and approved.

C. Accident Heat Load Calculations

The team reviewed Calculations HVR-32, Rev. 3, "Reactor Building Containment and Auxiliary Bay Heat Gain," and HVR-38, Rev. 6, "HVR Unit Coolers - Cooling Capacity Verification." The licensee considered the worst case heat input for the drawdown analysis with the minimum cooling available from the Division I SW system equipment, i.e., a LOCA plus the loss of a 600 Volt bus with four service water pumps running. For the drawdown calculations, all Division II coolers were assumed to be unavailable, but conservatively, all fan motors on the coolers and all Division II pump motors were assumed to be running.

The team noted that the total heat input from electric motors was based on degraded voltage and rated Horsepower (HP). The licensee's reactor building heat load calculations initially used rated motor HP and efficiencies based on industry guidelines. After the containment drawdown issue was identified in 1987, motor heat loads were revised by using their Brake Horsepower (BHP) instead of their rated HP. This removed some conservatism from the analysis. The inspectors compared the heat loads used in the analysis with the actual heat loads expected from the unit cooler motors when operating at 100% voltage and 90% degraded voltage, which indicated small increases (<1%) in the overall heat load of about 3

million BTU/hr. However, this discrepancy could be significantly greater if rated HP was not used for large pump motors. The licensee subsequently initiated DER-2-93-1572 to resolve the issue of heat input contribution from electrical motors and to make appropriate adjustments to the heat input calculations, if necessary.

D. Performance of Safety-Related Unit Coolers Under LOCA Conditions

The team reviewed the licensee's engineering methods used to evaluate the performance of individual safety-related unit coolers under design basis accident conditions. The review included field observation of a performance test on one cooler, the licensee's acceptance criteria for test data, the method of computing a heat exchanger fouling factor from test data, and the methods applied to project unit cooler performance under accident conditions.

During the performance test of unit cooler 2HVR*UC404B, the service water flow rate was measured by a turbine meter which indicated flow to the nearest full digit. Since this flow rate was used directly for computing the heat transfer rate, any inaccuracies in flow measurement would be proportionally reflected in the calculated heat transfer rate and could introduce significant error in the cases where service water flow rates are relatively small. A different instrument may have measured service water flow more precisely, but the turbine meter appeared to be more reliable than the ultrasonic flow instruments recently used in these tests. The service water inlet and outlet temperatures were measured to the second decimal point. The performance test data were collected over three intervals of approximately 15 minutes each, when steady state conditions were reached. The performance test set-up appeared to be adequate for its application. Also, the test methods and instruments used to measure flow and temperature progressively improved since the start of the heat exchanger test program. The team determined that the unit cooler test data obtained in early tests should be revalidated, since the licensee was still improving its test methodology.

The licensee used a commercial computer program, "AIRCOOL," to calculate the fouling factors of the existing unit coolers. Using this computer program, the licensee first recalculated the design heat removal capacity of all safety-related unit coolers. A comparison of the calculated values of heat removal capacity with the original vendor's data showed good agreement (within $\pm$ 5%), thus validating the AIRCOOL program. The team considered that the licensee's methodology for calculating fouling factors for the unit coolers from the test data provided reasonably accurate results. For most unit coolers, the calculated tube-side fouling factors substantially exceeded the design value of 0.001 BTU/hr/ft^2/°F assumed by the vendor. Inspectors reviewed the licensee's approach for predicting the performance of the fouled unit coolers under accident conditions. The licensee calculated the expected heat removal capacity of any unit cooler based on the predicted service water flow to the unit cooler under LOCA conditions and the calculated fouling factor. The calculation appropriately assumed a service water inlet temperature of 82°F.

The original calculation (No. A10.1-N-91) providing service water flows to the unit cooler under LOCA conditions did not consider the existing degree of fouling or flow degradation. Therefore, the licensee calculated new predicted service water flow to unit coolers under LOCA conditions by multiplying the original calculated values by the ratio of flow obtained during unit cooler performance testing to the original generation flow provided in Calculation

No. A10.1-N-109. The team considered this empirical method a weakness of the licensee's approach to determining unit cooler performance, since it assumed uniform degradation due to fouling throughout the service water system. The licensee's unit cooler performance evaluation indicated the degradation of a number of unit coolers to less than 70% of the original capacity, although that level of degradation was still acceptable in the secondary containment drawdown analysis. The team concluded that the current approach may be acceptable for the short term since heat removal capacity was appreciably more affected by fouling factor than service water flow rate, but was not adequate for the long term under conditions of continuous flow degradation. The general effect of system-wide degradation was analyzed using a total system flow curve and an assumed uniform flow reduction from pump head loss. This method of analysis indicated only that the total system flow is adequate. However, non-uniform system degradation results in high localized reduction in margin available for cooling vital equipment.

The thermal analysis used conservative assumptions regarding heat gains and losses through piping, cabling, and containment walls into compartment spaces; e.g., heat losses were not assumed through the basemat floor for pump rooms at the lowest level. Heat inputs were calculated for all active piping systems, electrical cabling, and for the primary containment wall. All other walls represented conduction paths for heat losses. In 1987, Calculation HVR-38 was amended to include new calculated equilibrium temperatures in all general areas and vital equipment compartments. It assumed that both Divisions I & II coolers were available and that the service water inlet temperature was at its maximum value of 82°F. In all cases, the maximum anticipated temperature was below the maximum allowed by design. However, these calculations were performed using system flow values that were assumed in the 1983 hydraulic analysis. The licensee had not performed a calculation to determine the final equilibrium temperatures assuming maximum heat loading and minimum cooling with Division I only. The original design of the SW system allowed for a 30% reduction in system capability to meet the minimum cooling requirements. Inspectors were concerned that some Division I unit coolers were performing at less than 70% of their original design capability and may not be able to provide sufficient cooling during maximum heat load conditions, e.g. 2HVR*UC405 and 2HVR*UC407A. The Division I cooling capacities are as follows:

Division I Unit Cooler 2HVR*UC	Current Cooling Capacity as % of Design Capacity	Compartment
401A	71.65%	RHR Pump Rm A
401D	76.02%	RHR Pump Rm A
402A	94.79%	LPCS Pump Rm
402B	97.32%	LPCS Pump Rm
404A	82.77%	Gen. Area Elev. 175'
404B	90.70%	Gen. Area Elev. 175'
405	63.06%	RHR HX Rm A
407A	64.46%	Gen. Area Elev. 215'
407B	78.36%	Gen. Area Elev. 215'
407C	97.32%	Gen. Area Elev. 215'

410A	80.89%	Gen. Area Elev. 240'
411A	86.52%	Gen. Area Elev. 261'
414A	77.82%	Gen. Area Elev. 261'
412A	76.74%	RCIC Pump Rm
413A	99.98%	Reactor Bldg. Gen. Area

Inspectors reviewed the total heat removal (BTU/hr) capacities available in all general area coolers and concluded that they were capable of removing the total heat load during LOCA conditions. Reactor building general areas share common spaces and air is exchanged between the different elevations. The under-capacity of cooler 407A is therefore compensated for by other general area coolers. For unit cooler 405, the design maximum temperature for the RHR HX Room A is 120°F and the anticipated equilibrium temperature under LOCA conditions is approximately 123.5°F. Since this compartment does not contain any vital active equipment, the inspectors considered that the excess temperature is acceptable for short term operability considerations.

E. Conclusions

The licensee demonstrated that the SW system in Unit 2 is capable of removing adequate heat during worst case accident conditions to provide for safe shutdown of the facility. Although the licensee's revised hydraulic analysis for the system was not finalized during this inspection, the preliminary results, coupled with the results of heat exchanger performance testing, provided a sufficient justification for continued operability of the SW system in the near term. However, localized flows in SW system have degraded specific heat exchanger performance to below their required design capability. Two unit coolers in Division II and one unit cooler in Division I are currently unable to keep their respective room temperatures below their design maximum. Although the calculated temperatures are acceptable for short-term operability purposes, resolution of nonconforming conditions in heat exchanger performance requires corrective actions to restore the entire SW system to its full design capability. This item is closed based upon a review of the current SW system analyses and heat exchanger performance data and the inspectors' conclusion that the operability status of system unit coolers is justified for the short term. However, the licensee has not yet finalized their long-range plans for recovering full system capability. The licensee is currently progressing toward identification of specific actions required to restore the system. The remaining items will be tracked under URI 50-410/93-80-02 discussed below.

3.3 URI 50-410/93-01-06 (Closed): TS Interpretation #25 Adequacy

This concern was originally initiated as part of URI 50-410/93-12-04 because plant operators were required to calculate the total available cooling capacity in order to keep the SW system operable without entering a Technical Specifications LCO while some unit coolers were out of service for testing or maintenance. A Technical Specifications Interpretation (TSI) was written to provide instructions for determining that the available cooling capacity was adequate for minimum post-accident containment cooling and drawdown. This TSI is still in use and has been revised on numerous occasions because of questionable engineering basis. A special operating requirement in this TSI exists which maintains a minimum temperature difference between secondary containment air and service water inlet temperature. The TSI

was based upon an assumed average cooler degradation of 30% under worse case conditions. The assumed average of 70% capacity was not valid for all situations where some unit coolers are permitted to be removed from service without entering a technical specifications LCO.

Additional NRC concerns were related to some incorrect assumptions used to meet environmental qualification requirements for certain equipment. The licensee previously made some wrong assumptions regarding the actual heat loads generated during accident conditions that resulted in different maximum temperatures in the divisionalized chiller equipment rooms and electrical tunnel area which would exceed the design limit of 104°F if the chillers were not operable. Engineering subsequently reviewed all equipment affected by the loss of each unit cooler and determined specific LCO actions that would be required in each case depending on the equipment affected and its functional capability at elevated temperatures. The licensee also identified that the safety analysis to support operability of equipment could not be located. The inspectors considered that this represented inadequate design control by the licensee. However, this was not pursued as a significant issue at this time because the licensee corrected TSI #25 and the design control measures currently in place during this inspection appeared to be adequate to prevent another occurrence of lost calculations or analyses.

TSI #25 does not currently allow room coolers to be taken out of service without entering an LCO. Some area coolers can be removed without an LCO entry if sufficient thermal capacity is available to meet design heat loads. No coolers required for drawdown can be taken out of service without entering an LCO. The inspectors verified that those coolers currently in TSI #25 that don't require entry into an action statement when removed from service would not render any equipment inoperable. Based upon the above, this item is closed.

3.4 URI 50-410/93-80-02 (Open): Long Term Corrective Actions For SW System Degradation

The licensee identified in DER 2-93-0773 that Unit 2 did not have a comprehensive plan for managing their GL 89-13 program in an integrated and coordinated manner. The causes for large scale SW system degradation and siltation, and proposed long term preventive measures are currently being reviewed by the licensee. A project engineer has been assigned to study the viability of various options for long range plans to restore the system to its design function. Formulation of recommendations will be presented to an executive management committee by November 1, 1993 for approval. Some of the options being considered include chemical cleaning the entire SW system, selective pipe replacements, SW system component material changes, and redesign of SW system sections to a closed cooling loop design.

The results of the 1993 hydraulic calculations and the effects of the revised accident flow rates for safety-related unit coolers indicate that the system will perform better than previously assumed. However, almost 75% of the throttle valves on the service water outlets on the unit coolers are turned to the fully open position. Further system degradation cannot be overcome for these coolers by opening their discharge throttle valves. As of this inspection, one of the unit coolers (Division II) used in secondary containment drawdown had

not yet been field tested. Approximately fifteen other safety-related coolers in the SW system were also not yet tested. The licensee is committed to continue to revise thermal performance calculations for specific coolers based upon actual test data in order to assure continued operability for accident conditions.

Long term planning for the prevention of further flow and performance degradation is necessary. The licensee was investigating various long term options for system improvement or changes to prevent continuous service water flow and cooler performance degradation. The licensee agreed to formally present to the NRC their decisions on the recommended course of actions with their implementation schedule for the long term resolution of flow degradation. Pending establishment of these long term plans and the schedule for implementation by the licensee, this item remains unresolved (URI 50-410/93-80-02).

4.0 UNRESOLVED ITEMS

Unresolved items are matters for which more information is required to ascertain whether they are acceptable items, violations or deviations. Unresolved items are included in Sections 2.9 and 3.4.

5.0 MANAGEMENT MEETINGS

During the course of the inspection, the inspectors had meetings with licensee management to discuss the status of the inspection and the team's findings and concerns. The inspectors met with those denoted in Appendix A on July 16, 1993, to discuss the preliminary inspection findings as detailed in this report. The licensee acknowledged the inspection findings, as discussed by the inspectors.

Appendix A

Persons Contacted

Niagara Mohawk Power Corporation

* A. Andersen, Operations Support, Unit 2
* M. Balduzzi, Operations General Supervisor, Unit 1
* J. Blasiak, Chemistry Manager, Unit 2
* A. Chaudhary, Mechanical Design Engineer, Unit 1
G. Corell, Manager, Chemistry, Unit 1
* K. Dahlberg, Plant Manager, Unit 1
* R. Deuvall, Supervisor, Mechanical Design, Unit 2
* J. DiFabio, System Engineer, Unit 1
J. Dillon, Supervisor, Audits, QA
H. Flanagan, Supervisor, Environmental Services
* J. Forderkonz, Operations Support, Unit 1
R. Green, System Engineer, Unit 2
B. Holloway, Chemistry, Unit 1
* J. Kroehler, Manager, QA Support
* T. Lee, Supervisor, Mechanical Design, Unit 1
* R. Longo, Jr., Maintenance General Supervisor, Unit 1
* R. Magnant, Licensing
* E. McCaffrey, Maintenance, Unit 1
* T. McCarthy, System Engineering, Unit 2
* J. Mueller, Manager Operations/Acting Plant Manager, Unit 2
* J. Perry, Vice-President, QA
G. Thompson, System Engineering General Supervisor, Unit 2
K. Ward, Manager, Engineering, Unit 2
* H. Wysocki, System Engineer, Unit 1
D. Young, QA
* A. Zallnick, Supervisor, Site Licensing

Nuclear Regulatory Commission (NRC)

* J. Durr, Chief, Engineering Branch, Region I

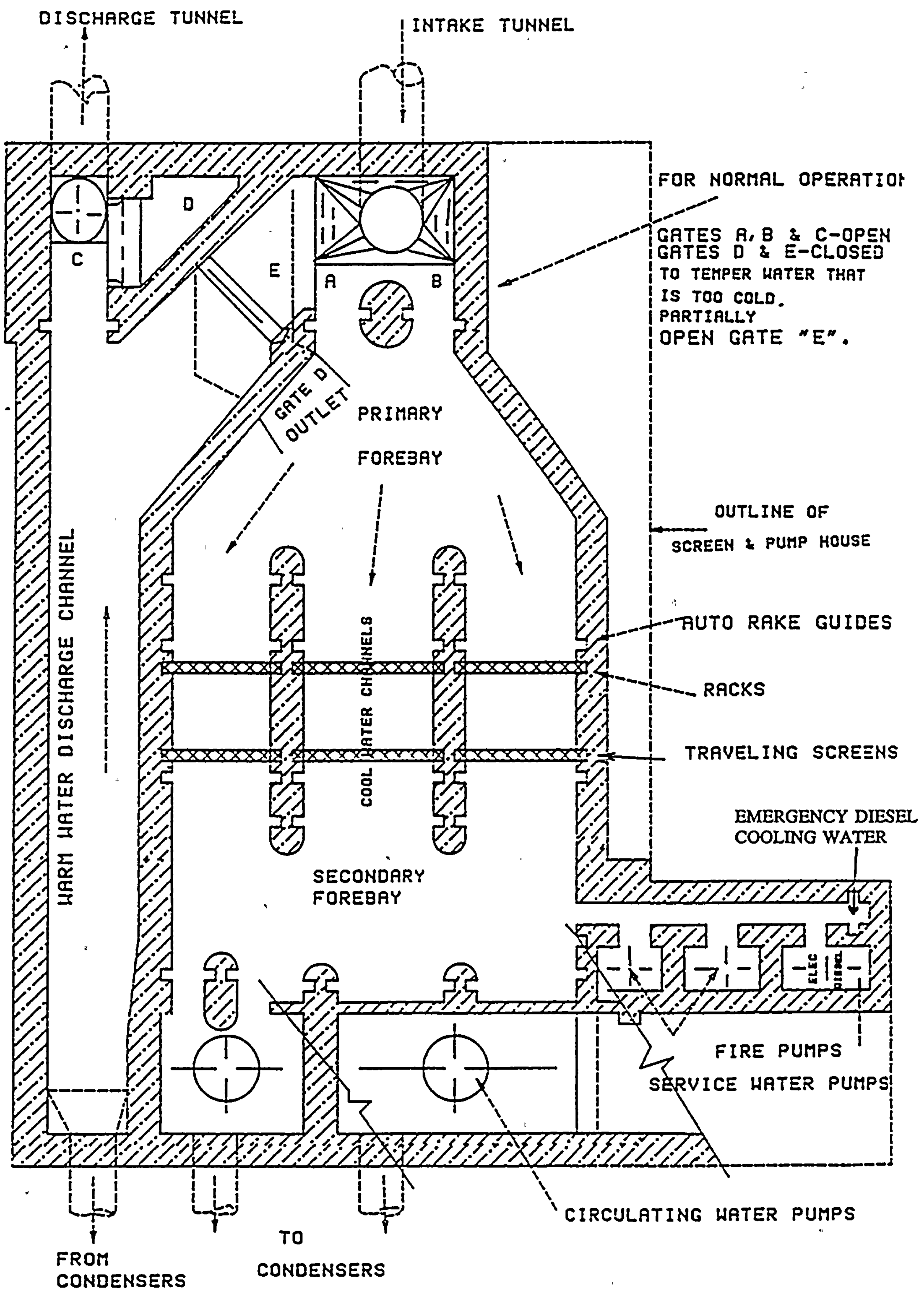
* Denotes attendance at the exit meeting held at Nine Mile Point, July 16, 1993.

TABLE 1
NINE MILE POINT UNIT 1 COOLING PUMP DESCRIPTIONS

COMPONENT	SAFETY RELATED	AUTOMATIC or MANUAL OPERATION	PUMP SUCTION LEVEL/ NPSH reqd
Emergency Service Water +	yes	manual	230.0 / 234.7 ft.
Diesel Generator Cooling Water +	yes	automatic	232.0 / 234.1 ft.
Containment Spray Raw Water +	yes	manual	228.0 / 232.0 ft.
Circulating Water	no	manual	221.7 / 233.0 ft.
Normal Service Water +	no	manual	225.0 / 236.0 ft.
Diesel Fire Water	Tech Spec	automatic	238.0 / 234.7 ft.
Electric Fire Water	Tech Spec	automatic	220.0 / 232.0 ft.

+ Reviewed in the licensee SW audit and NRC inspection.

FIGURE 1
NINE MILE POINT UNIT 1 INTAKE STRUCTURE



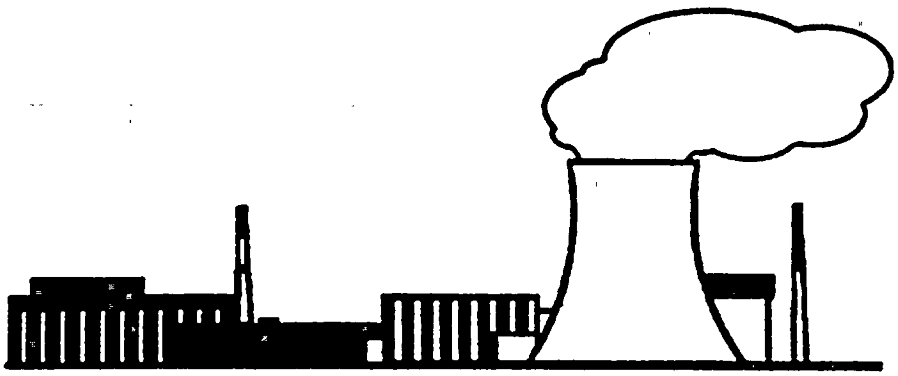
ATTACHMENT A

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT NUCLEAR STATION

UNITS 1 AND 2

QUALITY ASSURANCE AUDITS OF SERVICE WATER SYSTEMS



PRESENTATION TO NRC **JUNE 9, 1993**

AGENDA

INTRODUCTION	D. GREENE
PURPOSE OF AUDIT	J. KROEHLER
AUDIT PREPARATION	D. H. YOUNG
SYSTEM OVERVIEWS	T. D. LEE K. D. WARD
AUDIT RESULTS AND TECHNICAL FINDINGS	T. DEL GAIZO
LONG TERM ISSUES - UNIT 2	K. D. WARD
SUMMARY AND CONCLUSIONS	C. D. TERRY

INTRODUCTION

PURPOSE

BACKGROUND AND OVERVIEW

PURPOSE OF AUDIT

SERVICE WATER SYSTEM ENGINEER REQUESTED CHECKOUT OF GENERIC LETTER 89-13 IMPLEMENTATION IN AUGUST 1992

WITH POTENTIAL FOR NRC SWSOPI, QUALITY ASSURANCE EXPANDED THE SCOPE TO LOOK AT:

- DESIGN
- OPERATION
- TESTING
- MAINTENANCE
- WORST CASE PERFORMANCE

AUDIT PLAN BASED ON NRC INSPECTION MANUAL 2515/118 AND RESULTS AT OTHER PLANTS

SUCCESSFUL AUDIT AT NMP2 RESULTED IN A COMPARABLE AUDIT ON NMP1

AUDIT SCOPE DEVELOPMENT

NRC INSPECTION MANUAL TEMPORARY INSTRUCTION 2515/118 USED AS A GUIDE

5 MAJOR TOPICS

- DESIGN REVIEW AND CONFIGURATION CONTROL (11 Areas)
- OPERATIONS (8 Areas)
- MAINTENANCE (9 Areas)
- SURVEILLANCE AND TESTING (12 Areas)
- QUALITY ASSURANCE AND CORRECTIVE ACTION (5 Areas)

REVIEWED 18 NRC CONDUCTED SERVICE WATER INSPECTIONS

- DEVELOPED MATRIX TO FOCUS PLANNING ON POTENTIAL AREAS OF WEAKNESS
- CONSULTED WITH DESIGN ENGINEERING AND SYSTEM ENGINEERING
- GENERATED TECHNICAL AUDIT PLAN

COMPARED AUDIT PLAN TO TEMPORARY INSTRUCTION TO VERIFY COVERAGE

AUDIT TEAM

REVIEWED FIVE TOPIC AREAS TO DETERMINE SKILLS REQUIRED

- DESIGN EXPERIENCE
- VERTICAL SLICE TECHNIQUE
- SERVICE WATER SYSTEM AUDIT EXPERIENCE

RETAINED TWO CONSULTANTS TO ENHANCE AUDIT DEPTH, DETAIL AND INDEPENDENCE

- ONE HAS MORE THAN 13 YEARS SERVICE WATER SYSTEM DESIGN EXPERIENCE
- ONE HAS 13 SERVICE WATER INSPECTIONS/AUDITS EXPERIENCE

ONE INDEPENDENT SAFETY ENGINEER ASSIGNED TO REVIEW GENERIC LETTER 89-13 IMPLEMENTATION

ASSIGNED FOUR AUDITORS

- EACH HAS MORE THAN 10 YEARS EXPERIENCE IN NUCLEAR POWER
- EACH HOLDS A CURRENT LEAD AUDITOR CERTIFICATION

AUDIT PREPARATION
AUDIT SUPPORT TEAM

PRIMARY RESPONDENTS FOR AUDITED ORGANIZATIONS

- ADDRESSED AUDITORS' CONCERNS AND QUESTIONS

- EXPEDITED AUDITORS' DOCUMENTATION REQUESTS

FULL TIME ASSIGNEES

- 5 ENGINEERS

- 1 OPERATIONS SPECIALIST (UNIT 2)
  2 OPERATIONS SPECIALISTS (UNIT 1)

- 1 MAINTENANCE ENGINEER

- 1 CHEMISTRY TECHNICIAN

FULL SUPPORT FROM TECHNICAL SUPPORT DEPARTMENT AND DESIGN ENGINEERING

SENIOR MANAGEMENT INVOLVEMENT

- PROVIDED OPEN, UPFRONT DISCLOSURE OF POTENTIAL PROBLEMS

- WANTED A VERY SELF-CRITICAL REVIEW

- FOSTERED OPEN, HONEST DISCUSSION OF POTENTIAL PROBLEMS

SERVICE WATER SYSTEM
AUDIT STATISTICS

UNIT 1

AUDIT SCHEDULE:	MAY 3, 1993 - MAY 7, 1993 MAY 7, 1993 - MAY 28, 1993
AUDIT TEAM MAN-HRS:	960
AUDIT SUPPORT TEAM MAN-HRS:	960

UNIT 2

AUDIT SCHEDULE:	MARCH 8, 1993 - APRIL 2, 1993
AUDIT TEAM MAN-HRS:	1280
AUDIT SUPPORT TEAM MAN-HRS:	1600

UNIT 2

SYSTEM OVERVIEW	K. D. WARD
AUDIT RESULTS	T. DEL GAIZO

NINE MILE POINT UNIT 2
SERVICE WATER SYSTEM

- SERVES BOTH SAFETY RELATED AND NON-SAFETY RELATED COMPONENTS

- OPEN CYCLE DESIGN

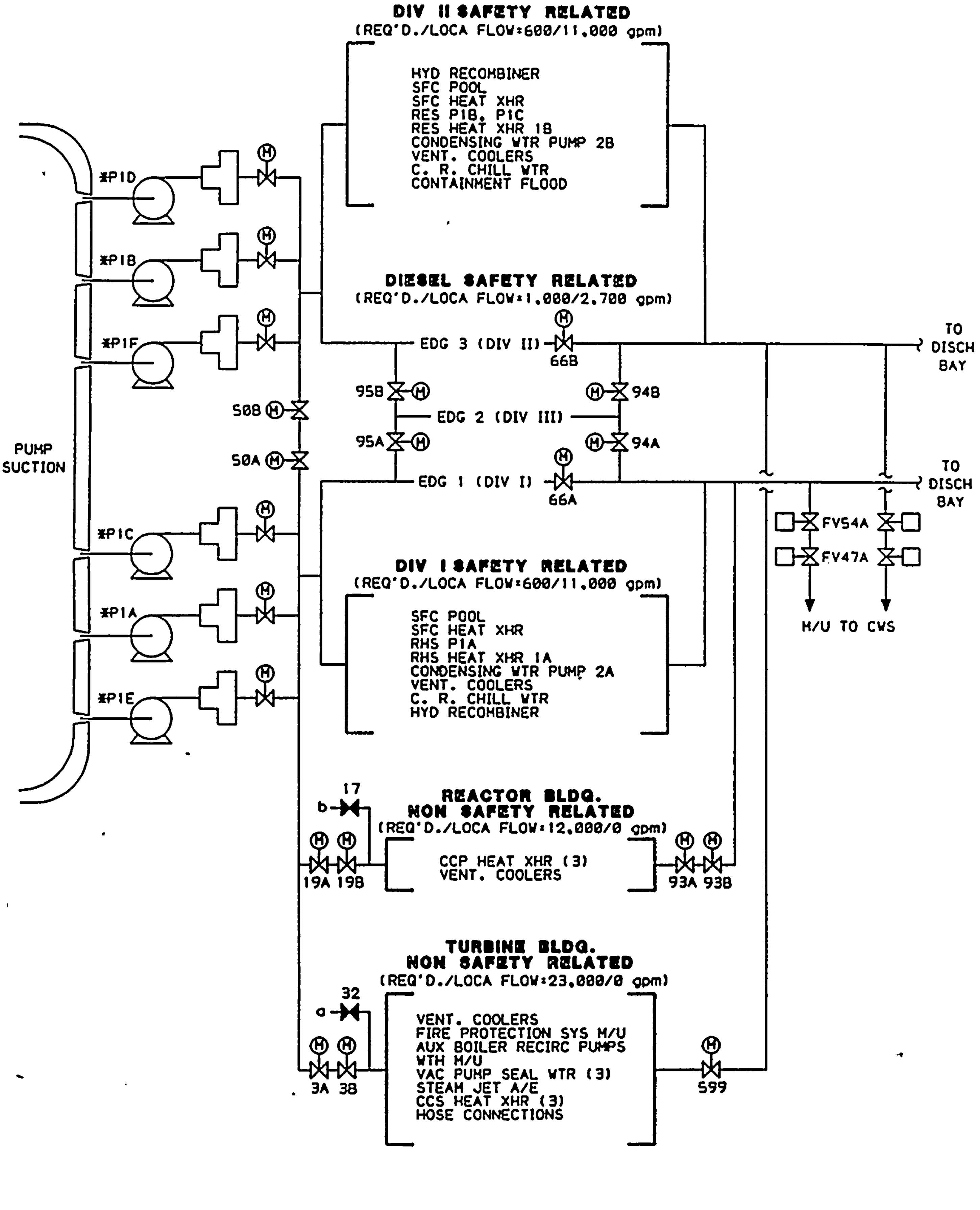
- NORMAL OPERATION - 4 OF 6 PUMPS AT NOMINAL 10,000 GALLONS PER MINUTE EACH - CROSS TIE BETWEEN DIVISIONS OPEN

- DBA LOCA/LOOP FLOW APPROXIMATELY 3,400 GALLONS PER MINUTE FOR 1 PUMP -- DIVISIONS ISOLATE WITH PUMP IN EACH DIVISION -- NSR LOADS ISOLATED ON LOSS OF OFFSITE POWER

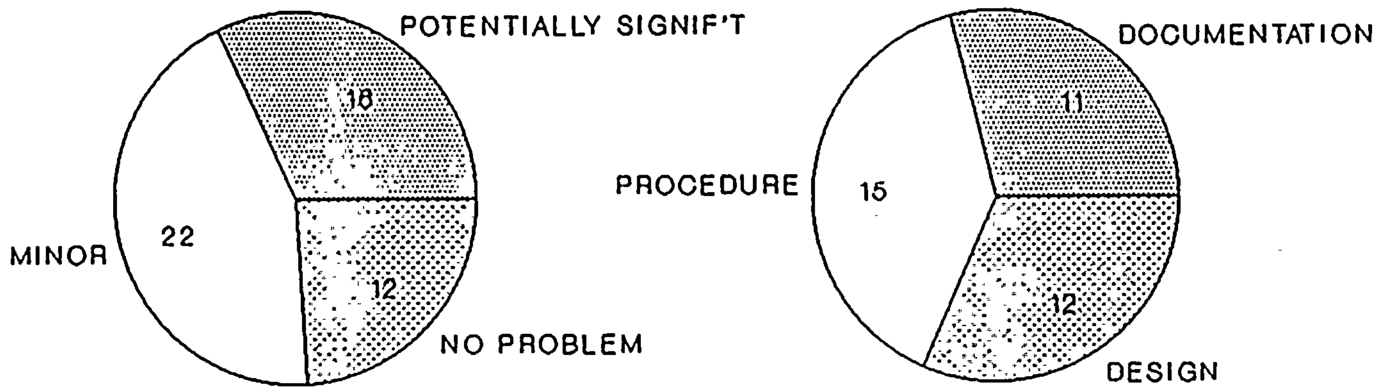
- SAFETY RELATED DESIGN - ASME III, CLASS 3

- NON-SAFETY RELATED - B31.1

SERVICE WATER SYSTEM
NINE MILE POINT - UNIT 2
NOMINAL FLOW, 40,000 gpm



UNIT 2 SERVICE WATER AUDIT QUESTIONS



50 QUESTIONS

POTENTIALLY SIGNIFICANT / MINOR QUESTIONS

AUDIT RESULTS
UNIT 2

STRENGTHS OF AUDITED ORGANIZATIONS

- NUMBER AND QUALITY OF DESIGN CALCULATIONS
- TECHNICAL STAFF TRAINING
- IST DOCUMENTATION
- WORK REQUEST BACKLOG REDUCTION
- RESOLUTION OF PUMP IMPELLER PROBLEMS

TECHNICAL ISSUES

AUTOMATIC ISOLATION OF SEISMIC CATEGORY II PIPING

- SEISMIC RUPTURE OF CATEGORY II PIPING WITHOUT CONCURRENT LOOP
- EARTHQUAKE CAPABLE OF RUPTURING PIPE WOULD UNDOUBTEDLY CAUSE LOOP; IF NO LOOP, EDG'S WON'T START AND TIME IS AVAILABLE FOR MANUAL ACTIONS
- RESPONSE ACCEPTABLE/ISSUE CLOSED

TECHNICAL SPECIFICATION SURVEILLANCE REQUIREMENT

- OPERABILITY CRITERIA (6500 GPM AT 80 PSIG)
- ENGINEERING PREPARED TECHNICAL BASIS
- TECHNICAL SPECIFICATION REVISION RECOMMENDED

TECHNICAL ISSUES (Cont'd)

EDG COOLER ISOLATION VALVE AUTOMATIC CLOSURE

- EDG'S ISOLATED ON LOW PRESSURE SIGNALS
- SWITCH LOCATIONS AND SETPOINTS SUSCEPTIBLE TO INADVERTENT ISOLATION
- PLANT CHANGE REQUEST INITIATED FOR DIVISIONS I AND II (DIVISION III BEING CONSIDERED)

EDG FLOW RATES

- SWS OPERATING PROCEDURE CONFIRMED MINIMUM EDG FLOW AT 450 GPM
- DESIGN BASIS NOMINAL EDG FLOW IS 800 GPM
- PROCEDURE CHANGE INITIATED

TECHNICAL ISSUES (Cont'd)

EDG JACKET WATER COOLER DESIGN PRESSURE

- EDG DIVISION I AND II JACKET WATER COOLER DESIGN PRESSURE 100 PSIG
- SERVICE WATER DESIGN PRESSURE 150 PSIG
- DEVIATION/EVENT REPORT INITIATED

GENERIC LETTER 89-13 COMMITMENTS

- ALL ACTIONS ADDRESSED BUT WITHOUT INTEGRATED IMPLEMENTATION PLAN
  - UNIT COOLER TESTING ONGOING
  - PROCEDURE PREPARATION IN PROGRESS
- INTEGRATED PLAN TO BE DEVELOPED

TECHNICAL ISSUES (Cont'd)

SECONDARY CONTAINMENT DRAWDOWN ANALYSIS

- TEAM REVIEWED ANALYSIS ASSUMPTIONS, INPUT AND METHODOLOGY
- ANALYSIS FOUND EXTREMELY CONSERVATIVE
  - SIZE AND LOCATION OF ASSUMED HOLE IN SECONDARY CONTAINMENT BOUNDARY
  - SINGLE FAILURE OF 600 VOLT BREAKER

AUDIT CONCLUSIONS
UNIT 2

FUNCTIONALITY

GENERIC LETTER 89-13

- EXPEDITE COMPLETION OF ACTIONS
- ADDRESS FLOW DEGRADATION IN THE LONG TERM

LONG TERM IMPROVEMENTS

- MITIGATION OF FLOW DEGRADATION
- PERIODIC FLOW BALANCES
- CONTINUE TO KEEP ABREAST OF INDUSTRY BIOCIDE TREATMENT IMPROVEMENT OPPORTUNITIES

LONG TERM ISSUES
UNIT 2

PROGRAM STATUS

- TESTING PROGRAM FOR REACTOR/CONTROL/ DIESEL BUILDING COOLERS HAS BEEN IMPLEMENTED

- COOLERS TESTED TO DATE IN REACTOR/CONTROL/DIESEL BUILDING SHOW COOLER PERFORMANCE DEGRADATION

- CHEMISTRY AND METALLURGICAL SAMPLES INDICATE MIC ACTIVITY

UNIT COOLER ASSESSMENT

- RECIRCULATION UNIT COOLERS ARE 100% OF THEIR DESIGN HEAT DUTY CAPACITY

- THE BALANCE OF THE REACTOR BUILDING DRAWDOWN COOLERS TESTED AT AN AVERAGE OF 82% OF DESIGN HEAT REMOVAL, PROVIDING SUFFICIENT MARGIN (>70%) TO PERFORM DUTY

- THE COMBINED LOCA HEAT LOAD OF THE NON-DRAWDOWN SAFETY-RELATED UNIT COOLERS IS 82% OF DESIGN HEAT LOAD CAPACITY AT 82°F SERVICE WATER TEMPERATURE - CAPABLE OF REMOVING REQUIRED LOCA HEAT LOADS

- BROMINE TREATMENT OF SERVICE WATER IS BEING EVALUATED TO DETERMINE IMPACT ON MIC GROWTH

OPTIONS BEING CONSIDERED

- IMPROVEMENT OF UNIT COOLER EFFICIENCY
  - CHEMICALLY CLEAN COOLERS
  - COOLER COIL CHANGEOUT

- IMPROVEMENT OF SERVICE WATER FLOW
  - REPLACE EXISTING PIPE IN-KIND
  - REPLACE EXISTING PIPE WITH AN UPGRADED MATERIAL (316SS/AL6XN)
  - CHEMICALLY CLEAN PIPING
  - REDESIGN SYSTEM FOR CLOSED LOOP OPERATION

ACTIONS TO DATE

- INJECTING BROMINE 9/92 INTERMITTENTLY AND SINCE 1/93 REGULARLY INJECTING

- HAVE INSTALLED SAMPLE RACKS PRIOR TO AND AFTER CHEMICAL INJECTION TO DEVELOP DEGRADATION CURVES

- ASSESSED CURRENT CONDITIONS AND VERIFIED OPERABILITY THROUGH NEXT CYCLE

- METALLURGICAL SAMPLES SUBMITTED TO VENDORS TO EVALUATE CHEMICAL CLEAN OPTION

- REPLACED WATER SUPPLY LINES ON RAD MONITOR

MILESTONE SCHEDULE

	COMPLETE
COMPLETE COOLER TESTING	SEPT. 30, 1993
CONCEPTUAL ENGINEERING	NOV. 1, 1993

UNIT 1

SYSTEM OVERVIEW	T. D. LEE
AUDIT RESULTS	T. DEL GAIZO

NINE MILE POINT UNIT 1
RAW WATER COOLING SYSTEMS
(SAFETY RELATED)

- SERVICE WATER CONSISTS OF THREE INDEPENDENT DEDICATED RAW WATER COOLING SYSTEMS

    - EMERGENCY SERVICE WATER SYSTEM (ESW)

    - EMERGENCY DIESEL GENERATOR COOLING SYSTEM (EDGC)

    - CONTAINMENT SPRAY RAW WATER COOLING SYSTEM (CSRW)

- ALL THREE ARE INHERENTLY SIMPLE, ONCE THOUGH DESIGNS, AND ARE VERY RELIABLE WITH AMPLE REDUNDANCY

- ESW AND THE CSRW SYSTEMS ARE MANUALLY INITIATED THROUGH CONTROLLED PROCEDURES, OPERATORS HAVE MUCH CONTROL OVER THE OPERATION OF THESE SYSTEMS

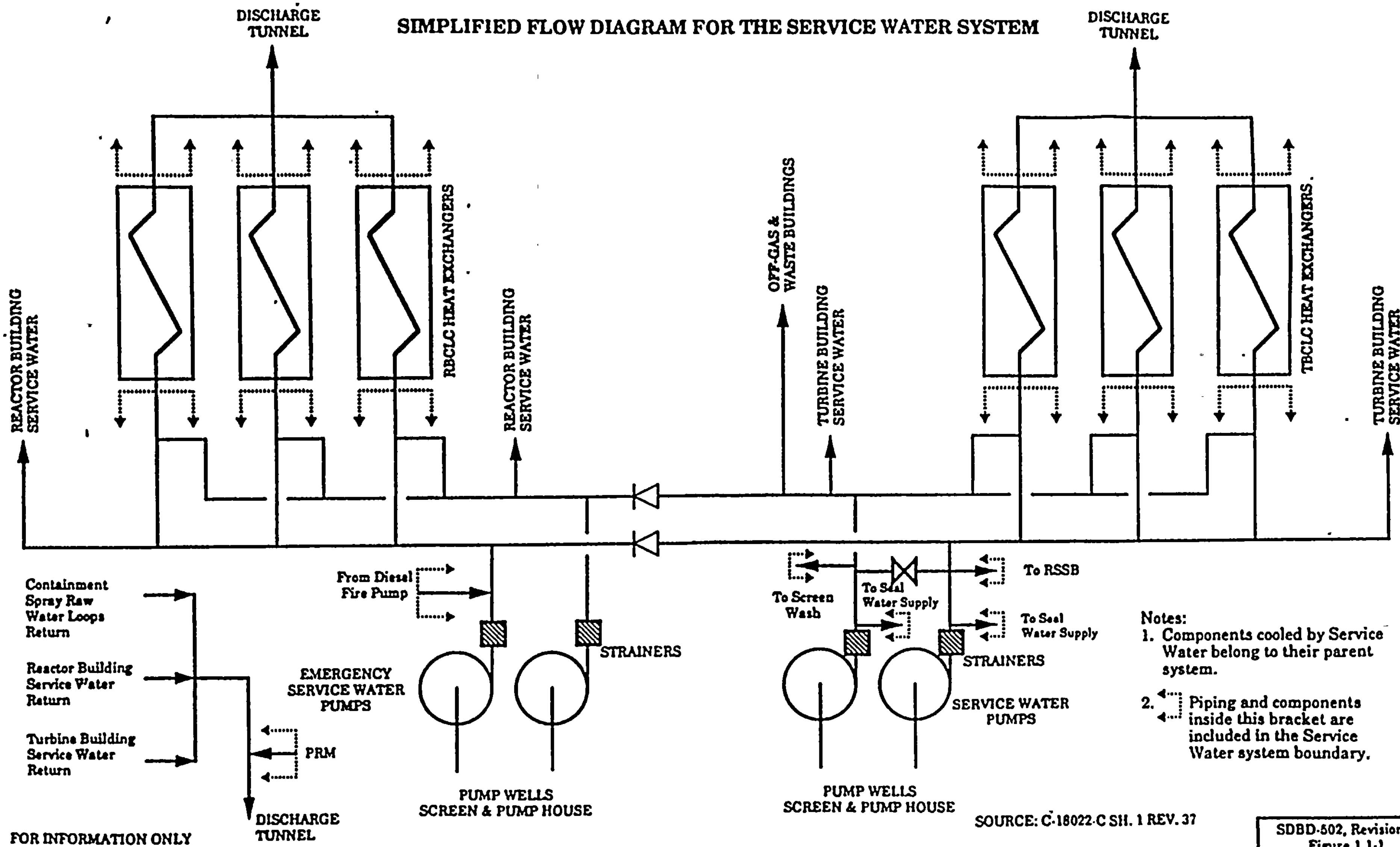
NINE MILE POINT UNIT 1
RAW WATER COOLING SYSTEMS (CONT'D)
(SAFETY RELATED)

- ESW
  - NORMAL SW vs ESW SYSTEM
  - DFP CROSS TIE
  - RBCLC HEAT LOAD WITH LOOP IS VERY LOW (Control Room/SFPC)

- EDGC SYSTEM HAS INDEPENDENT COOLING SUBSYSTEMS FOR EACH DIESEL GENERATOR.
  - DFP CROSS TIE

- CSRW SYSTEM HAS 400% COOLING FLOW REDUNDANCY.
  - CROSS TIE TO CONTAINMENT SPRAY

SIMPLIFIED FLOW DIAGRAM FOR THE SERVICE WATER SYSTEM



Notes:
1. Components cooled by Service Water belong to their parent system.
2. Piping and components inside this bracket are included in the Service Water system boundary.

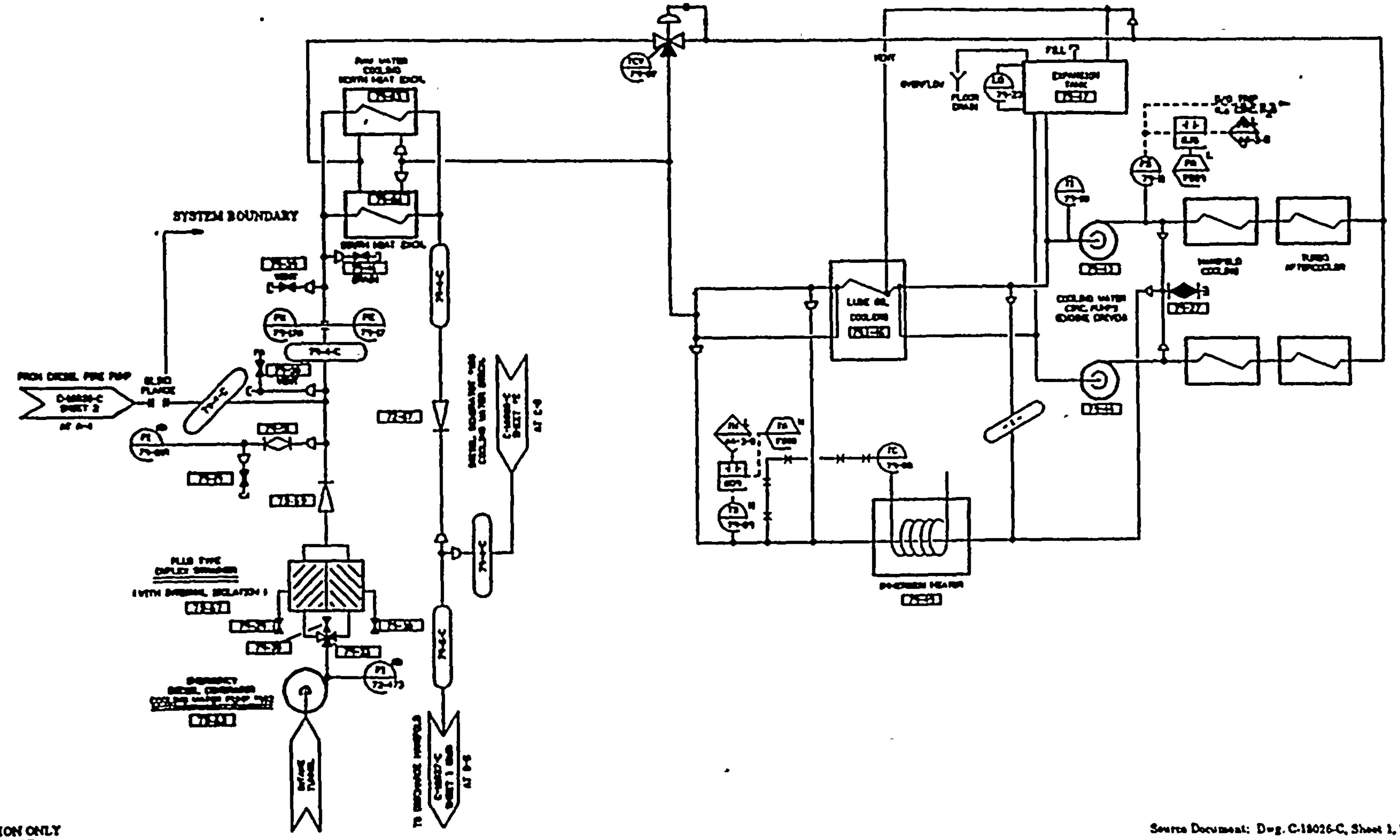
SOURCE: C-18022-C SH. 1 REV. 37

FOR INFORMATION ONLY
NOT FOR DESIGN

SDBD-502, Revision 0
Figure 1.1-1

Figure 1.2-5

DG102 COOLING WATER SYSTEM
(Typical for DG103)



"FOR INFORMATION ONLY
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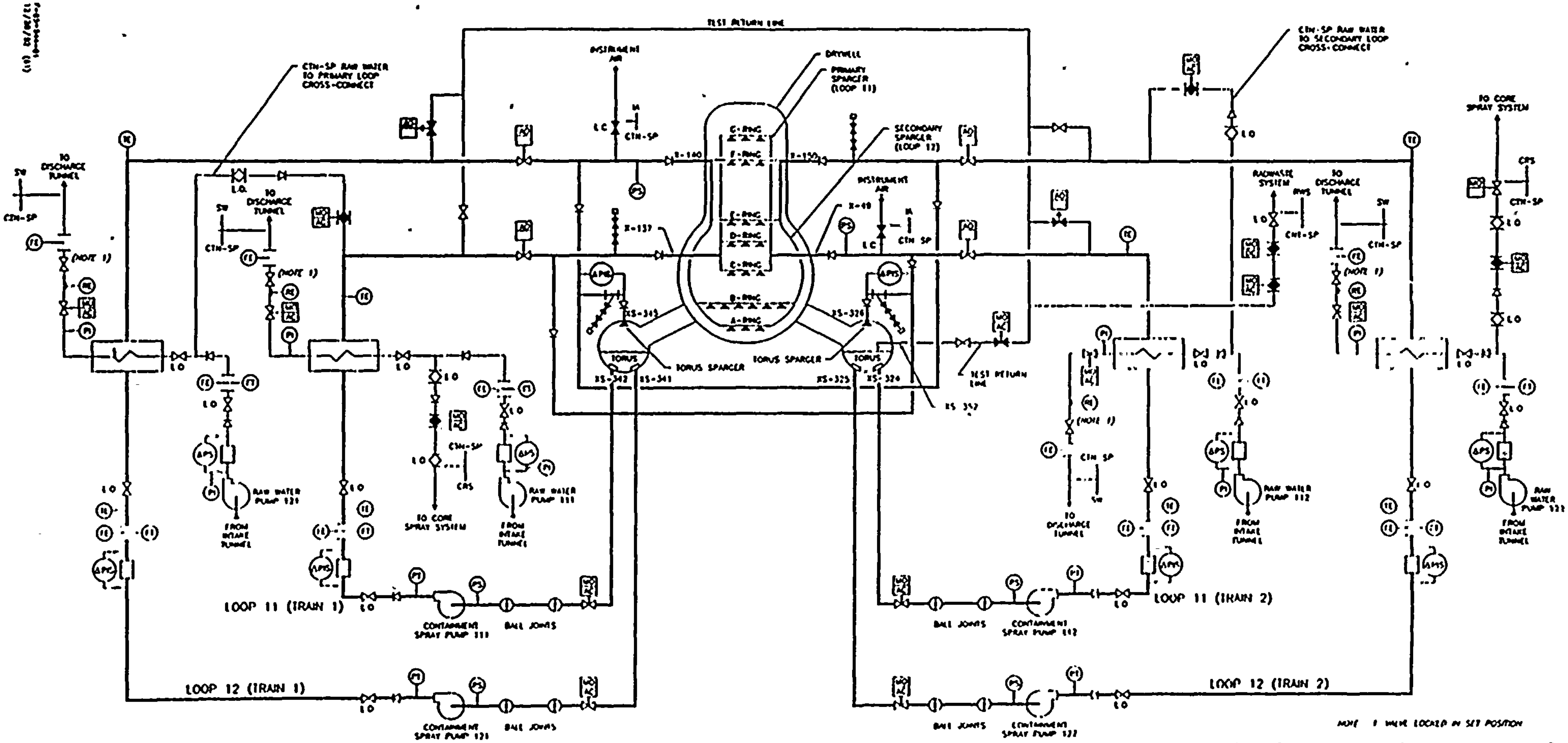
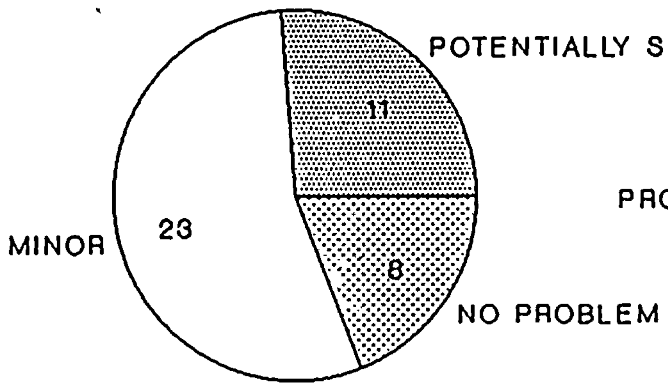
Source Document: Dwg. C-18026-C, Sheet 1, Rev. 10

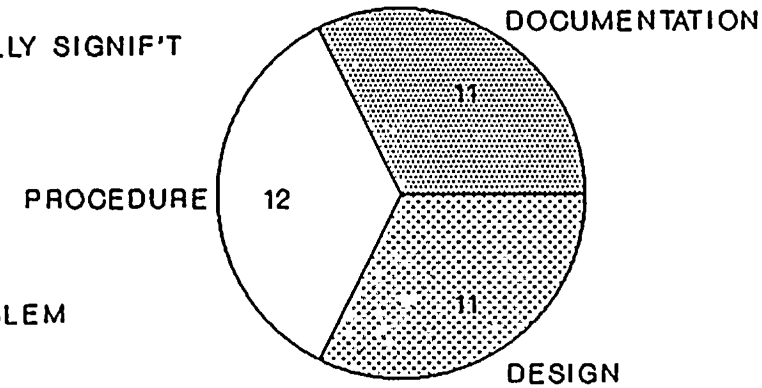


Containment Spray System
Schematic and Boundary Diagram
(Source NMPC Drawing C-18012-C Sh. 1 & 2)
Figure 12-1

UNIT 1 SERVICE WATER AUDIT QUESTIONS



42 QUESTIONS



POTENTIALLY SIGNIFICANT / MINOR QUESTIONS

STRENGTHS OF AUDITED ORGANIZATIONS

- 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

TECHNICAL ISSUES

SAFETY RELATED CHECK VALVES

- DESIGN BASIS AS PASSIVE DEVICES
- TREATED AS ACTIVE DEVICES FOR OPERATIONS AND TESTING
- RECOMMENDED EVALUATE ON CASE-BY-CASE BASIS

CS RAW WATER HEAT EXCHANGER DIFFERENTIAL PRESSURE

- DESIGNED FOR 10 PSIG RAW WATER SYSTEM OVERPRESSURE
- DER INDICATED OVERPRESSURE NOT ALWAYS AVAILABLE
- RADIATION MONITORS MAY NOT BE EFFECTIVE
- ISSUE TO BE RESOLVED IN MODIFICATION AND DER PROCESSES

ESW PUMP STRAINER DIFFERENTIAL PRESSURE

- ALARM ACTUATES AT 10 PSID
- DESIGN CALCULATIONS USED 2 TO 3 PSID
- SURVEILLANCE PROCEDURE TREATED STRAINER AS FIXED RESISTANCE
- DEVIATION/EVENT REPORTS INITIATED TO RESOLVE BOTH QUESTIONS

CS RAW WATER HEAT EXCHANGER RELIEF PROTECTION

- NO RELIEF VALVES INSTALLED
- DISCHARGE PATH ALWAYS AVAILABLE THROUGH INTERLOCKS
- PROCEDURE TO ISOLATE HEAT EXCHANGER IN HIGH RADIATION CONDITION MODIFIED TO ASSURE CONSTANT VENTS REMAIN OPEN

TECHNICAL ISSUES (CONTINUED)

CONTAINMENT SPRAY WATER SEAL

- WATER SEAL PROVIDED IN LIEU OF APPENDIX J LOCAL LEAK RATE TESTING
- ONE CS PUMP IS SECURED WHEN RAW WATER PUMP STARTED FOR TORUS COOLING
- WATER SEAL PROVIDED ONLY IN SPRAY MODE IN ACCORDANCE WITH SAFETY EVALUATION. AT LEAST TWO CS PUMPS RUN IN THE SPRAY MODE

GENERIC LETTER 89-13

- HEAT EXCHANGERS CLEANED ON ANNUAL BASIS
- CS HEAT EXCHANGERS MAINTAINED IN DRY LAYUP
- RECOMMENDED DEVELOP INTEGRATED PLAN

AUDIT CONCLUSIONS
UNIT 1

FUNCTIONALITY

GENERIC LETTER 89-13

- FULLY IMPLEMENTED
- RECOMMENDED INTEGRATED PLAN

SUMMARY AND CONCLUSIONS

CONCLUSIONS

- NMPC IS CONFIDENT THAT WE HAVE CONDUCTED THOROUGH AUDITS OF THE SERVICE WATER SYSTEMS FOR BOTH UNITS

- DEMONSTRATED THE BEST APPROACH IS TO AUDIT NMPC'S RESULTS

- NMPC CONTINUES ITS DILIGENT AND AGGRESSIVE MONITORING OF SERVICE WATER SYSTEMS