North Atlantic

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The Northeast Utilities System

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Senior Vice President &
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NYN- 94111

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United States Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Document Control Desk

References:
(a) Facility Operating License No. NPF-86, Docket No. 50-443

(b) Teleconference between USNRC (R. Cooper, et. al.) and North Atlantic (B. Drawbridge, et. al.) on September 26, 1994, regarding potential for bolt degradation in the Seabrook Station Service Water Pumps

(c) Teleconference between USNRC (J. Rogge) and North Atlantic (B. Drawbridge) on September 26, 1994, requesting a letter on the Service Water Pump bolt degradation

Subject: Service Water System Pump Bolt Degradation

Gentlemen:

During the third refueling outage, North Atlantic Energy Service Corporation (North Atlantic) identified two degraded stainless steel column bolts on a Service Water Cooling Tower pump. North Atlantic tested the subject bolts and determined that they were sensitized as a result of improper heat treatment, hence allowing int rgranular corrosion to take place. Based on this, North Atlantic expanded the scope of the evaluation a d testing to include other critical Service Water pump bolts. North Atlantic continues to evaluate this c ndition and is implementing corrective actions to address all identified bolt degradation.

On September 26, 1994, North Atlantic participated in a teleconference [Reference (b)] with USNRC personnel to discuss the status of the aforementioned evaluation, the basis for continued operability, and the current repair plans. In a subsequent teleconference [Reference (c)], the USNRC requested that North Atlantic submit a letter describing: 1) the basis for operability of the Service Water System; 2) repair plan and a discussion of any constraints; 3) potential or need for increased surveillances; 4) failure mechanism; and, 5) vendor information. Accordingly, the enclosures address the first three requests. The remaining information will be provided in subsequent correspondence when the evaluation of this condition is completed.

Enclosure 1 provides the basis for North Atlantic's conclusion that the Service Water System is operable. Bolt degradation is not widespread based on a comprehensive review of in-service bolting historical data. Anticipated worst case intergranular corrosion degradation is on the order of one percent

A065

of all Service Water pump column flange bolts. Additionally, significant margin exists with respect to all applicable Service Water pump bolted joint designs such that worst case anticipated bolt degradation would have no impact on each joint's ability to perform its respective design function. In conclusion, North Atlantic remains confident that all six Service Water System pumps are fully operable.

Enclosure 2 provides the current repair plan and schedule to correct the subject condition. This plan represents a comprehensive set of corrective actions to ensure that all six Service Water pumps are rebuilt in an expeditious manner. The plan includes the initial replacement of two of the four ocean Service Water pumps, one in each train, with pumps that will be rebuilt with new bolts unless records and analysis confirm that the subject bolts are not sensitized. Subsequently, the two Cooling Tower Service Water pumps will be removed, rebuilt, and replaced. Finally, the remaining two ocean Service Water pumps will be removed and rebuilt. This enclosure also describes the constraints associated with the pump repair process.

Enclosure 3 describes the existing surveillances conducted for the Cooling Tower and ocean Service Water pumps and North Atlantic's current surveillance activities prior to and during the pump repair process. Specifically, North Atlantic will rely on existing surveillances in addition to supplementing those associated with vibration monitoring. North Atlantic is confident that these surveillance activities will be effective at providing early identification of any Cooling Tower or ocean Service Water pump degradation.

The aforementioned basis for operability and the repair plan are based on the information available at this time, and is subject to update/revision as new information becomes available. North Atlantic will continue to apprise the NRC Resident Inspectors of any changes to the basis for operability and/or the repair plan. Notwithstanding the current plans, North Atlantic will not hesitate to take additional action should new information become available that indicates that the Service Water pumps inoperable.

Should you have any questions concerning this response, please contact Mr. James M. Peschel, Regulatory Compliance Manager, at (603) 474-9521, extension 3772.

Very truly yours,

Ted C. Feigenbaum

TCF:JES/jes

Enclosure

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ENCLOSURE 1 TO NYN-94111

Basis for Operability of Service Water System Pumps

1. Introduction

The following provides the basis for operability for the Seabrook Station Cooling Tower (CT) pumps 1-SW-P-110-A and B and for the ocean Service Water (SW) pumps 1-SW-P-41-A, B, C and D due to potentially degraded column flange bolts, column to bowl bolts, bowl studs, and impeller thrust ring retainer cap screws.

2. Background

During the third refueling outage (OR03) CT pump 1-SW-P-110-A was inspected by divers. This inspection revealed that the ends of two 1"-8 N.C. x 4" long flange bolts had separated from the nut/bolt. The bolt material specified is a type 316 austenitic stainless steel alloy (SA-193-B8M). The bolts are torqued to 254 ft-lb which produces a preload of approximately 90% of the material's yield strength. These bolts hold together the stainless steel flanges of the pump column. There are a total of 144 bolts in each pump with this function. The degraded bolts were supplied by Johnston Pump Company, the pump manufacturer. Laboratory testing revealed that the subject bolts had severely sensitized grain structures and had degraded due to intergranular attack. In response to these findings, North Atlantic reviewed the operating and maintenance history of the SW and CT pumps and expanded the scope of the evaluation to include additional critical bolting material.

3. Service Water System

The Service Water (SW) System transfers the heat from various sources in both the primary and secondary portions of the plant to the ultimate heat sink. The ultimate heat sink consists of both the Atlantic Ocean via the Circulating Water System and the SW Cooling Tower. Either of these sources is sufficient to provide the required cooling following a design basis accident, assuming a single failure of one train of the SW System. However, neither the Circulating Water System ocean tunnels nor the SW Cooling Tower is qualified for all design basis events. Therefore, the SW System uses both the ocean and cooling tower subsystems to provide the required cooling function.

Normally, the SW System is aligned to the Atlantic Ocean ultimate heat sink, with provisions for automatic transfer to the Cooling Tower ultimate heat sink. Transfer from the Cooling Tower to the ocean is accomplished manually in accordance with operating procedures.

The Cooling Tower is a Seismic Category I Mechanical Draft cooling tower that provides an alternate source of cooling water completely independent of the circulating water tunnels and the Atlantic Ocean. The tower is designed to provide sufficient cooling capacity during a loss of coolant accident (LOCA) while

sustaining any single active failure. Each train-associated CT pump, fan, and associated electrical equipment serving a single primary component cooling water heat exchanger has a common emergency electrical power supply and is separated from the other train's power supply. A loss of power to the electrical equipment supplying one flow train would only affect that flow train and would still allow sufficient capacity for cooling the unit under a LOCA condition.

The Cooling Tower functions as the backup ultimate heat sink, assuming service water heat loads following a seismic event which results in the collapse and greater than 95% blockage of the Circulating Water System ocean tunnels. The design basis for the Cooling Tower assumes that the seismic event which results in the collapse of the ocean tunnels also results in a LOCA and a loss of offsite power. The design basis heat load for the tower therefore consists of the Residual Heat Removal System heat rejection, Containment Spray System heat rejection, Emergency Diesel Generator cooling system heat rejection, Cooling Tower pump heat, and other small heat loads imposed on the Primary Component Cooling Water System during the accident. The Cooling Tower ultimate heat sink was originally designed to support operation of two units at the Seabrook site. The design basis for the Cooling Tower therefore included the post-LOCA heat loads from one unit and the cooldown loads from the second unit. As the Cooling Tower serves only a single unit, significant margin exists in its heat removal capability.

Only one SW pump or one CT pump in one train is required to operate to perform the safety function of the Service Water System.

4. <u>Description of Observed Bolt Degradation</u>

The observed bolt degradation is the result of a sensitized condition that could result in accelerated corrosion of the bolt material in the Cooling Tower and the seawater environments. Bolting that is on the non-wetted pump column flanges is not subject to this corrosion mechanism. The following summarizes the functions of bolts reviewed as part of the evaluation process.

The degraded column flange bolting holds the pump column flanges together. Degradation of multiple bolts could result in fluid leakage at the flanged joints resulting in reduced flow delivery or in misalignment of the pump shaft resulting in excessive pump vibration and premature pump wear. Other potentially degraded external bolting includes the column to bowl bolts and bowl studs, which have functions similar to the column flange bolting. Potentially degraded internal bolting serves to retain pump thrust rings to the impellers and shafts for both the SW and CT pumps. Degradation of these internal bolting components could cause separation of the impeller from the shaft resulting in excessive pump vibration and degradation in pump performance.

The design function of the column flange bolts, column to bowl bolts and bowl studs is to transfer load between the individual pump sections at each flange such that the pump functions as a continuous beam. Loads transferred across the

flanges are the deadweight, seismic, and pressure loads. The design function of the SW and CT pump thrust ring retainer bolting is to provide clamping force to hold the thrust ring retainer to the impeller. This maintains impeller thrust ring to shaft engagement. Additionally, in the CT pump design, the thrust ring retainer bolting also transmits impeller downward thrust to the thrust ring retainer and thrust ring.

5. Basis for Operability

Initially, upon identification of the subject condition, North Atlantic submitted one of the degraded bolts to a laboratory for analysis. The testing included ASTM A262 practice "A," and ASTM A262 practice "E," for confirmation of degradation. The chemical analysis and the mechanical properties test results indicated that the bolt met the requirements of SA-193-B8M. However, the material was severely sensitized. This sensitization is a result of an improper, or lack of, a required carbide solution heat treatment by the bolt manufacturer. The lack of a proper heat treatment does not reduce the bolt's mechanical properties, but does markedly reduce the corrosion resistance of the material in an aqueous environment. The second bolt from CT pump 1-SW-P-110A, and one bolt from SW pump 1-SW-P-41B were subsequently examined. The second CT pump bolt was similar to the first in that it exhibited significant sensitization and severe, circumferential corrosion damage. The bolt from the SW pump, although sensitized, exhibited minor corrosion damage in the form of localized pitting.

The two significantly degraded CT pump bolts separated near the outboard end of the nut. The two significantly degraded bolts had approximately 4 threads engaged into the nut. The engaged threads, remaining shank section and head on each bolt exhibited minimal corrosion damage. For each of the severely degraded bolts, adequate thread engagement existed (minimum of 3 threads) to maintain a structurally sound joint. The bolting degradation was due to an intergranular corrosion mechanism initiated by crevice corrosion. The unengaged outboard bolt/nut threads would serve as an ideal crevice corrosion site due to their proximity to oxygen enriched electrolyte. Subsequent deterioration was caused by intergranular corrosion due to the severely sensitized microstructure.

Subsequently, North Atlantic compiled the SW pump and CT pump bolting history summaries that are provided in Appendix II. Based on inspection of bolting replaced during the December 1992 SW-P-41C pump overhaul, review of all SW pump and CT pump overhaul work packages, and discussions with all levels of maintenance personnel, it was determined that 5 additional SW pump column bolts were significantly degraded due to intergranular corrosion. The balance of bolting replaced among the SW and CT pumps exhibited minor degradation due to crevice corrosion or pitting and did not show signs of intergranular attack.

Industry experience indicates that austenitic stainless steel bolting typically experiences pitting corrosion in a seawater environment. Significant corrosion degradation as seen in the bolting attacked by the intergranular mechanism has not

been detected during any previous pump inspections with the exception of the SW-P-41C overhaul (December 1992) and SW-P-110A diver inspections. Any significant degradation of the inservice bolting would be detectable as increased pump vibration or reduced pump performance during surveillance testing due to flange leakage/separation. The current surveillances for the CT pumps and SW pumps demonstrate acceptable pump performance.

Service water pump and cooling tower pump experience to date indicates that intergranular corrosion has not been a significant issue. From Appendix II, less than 1% of the SW and CT pump column flange bolting have experienced this form of corrosion damage. Therefore, the corrosion damage to the column flange bolting is not widespread. Additionally, during the diver inspection of the CT pumps, no other bolt ends were observed to be loose or damaged.

The SW and CT pump bolting history provided in Appendix II indicates that of all critical fasteners listed for each type of pump, only the column flange bolts (80067-AN) have been observed to exhibit intergranular corrosion damage. The 1-inch and 1-1/8-inch column to bowl machine bolts (80067/80070) have a similar function as the column bolting but have never been replaced as noted in the Appendix. Specimen testing for sensitization has not yet been completed on these bolts but service history to date based on various pump overhauls (both SW and CT pumps) indicates that intergranular corrosion degradation has not been observed.

The 1-inch and 1-1/8-inch bowl studs for both the CT and SW pumps (80065) are not believed to be sensitized based on analysis results. No studs have ever been replaced due to corrosion damage in either the CT or SW pumps nor have any of these studs ever exhibited signs of intergranular attack. Since there is no indication to date that they are sensitized, they would not be susceptible to the intergranular corrosion mechanism. However, additional laboratory testing of additional stud specimens will be required before these studs may be categorically excluded from the scope of this evaluation.

The CT pump 7/8-inch hex head impeller thrust ring retainer cap screws are fabricated from sensitized material. They are therefore, potentially susceptible to the intergranular corrosion mechanism. However, based on the Appendix II CT pump bolting history, none of these bolts exhibited any signs of degradation during the SW-P-110A overhaul of OR02. These bolts had been in service for approximately 9 years and were re-used during the pump overhaul. It is believed that due to tight tolerances in the impeller to thrust retaining ring bolted joint that water intrusion into the joint is minimal. Therefore, bolting contact with aqueous electrolyte, which is necessary to cause intergranular corrosion, may be minimal in comparison to column flange bolting.

The SW pump 3/8-inch socket head cap screws that serve as internal thrust ring retainer bolts are not believed to be sensitized based on laboratory analysis. Once again, additional laboratory results will be necessary before firmly concluding

that all in-service 3/8-inch thrust ring retainer bolts are not susceptible to intergranular attack. Appendix II bolting historical data indicates that intergranular corrosion has not been observed on any of these fasteners to date and that these fasteners have been reused after pump overhauls. These fasteners are also similar to the CT pump 7/8-inch cap screws in that the thrust ring retainer to impeller bolted joint design has tight tolerances. Therefore it is believed that water intrusion into the bolted joint crevices is minimal thereby retarding or preventing the initiation of intergranular attack.

As part of the evaluation process, a SW and CT pump external bolting stress analysis margin evaluation was developed. Based on this analysis, it is concluded that for the SW pumps, 5 of 20 1-inch column bolts and 4 of 24 (1-1/8) inch column to bowl bolts or bowl studs are required per flanged joint to maintain pump structural integrity during the SSE based on uniform distribution around the joint. For the CT pumps, 18 of 24 1-inch pump column bolts, column to bowl bolts or bowl studs are required per flanged joint based on design basis loadings and uniform distribution around the joint. Based on a review of the SW and CT pump bolting history summary of Appendix II which postulates approximately 1% of the column flange bolting to be potentially significantly degraded (0% for column to bowl bolts and bowl studs), this equates to less than 2 degraded column flange bolts per pump. Accordingly, significant margin exists with respect to minimum required bolting.

North Atlantic requested Johnston Pump to perform an analysis of the internal impeller thrust ring retainer bolts for both the CT and SW pumps. This evaluation concluded that for the CT pumps, 3 of 6 (7/8) inch cap screws are required in order to retain the impeller thrust ring such that it remains in contact with the pump shaft keyed slot. The evaluation covering the SW pump requires that 1 of 4 (3/8) inch socket head cap screws maintain load carrying integrity. Since none of these fasteners have ever exhibited intergranular corrosion degradation per the Appendix II bolting history summary, it is highly unlikely that bolting degradation will occur such that no margin remains. Additionally, initial specimen testing (4 samples) reveals that the 3/8-inch SW pump bolts are not sensitized.

The CT and SW pumps remain capable of performing their design basis decay heat and equipment heat removal function. Degradation of pump performance has not been noted to date. Excessive degradation of the external flange bolting would be detectable as either increased pump vibration or decreased flow/head. Prior CT and SW pump inspections indicated some pitting corrosion of the bolting material which required bolting replacement as documented in Appendices I and II. Only 7 CT and SW pump column flange bolts to date have exhibited significant degradation due to intergranular corrosion. Therefore, the operating and maintenance history review indicates that SW and CT pump column flange cap screw corrosion is not widespread and is limited to approximately 1% of the total population of bolts which have been in service. The SW and CT pump column to bowl bolts, bowl studs and impeller thrust ring retaining cap screws

have never exhibited signs of intergranular degradation based on multiple pump overhauls. Significant margin exists in all critical bolting applications including the SW and CT pump external column bolting and the pump internal impeller thrust ring retainer cap screws. Finally, it is unlikely that all affected bolting on the service water and cooling tower pumps would be degraded to the extent that all six pumps are inoperable.

6. Conclusion

The CT pumps 1-SW-P-110-A and B and the SW pumps 1-SW-P-41-A, B, C, and D are capable of performing their design basis function with potentially sensitized and degraded pump column flange bolts, column to bowl bolts, bowl studs and pump internal impeller thrust ring retainer cap screws. The bases for this conclusion are as summarized as follows:

a) Postulated bolting degradation is not widespread based on a comprehensive review of in-service bolting historical data. Anticipated worst case intergranular corrosion degradation is on the order of 1% of all column flange bolts. Intergranular attack has never been identified on any other SW or CT pump bolting.

b) Significant margin exists with respect to all applicable SW and CT pump bolted joint designs such that worst case anticipated bolting degradation would have no impact on each joint's ability to perform its respective design basis function.

Therefore, 1-SW-P-41 A, B, C, D and 1-SW-P-110 A and B are considered to be operable.

SERVICE WATER SYSTEM BOLTING
JOHNSTON PUMP COMPANY

1. SYSTEM FUNCTION

A. SERVICE WATER PUMPS (1-SW-P-41A THRU 41D) - PROVIDE HEAT SINK FOR NORMAL AND ACCIDENT LOADS (2 REQUIRED). 2 STAGE VERTICAL PUMP CONSISTING OF 7 COLUMN SECTIONS

- TWENTY 1" CAP SCREWS PER COLUMN FLANGE (140 PER PUMP)
- TWENTY FOUR 1-1/8" CAP SCREWS THAT ATTACH THE LAST COLUMN TO THE BOWL ASSEMBLY (24 PER PUMP)
- TWENTY FOUR 1-1/8" STUDS PER BOWL (48 PER PUMP)
- FOUR 3/8" SOCKET HEAD CAP SCREWS PER IMPELLER (IMPELLER RETAINER CAP SCREWS) - INTERNAL (8 PER PUMP)

B. COOLING TOWER PUMPS (1-SW-P-110A AND 110B) - PROVIDES HEAT SINK ONLY UPON LOSS OF OCEAN HEAT SINK TUNNELS. TWO STAGE VERTICAL PUMPS CONSISTING OF SIX COLUMN SECTIONS

- TWENTY FOUR 1" CAP SCREWS PER COLUMN FLANGE (144 PER PUMP)
- TWENTY FOUR 1" CAP SCREWS THAT ATTACH THE LAST COLUMN TO THE BOWL ASSEMBLY (24 PER PUMP)
- TWENTY FOUR 1" STUDS PER BOWL (48 PER PUMP)
- SIX 7/8" CAP SCREWS PER IMPELLER (IMPELLER RETAINER CAP SCREWS) - INTERNAL (12 PER PUMP)

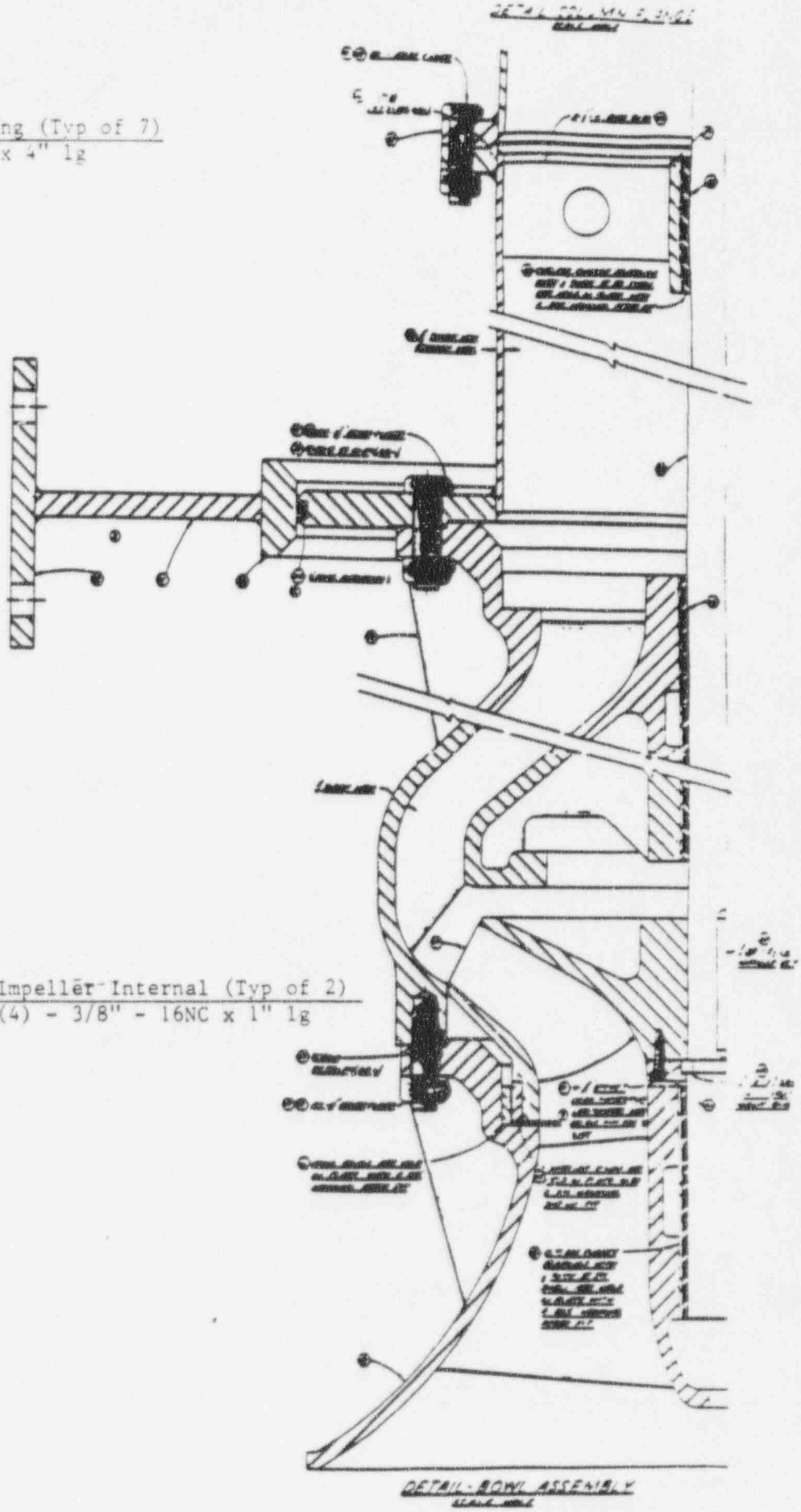
SX PUMP

Column Flg Bolting (Typ of 7)
(20) - 1" - 8NC x 4" lg

Column - Bowl Bolting
(Typ of 1)
(24) - 1 1/8" - 8NC x 4½" lg

Impeller Internal (Typ of 2)
(4) - 3/8" - 16NC x 1" lg

Bowl Studs (Typ of 2)
(24) - 1 1/8" - 8NC x 4½" lg



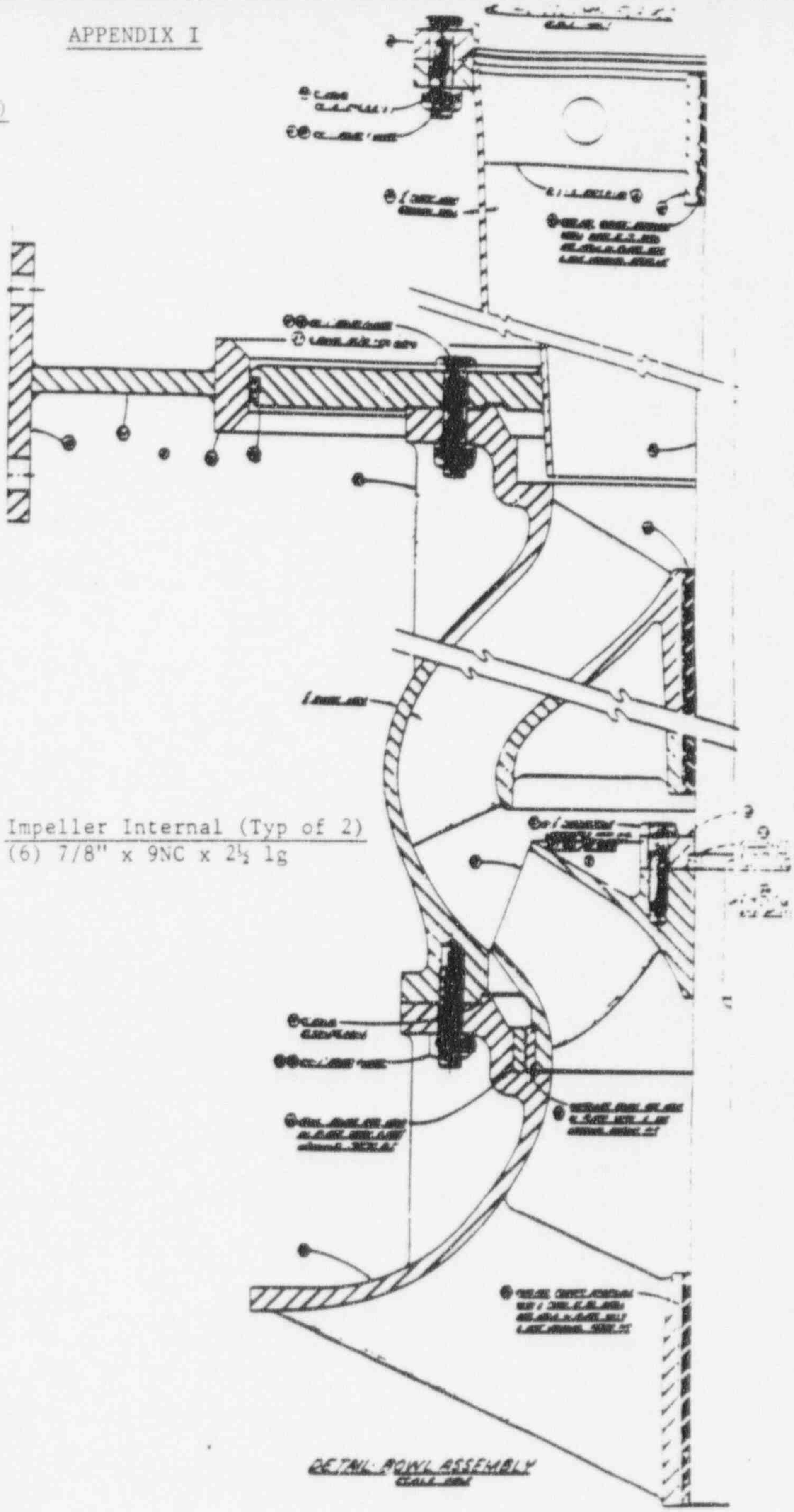
APPENDIX I

Column Flg Bolting (Typ of 6)
(24) - 1" x 8NC x 4" lg

Column - Bowl Bolting (Typ of 1)
(24) - 1" x 8NC x 4½" lg

Impeller Internal (Typ of 2)
(6) 7/8" x 9NC x 2½ lg

Bowl Studs (Typ of 2)
(24) 1" - 8NC x 4½" lg



SWP/CTP REPLACEMENT AND OVERHAUL SUMMARY

SEPT '91 - OR01

- SW-P-41B OVERHAULED AND REINSTALLED AFTER APPROXIMATELY <u>8 YEARS</u> AND <u>22,000 RUN HOURS</u>. <u>30</u> COLUMN FLG BOLTS REPLACED - <u>NONE HAD SIGNIFICANT DEGRADATION</u>.

- SW-P-41A OVERHAULED AND REINSTALLED AFTER APPROXIMATELY <u>8 YEARS</u> AND <u>25,000 RUN HOURS</u>. <u>17</u> COLUMN FLG BOLTS REPLACED - <u>NONE HAD SIGNIFICANT DEGRADATION</u>.

OCT '92 - OR02

- SW-P-41C REPLACED WITH NEW UNIT 2 SPARE AFTER APPROXIMATELY <u>9 YEARS</u> AND <u>22,500 RUN HOURS</u>. PUMP NOT DISASSEMBLED.

- SW-P-41D REPLACED WITH NEW UNIT 2 SPARE AFTER APPROXIMATELY <u>9 YEARS</u> AND <u>26,000 RUN HOURS</u>. PUMP NOT DISASSEMBLED (BOLTS NOT INSPECTED).

- SW-P-110A OVERHAULED (WITH SOME UNIT 2 COMPONENTS) AND REINSTALLED AFTER APPROXIMATELY <u>9 YEARS</u> AND <u>7,800 RUN HOURS</u>. <u>54</u> COLUMN FLG BOLTS REPLACED. NONE HAD SIGNIFICANT DEGRADATION.

DEC '92 - OCEAN STORM

- SW-P-41C REMOVED DUE TO HIGH VIBRATION AFTER 204 RUN HOURS. REPLACED WITH PREVIOUS SW-P-41C WHICH HAD <u>39</u> COLUMN FLG BOLTS REPLACED (ORIGINAL BOLTING). - <u>5 BOLTS HAD SIGNIFICANT DEGRADATION</u>.

FEB '93

- SW-P-41D REMOVED DUE TO HIGH VIBRATION AFTER APPROXIMATELY <u>500 RUN HOURS</u>. REPLACED WITH FORMER SW-P-41C WHICH WAS REPLACED AFTER 204 RUN HOURS IN DEC '92. THIS REPLACEMENT PUMP WAS A "NEW" UNIT 2 PUMP. - NO BOLTING REPLACED.

APR '93

- SW-P-41B REMOVED AFTER <u>1½ YEARS</u> AND <u>5,000 RUN HOURS</u>. REPLACED WITH FORMER SW-P-41D. (REBUILT FROM UNIT 1 & 2 SPARE PARTS). NO DATA ON BOLTING REPLACEMENT.

APR '94

- THE EXPOSED THREADED ENDS OF 2 SW-P-110A (CTP) BOLTS BROKE DURING DIVER INSPECTION OF CT BASIN. 4 THREADS REMAINED ENGAGED IN EACH NUT - BOLTING RETAINED LOAD CARRYING CAPACITY.

- 2 DEGRADED BOLTS WERE REPLACED.

SENSITIZATION OF AUSTENITIC STAINLESS STEELS

MECHANISM

- OCCURS WHEN AUSTENITIC STAINLESS STEELS ARE HEATED IN THE APPROXIMATE TEMPERATURE RANGE OF 950 - 1450°F.

- CHROMIUM CARBIDE (CR_{23} C_6) PRECIPITATES AT THE GRAIN BOUNDARIES IF CARBON CONTENT IS ABOUT 0.02% OR HIGHER (E.G. 316 SS SA-193 B8M).

- AREAS ADJACENT TO GRAIN BOUNDARIES BECOME DEFICIENT OF CHROMIUM AND THEREFORE SUSCEPTIBLE TO INTEGRANULAR CORROSION ATTACK.

- MECHANICAL OR CHEMICAL MATERIAL PROPERTIES ARE NOT AFFECTED AS RESULTS OF SENSITIZATION.

PREVENTION

- SOLUTION - QUENCHING HEAT TREATMENT (HEATING TO 1950 TO 2050°F FOLLOWED BY WATER QUENCH OR QUICK AIR COOL)

- CHROMIUM CARBIDE DISSOLVES AT THESE TEMPERATURES AND WILL NOT REFORM IF MATERIAL IS QUICKLY COOLED.

SA-193 B8M

- MANDATES CARBIDE SOLUTION HEAT TREATMENT (SOLUTION - QUENCHING) AFTER ROLLING OR FORGING AND COOLING TO AMBIENT TEMPERATURE. THIS REQUIREMENT PROTECTS AGAINST SENSITIZING THE BOLTING MATERIAL DURING BOLTING MANUFACTURING.

SW-P-41 A/B/C (NOTE 1)
SWP BOLTING HISTORY SUMMARY (SINCE 1983)

JOHNSTON PART NO.	DESCRIPTION	(A) TOTAL QTY PER PUMP	(B) TOTAL QTY REPLACED (X PUMPS)	(C) (= XA + B) TOTAL QTY IN-SERVICE	(D) TOTAL QTY W/ SIGNIFICANT DEG.	(E) (= D/C X 100) PERCENT W/ SIGNIFICANT DEG.	SENSI-TIZED
80067-AN	1"- 8NC X 4" LG HEX HD CAP SCREW (COLUMN FLG BOLTING)	140	86 17-41A (OR-01) 30-41B (OR-01) 39-41C (STORM)	506	5	1%	YES
80070-AN	1 1/8"- 8NC X 4½" LG HEX HD MACHINE BOLTS (COLUMN - BOWL FLG BOLTING)	24	0	72	0	0%	TBD
80065-AN	1 1/8" - 8NC X 4½" LG BOWL STUDS	48	0	144	0	0%	NO
80069-AN	3/8" - 16 NC X 1" LG SOCKET HD CAP SCREWS (INTERNAL THRUST RING RETAINER BOLTING	8	0	24	0	0%	NO

NOTES:

(1) 7 PUMPS HAVE BEEN OVERHAULED OR REPLACED TO DATE. THIS DATA IS BASED ON OVERHAUL OF SW-P-41 A/B/C WHICH HAVE DOCUMENTED BOLTING REPLACEMENTS.

(2) ALL PUMPS HAD 8-9 YEARS OF SERVICE (ALL BOLTING 8-9 YEARS OF SERVICE)

SW-P-110A (NOTE 1)
CTP BOLTING HISTORY SUMMARY (SINCE 1983)

JOHNSTON PART NO.	DESCRIPTION	(A) TOTAL QTY PER PUMP	(B) TOTAL QTY REPLACED (X PUMPS)	(C) (= XA + B) TOTAL QTY IN-SERVICE	(D) TOTAL QTY W/ SIGNIFICANT DEG.	(E) (= D/C X 100) PERCENT W/ SIGNIFICANT DEG.	SENI-TIZED
80067-AN	1"- 8NC X 4" LG HEX HD CAP SCREW (COLUMN BOLTING)	144	56 54 (OR02) *2 (OR03)	200	2*	1%	YES
80067-AN	1" - 8NC X 4½" LG HEX HD CAP SCREW (COLUMN TO BOWL BOLTING)	24	0	24	0	0%	TBD
80065-AN	1"- 8NC X 4½" LG BOWL STUD	48	0	48	0	0%	NO
80074-AN	7/8" - 9NC X 2½" LG HEX HD CAP SCREW (IMPELLER THRUST RING RETAINER CAP SCREWS)	12	0	12	0	0%	YES

NOTES:

(1) DATA BASED ON OVERHAUL OF SW-P-110A AFTER 9 YEARS OF SERVICE. SW-P-110B HAS NOT YET BEEN OVERHAULED.

(2) 54 BOLTS REPLACED OR-02 - NONE NOTED WITH INTERGRANULAR CORROSION OR SIGNIFICANT DEGRADATION. 2 ADDITIONAL BOLTS REPLACED IN OR-03 BASED ON DIVER INSPECTION.

(3) 2 SIGNIFICANTLY DEGRADED BOLTS (INTERGRANULAR CORROSION) FOUND IN OR-03 DURING DIVER INSPECTION. THESE BOLTS WERE REPLACED.

ENCLOSURE 2 TO NYN-94111

Service Water System Pump Repair Plan

The following describes North Atlantic's current plan to correct the degraded bolting condition in the Cooling Tower (CT) and ocean Service Water (SW) pumps. This repair plan is based on the information, analysis, and evaluation that has been obtained/performed to date, and is therefore subject to change as the evaluation process continues. Additionally, the proposed schedule dates are preliminary as they are highly dependent on, and may be affected by, the availability of materials, unforeseen plant evolutions, weather conditions, or completion of prior work. Repair activities will also be coordinated with each train's system week to maximize equipment availability. North Atlantic also intends to maximize the use of dedicated crews for repair activities.

At this time, it is anticipated that all SW and CT pumps will be rebuilt with new bolts for all applications where sensitized bolts were either found or expected to be found. This will include new column flange bolts, column to bowl bolts, bowl studs, and impeller thrust ring retainer cap screws. It should be noted that the scope of the bolt replacement may change as additional analysis is conducted. For example, certain bolts may not be replaced if records and analyses confirm that the subject bolts are not sensitized. However, in no case will bolts that are believed to be sensitized be utilized in the rebuild process. In addition, it must be noted that even though the discussion below includes the unlikely occurrence of tornado damage, North Atlantic will cease repair operations, return all available ocean SW pumps and CT pumps to service in the event of any severe weather warning.

North Atlantic anticipates that the revised Service Water System Technical Specification requested by License Amendment Request (LAR) 93-02 "Service Water System/Ultimate Heat Sink Operability Requirements," (NYN-93052) will be issued by the NRC during the period that the first SW pump is being rebuilt. Therefore, references to Technical Specification sections in the following discussion are based upon the proposed Technical Specifications. If the revised Technical Specifications are not issued when pump replacement begins, the repair plan and the related procedures will be revised to be consistent with the requirements of the existing Technical Specifications.

The current plan is to first rebuild two spare ocean SW pumps with upgraded components, including all new bolting material. It is anticipated that new bolts will be available at Seabrook Station on October 7, 1994, and that the rebuild process will commence (following receipt inspection) on October 11. Dedicated crews will be utilized to rebuild the two spare pumps.

On October 17, it is anticipated that one of the ocean SW pumps will be removed from service and replaced with one of the recently rebuilt ocean SW pumps. This evolution, and all required pump testing, is expected to be completed by the end of the day on October 19.

During the time that divers are in the SW forebay to assist in pump removal/installation (approximately 2 - 4 hours per operation), all four ocean SW pumps will be secured and the Cooling Tower will be utilized. At this time, Technical Specification 3.7.4, ACTION d., which provides a 24 hour allowed outage time (AOT), will be entered. Once the divers have exited the SW forebay and a minimum of one ocean SW pump in each loop is returned to service, the Limiting Condition for Operation (LCO) of Technical Specification 3.7.4 will be met and ACTION d.will be exited.

In the unlikely event that a design basis tornado renders the Cooling Tower fans inoperable while the divers are in the SW forebay, it would be necessary to remove the divers from the SW forebay and return an ocean SW pump to service within a maximum of 74 minutes. During the 74 minutes, the cooling water volume available in the Cooling Tower basin is adequate to remove the heat loads. The calculation that established the 74 minutes is available for review at Seabrook Station. It is anticipated that the divers could exit the SW forebay and an ocean SW pump returned to service within less than 10 minutes. Procedures will be developed and personnel will be assigned to facilitate expeditious removal of the divers and the return of an ocean SW pump to service should the need arise.

On October 24, it is anticipated that the second ocean SW pump will be removed from service and replaced with the second recently rebuilt ocean SW pump. This evolution, and all required pump testing, is expected to be completed by the end of the day on October 26. The same Technical Specification ACTION statements and procedural controls described above are applicable for this evolution.

In parallel, on September 30, it is anticipated that a spare CT pump will be brought onsite in preparation for rebuilding. On October 3, a dedicated crew will disassemble this pump and initiate the rebuild process once the bolts have been received on October 7. It is anticipated that this pump will be rebuilt by the end of the day on October 21.

On October 31, it is anticipated that one of the two CT pumps will be removed from service and replaced with the aforementioned rebuilt spare CT pump. This evolution, and all required pump testing, is expected to be completed by the end of the day on November 3. The pump that is removed from service will be subsequently rebuilt starting on November 1.

During the time that divers are in the Cooling Tower basin for pump removal/installation (approximately 2 - 4 hours per operation) both CT pumps will be secured and the ocean SW pumps will be utilized. At this time, Technical Specification 3.7.4, ACTION c., which provides a 72 hour AOT, will be entered. Once the divers have exited the Cooling Tower basin and one CT pump has been returned to service, ACTION c. will be exited and ACTION b., which provides a 7 day AOT, will be entered.

In the unlikely event that a design basis seismic event renders the ocean cooling water tunnels inoperable while the divers are in the Cooling Tower basin, it would be necessary to remove the divers and return a CT pump to service within 16 minutes. During the 16 minutes, adequate cooling water volume is obtained by two operating SW pumps via draindown of the SW forebay. If one SW pump is operating, this duration increases to 32 minutes. The calculation that established these time frames is available for review at Seabrook Station. It is anticipated that the divers could exit the Cooling Tower basin and a CT pump returned to service within less than 10 minutes. Procedures will be developed and personnel will be assigned to facilitate expeditious removal of the divers and the return of a CT pump to service should the need arise.

On November 7, it is anticipated that the second CT pump will be removed from service and replaced with the recently removed/rebuilt CT pump. This evolution, and all required pump testing, is expected to be completed by the end of the day on November 10. The same Technical Specification ACTION statements and procedural controls described above are applicable for this evolution.

From November 14 to December 16, 1994 the third and fourth ocean SW pumps will be removed from service, rebuilt and reinstalled. The same Technical Specification ACTION statements and procedural controls described above are applicable for these evolutions.

ENCLOSURE 3 TO NYN-94111

Service Water System Pump Surveillances

The following describes the existing surveillances performed on the CT and ocean SW pumps, and North Atlantic's current surveillance activities prior to and during the pump repair process.

1. Existing Surveillances

The CT and SW pumps are included as part of the Inservice Test Program (IST). As such, these pumps undergo quarterly surveillances to measure vibration and differential pressure. Data from these surveillances are trended to provide early indication of potential pump/system degradation.

Additionally, Nuclear Systems Operators (NSO) routinely observe operating Service Water System pumps to identify abnormal operating conditions. These observations have in the past successfully provided early identification of increased pump vibration caused by excessive bearing wear.

2. Intended Surveillance Activities

Prior to and during the pump repair process, North Atlantic will maintain the existing surveillance activities and supplement those associated with vibration monitoring. Specifically, in addition to the aforementioned vibration checks performed by NSO's, Technical Support engineers will measure pump vibration levels on a weekly basis for those pumps that are operating. This data will then be trended and evaluated.

North Atlantic does not intend to operate the normally idle CT pumps for the sole purpose of performing vibration measurements. This would be counter productive since it increases sea water intrusion into the otherwise fresh/brackish water contained in the Cooling Tower basin, which in turn increases the potential for biofouling. Additionally, this would unnecessarily increase the number of pump starts, which has the potential to adversely affect pump life as manifested in increased shaft journal bearing wear. This latter point is also the basis for not performing increased surveillances on any non-operating ocean SW pumps.

North Atlantic has apprised all Operations personnel to the potential for SW and CT pump bolt degradation. These personnel have been directed to closely monitor pump and system operating characteristics including vibration, pressure and flow, and to inform supervision of any abnormalities.

3. Recent/Upcoming Surveillances

The following describes the recently conducted and upcoming quarterly IST surveillances for both the SW and CT pumps:

Ocean SW Pumps

Pump A: The last surveillance was conducted on July 21, 1994; satisfactory; next surveillance will be conducted approximately on October 14, 1994.

Pump B: The last surveillance was conducted on September 1, 1994; this surveillance was acceptable although it indicated higher than previous vibration levels at one of the five monitoring locations. This reading was 0.24 inches per second at the upper bearing with the limit being less than 0.42 inches per second. The surveillance frequency of this pump was increased to every 46 days due to the slightly higher reading. The next surveillance will be conducted approximately on October 10, 1994.

Pump C: The last surveillance was conducted on July 21, 1994; satisfactory; next surveillance will be conducted approximately on October 14, 1994.

Pump D: The last surveillance was conducted on September 1, 1994; this surveillance was acceptable although it indicated higher than previous vibration levels at one of the five monitoring locations. This reading was 0.058 inches per second at the lower bearing with the limit being less than 0.120 inches per second. The surveillance frequency of this pump was increased to every 46 days due to the slightly higher reading. The next surveillance will be conducted approximately on October 10, 1994.

Cooling Tower Pumps

Pump A: The last surveillance was conducted on September 29, 1994; this surveillance was acceptable. The surveillance frequency of this pump was increased previously to every 46 days as a result of a slightly lower than normal pump developed head. While the developed head value returned to the normal band on the most recent test, the surveillance frequency will be maintained at the increased rate to monitor this parameter. The next surveillance will be conducted approximately on November 14, 1994.

Pump B: The last surveillance was conducted on September 29, 1994; satisfactory; the next surveillance will be conducted approximately on December 21, 1994.

4. Conclusion

North Atlantic is confident that the above surveillance data represents acceptable behavior for all six Service Water pumps due to the significant margin

between the measured data and the associated acceptance criteria limits. Additionally, for the two SW pumps "B" and "D" that exhibited an increased vibration level over previous test results, this increase was only observed on a single data point at only one test location. A true degraded condition would be manifested by much higher vibration readings than have been observed to date and would be apparent at more than one monitoring location. North Atlantic concludes therefore that there currently is not a degraded condition with any of the Service Water pumps. Should a degraded condition develop, it would be quickly identified and appropriate action taken as a result of the enhanced monitoring surveillance activities described earlier.