U. S. NUCLEAR REGULATORY COMMISSION
REGION I

Report Number:	94-03
Docket No.:	50-443
License No.:	NPF-86
Licensee:	North Atlantic Energy Service Corporation Post Office Box 300 Seabrook, New Hampshire 03874
Facility:	Seabrook Station
Dates:	January 19 - February 28, 1994
Inspectors:	Antone C. Cerne, Senior Resident Inspector Richard A. Laura, Resident Inspector Vonna L. Ordaz, Reactor Engineer
Approved By:	John F. Rogge 3/23/94 John Rogge, Chief Date Reactor Projects Section 4B, DRP

Inspection Summary: This inspection report documents the safety inspections conducted during day shift and back shift hours. The inspections assessed station performance in the areas of plant operations, maintenance, engineering, plant support, and safety assessment/quality verification.

Results: North Atlantic operated the facility safely, including full power operations and response to a reactor trip and the first safety injection at power experienced at Seabrook Station. One violation, that involved inadequate corrective action implementation for several main steam isolation valve performance problems during testing, was identified. One unresolved item was identified concerning the maintenance training qualification and qualification program guidance. See the executive summary for an assessment of licensee performance.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

SEABROOK STATION
NRC INSPECTION REPORT NO. 50-443/94-03

Plant Operations: The operators operated the facility safely during routine and non-routine activities. The operators reacted well to a bushing failure in the Tewksbury transmission line. Subsequent to a reactor trip/SI injection due to an unexpected main steam isolation valve (MSIV) closure, the operators followed the emergency procedures to stabilize plant conditions. Upon completion of the unplanned MSIV outage, the operators returned the plant to power in a safe and controlled manner. One minor configuration control issue was identified in which the plant operators are presented with conflicting guidance between certain service water system operating and alarm response procedures.

Maintenance: The maintenance staff performed well during the MSIV outage by conducting work with a "do the job right the first time" attitude. Four minor discrepancies were identified related to the work control process. A deficient main steam gage was brought to the licensee's attention that was entered into the work control system for corrective maintenance. A review of maintenance troubleshooting revealed that adequate troubleshooting controls exist. Increased management attention is needed in the area of maintenance training qualification and qualification program guidance.

Engineering: The MSIV repair team performed methodical troubleshooting, developed a comprehensive corrective maintenance plan, and developed a rigorous maintenance testing scheme. However, past efforts in diagnosing MSIV equipment deficiencies were inadequate and resulted in an unnecessary challenge of the operators and plant equipment. The event evaluation and root cause analyses identified short and long term corrective actions.

Plant Support: Health physics implemented the appropriate measures to control personnel radiation exposure and manage other radiation protection areas pursuant to the new 10 CFR 20 requirements. Security personnel maintained the station security log pursuant to 10 CFR 73 requirements. The security staff properly handled fitness-for-duty test failures for potential new hire employee candidates. The emergency preparedness staff conducted an emergency response organization notification system drill. Licensee performance in all plant support areas was good, and well responsive to both routine and emerging issues.

Safety Assessment/Quality Verification: Plant management exhibited a proper safety perspective by applying the lessons learned during the unplanned MSIV outage to the upcoming refueling outage to ensure that the work quality remains high. Improvement in the communication to site personnel of the content and implementation of the PERT and other performance improvement initiatives was evident.

TABLE OF CONTENTS

DETAILS

1.0 PLANT OPERATIONS (71707, 93702)

1.1 Plant Activities

At the beginning of this inspection period, the reactor was operating at 100% power. On January 19, a phase "A" insulator on the Tewksbury (Line 394) 345 Kv transmission line to the station failed. This failure caused the Line 394 switchyard breakers to open and thus, the loss of the Tewksbury offsite power to the station. The plant remained at 100% power while Line 394 insulators were replaced and the Tewksbury line was returned to service on January 24.

On January 25, the reactor automatically tripped from full power while operators were conducting a main steam isolation valve (MSIV) quarterly surveillance test. This test is intended to verify valve operability by performing a slow partial closure of each MSIV through 10% of valve travel from a full-open position. During the test, the "A" MSIV continued to stroke closed past the 10% mark, creating a pressure spike in the steam line which lifted some main steam line code safety valves. The resulting transient caused a shrink in the "A" steam generator, below the low-low level setpoint, generating a reactor trip signal.

Immediately prior to the reactor trip, plant operators stationed in the field attempted to shut a hydraulic isolation valve on the "A" MSIV; a planned contingency action intended to stop the valve closure and fully reopen the MSIV. This measure was unsuccessful and the MSIV continued to full closure.

Approximately thirteen seconds after the reactor trip, the plant received safety injection (SI) and phase "A" containment isolation signals, caused by low steam line pressure signals in the other three main steam headers, whose pressure was decreasing in response to the then fully closed "A" MSIV. With all MSIVs now closed, the operators used the emergency feedwater system and the atmospheric steam dump valves to cooldown, controlling secondary side pressures and temperatures, while implementing the Emergency Operating Procedures in post-trip and SI recovery on the primary side. Subsequently, a normal cooldown path using the startup feedwater pump, the feedwater and main steam bypass valves, and main condenser was established.

The plant remained in mode 3 (hot standby) until January 29 when the licensee commenced a cooldown to mode 5 (cold shutdown) for MSIV troubleshooting activities and other forced outage maintenance work. Mode 5 conditions were reached on January 30. After completing MSIV repairs, operators heated the plant to mode 4 (hot shutdown) and mode 3 on February 14 and took the reactor critical on February 16. The plant returned to 100% power on February 18 and remained at full power for the remainder of the inspection period.

1.2 Routine Plant Operations

The inspector conducted daily control room tours, observed shift turnovers, attended the morning station manager's meeting, and monitored plan-of-the-day meetings. The inspector checked and confirmed that operational activities were being performed in accordance with technical specification requirements. The inspector conducted tours in the primary auxiliary building, the emergency diesel generator rooms, the residual heat removal vaults, the turbine building, the fuel storage building, and the service water pump house. During the tours and attendance at the various meetings, the inspector noted an adequate implementation of operational controls over plant activities and an overall good performance, including cognizance of the current plant configuration, by the operations staff.

1.3 Offsite Power Source Independence

Coincident with the loss of the Tewksbury 345 Kv transmission line on January 19, as described in section 1.1 above, the Scobie (Line 363) 345 Kv line also tripped. This was identified to have been caused by an incorrectly armed protective relaying system on the transmission grid, which rendered the Scobie line vulnerable to overcurrent trips resulting from faults on adjacent line sections (e.g., Tewksbury). Line 363 was unavailable as a preferred offsite power source to Seabrook Station for approximately six minutes, until the transmission grid dispatchers disarmed the faulty protection circuitry and reclosed the breakers. However, since the breakers at the Seabrook end of the Scobie line did not open, the control room operators were unaware of the unavailability of Line 363 power until later on January 19, after power was restored. At that time operations personnel logged a late entry and exit into the action requirement of Technical Specification 3.8.1.1a for plant conditions with less than two physically independent circuits between the offsite electrical transmission network and the onsite distribution system. The inspector noted that during this event, offsite power continued to be supplied to Seabrook from a third 345 Kv line (Newington Line 369).

Since Seabrook Station is designed with three offsite preferred power supply lines, the redundancy required by the Technical Specifications and General Design Criterion (GDC) 17 of 10 CFR 50, Appendix A can be met with one 345 Kv transmission line out of service. However, because the event on January 19 resulted in the simultaneous loss of two transmission lines, the inspector questioned the "physical independence" of the Tewksbury/Scobie lines, given the protective relaying scheme which allowed one line failure to trip the other line. The inspector reviewed the Station Information Report (SIR 94-005) initiated to evaluate the Scobie line trip and attended a meeting on March 1 that discussed the January 19 event and overall Northeast Utilities System transmission planning options in response to power system oscillations observed on the grid on that date. Licensee engineering review of this issue resulted in an assessment of the Updated Final Safety Analysis Report (UFSAR) commitments and a review of compliance with GDC 17 requirements. The licensee evaluated the Northeast Power Coordinating Council (NPCC) basic criteria for the offsite power system design and operation and concluded that this criteria does minimize, to the extent practical, the simultaneous failure of independent circuits. It was noted, however, that the inherent features of the grid protective relaying scheme do create tne potential for a second 345 Kv line isolation, if a relay failure occurs coincident with a line fault.

The inspector examined the licensee assessment, evaluated referenced UFSAR sections and the NPCC protection criteria in accordance with the regulatory requirements delineated in GDC 17, and determined that the overall system design was consistent with the regulations and that licensee actions to address the problems identified with grid stability on January 19 have been appropriate. The inspector concluded that engineering sensitivity to the causes and corrective measures for potential common mode transmission line problems has been heightened. The inspector noted that SIR 94-005 should address any additional operational issues associated with this event. The inspector has no further questions and considers licensee followup to the partial loss of offsite power on January 19 to be comprehensive and appropriately directed toward the operations and safety concerns, as well as compliance with all regulatory requirements.

1.4 Reactor Trip/SI Actuation

On January 25, an automatic reactor trip occurred when main steam isolation valve (MSIV) 86 went fully closed during the conduct of MSIV surveillance testing. Approximately thirteen seconds after the reactor trip, a safety injection (SI) occurred. The inspector responded to the control room to observe operators place the plant in a more stable condition. The inspector determined that the immediate operator response activities were conducted with no adverse safety consequence. The MSIV maintenance troubleshooting and repairs, surveillance testing and previous MSIV maintenance history are evaluated respectively in sections 2.2, 2.3, and 3.1 of this report.

Event Chronology

The inspector developed the following event chronology from a main plant computer digital archive printout and discussions with licensee personnel. The time data is in the format of minutes:seconds:fraction of seconds, and is normalized to a 00:00:000 starting time when MSIV 86 left the full open position. (A) denotes an estimated time value.

Time	Response
00:00:000	MSIV 86 not full open (start of 10% stroke test)
01:00:000(A)	MSIV 86 reaches 10% closed and continues to travel shut. (The NSO stationed locally at MSIV 86 notifies the control room and attempts to shut the hydraulic isolation valve to stop MSIV 86 from closing further. Due to unexpected interference, the NSO is not able to fully shut the hydraulic isolation valve. MSIV 86 continues to close.)
01:20:030	Steam generator "A" low level

01:26:210	Steam generator "A" flow/feed mismatch
01:30:300	Steam generator safety valve open
01:30:830	Reactor Trip (signal - steam generator "A" low-low level)
01:30:900	"A" reactor trip breaker opens (Operators were attempting to manually trip the reactor at about the same time)
01:30:910	EFW pump start
01:31:600	Steam dump valves start to open
01:32:550	Generator breaker open
01:32:700	Turbine Trip
01:33:750	Pressurizer level deviation low alarm
01:40:260	MSIV 86 fully shut (total stroke close time of approx. 1.5 minutes)
01:43:050	SI actuation, containment isolation signal
01:43:070	Both EDGs auto start
01:43:120	Start of the SI "A", RHR "A", SI "B", and RHR "B" pumps
01:43:130	CCP "A" starts, (CCP B already running)
01:43:640	CVCS letdown isolates
01:49:210	Pressurizer level deviation low alarm clears
01:50:500	"B" EDG reaches rated speed and voltage
01:50:890	"A" EDG reaches rated speed and voltage
01:56:720	Steam generator safety valve shuts (open approx. 26.5 seconds)
02:05:240	Pressurizer level deviation high and backup heaters on
11:08:860	Pressurizer high level alarm
16:20:870	Pressurizer Ch 1 level high signal
17:41:430	CCP "A" secured
21:03:210	SI pump "A" secured
21:06:650	SI pump "B" secured
22:00:000(A)	Pressurizer level increases above the indicated range
24:40:730	Pressurizer pressure high alarm
25:18:910	"D" main steam ASDV manually opened to lower pressure
25:48:490	Pressurizer pressure high alarm clears
25:49:330	Letdown re-established
73:02:670	Level in the pressurizer decreases to the instrument indicating range, and continues to trend down to the normal band

Plant Response/Operator Actions

The inspector performed an assessment of overall operator performance with respect to this event. This NRC assessment is based upon inspector witness of the MSIV surveillance test briefing, observation of the actual MSIV 86 testing, response to the control room to observe operator actions, review of the main plant computer digital archive printout, attendance at several station event evaluation meetings, discussions with various operations personnel, and review of the draft event evaluation report.

The inspector reviewed the operator actions taken immediately prior to the automatic reactor trip. An auxiliary operator (AO) stationed locally at MSIV 86 recognized that the MSIV continued to close past the 10% close position. The automated MSIV test feature drives the MSIV from full open to 10% shut, and then back to the full open position. Pursuant to the MSIV surveillance test procedure, the AO attempted to close the manual hydraulic isolation valve to stop the MSIV from closing any further. The AO did not fully close the hydraulic isolation valve due to an unexpected interference. The AO exited the main steam tunnel for personnel safety reasons (i.e., potential lift of the main steam code safety valves).

As a result of MSIV 86 travelling shut, the "A" main steam (MS) header safety valves opened (for approximately 26.5 seconds) and at about the same time, an automatic reactor trip occurred due to low-low level in the "A" steam generator (SG). All twelve steam dump valves opened due to the reactor coolant loop 1 temperature increase. The "B", "C", and "D" SG pressures rapidly decreased as steam exhausted through the steam dump valves to the condenser. Approximately 13 seconds after the reactor trip, an SI actuation occurred due to the decreasing MS header pressures. A containment isolation occurred and letdown isolated. The emergency diesel generators (EDGs), standby centrifugal pump, both residual heat removal, and SI pumps started, as designed. Both high-head centrifugal charging pumps began to inject water into the reactor coolant system causing pressurizer level to increase.

The operators followed the emergency procedures to recover the plant from the reactor trip and SI injection. Pressurizer level increased beyond the indicating range until the pressurizer almost filled solid. Approximately 16 minutes after the SI actuation, the operators terminated the high head injection. The operators re-established letdown flow to lower pressurizer level to the normal band. The operators stabilized the plant in operational mode 3. Plant management formed an event evaluation team to review the cause of the event and recommend corrective actions.

The inspector observed that the operators exercised good command and control when transitioning through the emergency procedures. The inspector verified that the operators followed the proper emergency plan event classification procedures. In accordance with the established criteria, no emergency event was declared. The operators used repeat-back and independent verification communication techniques. The inspector noted that the SI actuation was the first one experienced at Seabrook during power operation. An off-watch shift superintendent provided extra assistance, as needed, to the operating crew. The inspector verified that the EDGs reached rated speed and voltage within ten seconds.

The event evaluation team evaluated the amount of time it took the operators to terminate high-head injection and re-establish letdown flow to recover pressurizer level. The operators expended approximately 15 minutes in establishing cooling to the service air compressors per step three of the SI termination procedure. The event evaluation team felt that this step could be sequenced after terminating injection/restoring letdown, thus allowing the operators to regain control of pressurizer level in a more timely manner.

The inspector concluded that operators safely placed the plant in a stable condition by following the emergency procedures. Major plant equipment responded as designed. No adverse safety consequence resulted from this event. The licensee identified a potential enhancement of the SI termination procedure that would allow the operators to better maintain control of pressurizer level.

Outage Activities

The operators cooled the plant down to cold shutdown to facilitate repairs to the MSIVs. Plant management stressed the nec ntify the true root cause of the MSIV testing anomalies and to perform the work . "do it right the first time" attitude. During the unplanned outage, plant management exhibited a proper safety perspective by directing corrective maintenance on the "B" primary component cooling water heat exchanger and on the high pressure feed water heater extraction steam check valves.

The licensee performed an event evaluation, an or tional root cause analysis, and an MSIV technical root cause analysis. The human iance enhancement system (HPES) coordinator performed a HPES review. The inspector determined that the licensee performed a thorough and self-critical review.

The inspector identified no operational safety concerns or technical problems with respect to the operator and station management response to this event. The activities conducted during the outage were appropriately directed to the plant equipment needed to support safe operation after plant restart.

1.5 Plant Restart

Prior to plant restart (i.e., reactor criticality) on February 16, the licensee conducted a post trip review in accordance with operations procedure, OS 1000.08. The inspector reviewed the various checklists associated with the station manager's post trip evaluative process and examined the attached logger and sequence data available from the main plant computer after the plant trip on January 25. A draft report, prepared by an event evaluation team to analyze the reactor trip, safety injection and plant response, was also reviewed. The inspector noted that station management had verified the completion of all short term recommendations prior to authorizing the plant restart. Other documents, including a memorandum to the senior vice president and chief nuclear officer providing an overview of the evaluations performed in response to the plant trip, were checked for information related to the overall licensee perspective on plant readiness for restart.

In the control room, the inspector examined the "Estimated Critical Position Data & Analysis Form," reviewed the mode change checklists, and discussed with operations personnel the remaining work required to be accomplished before the process of boron dilution, in preparation for control rod withdrawal to criticality, could commence. The inspector assessed the licensee's overall post trip review process, as implemented for the January event and subsequent corrective actions, and verified that the operators on shift were cognizant of the remaining work requirements and the existing plant configuration prior to the approach to criticality. The inspector independently checked the boration flow path lineup and the electrical power supply availability and confirmed with the licensee the conduct of required check valve leakage testing and implementation of steam generator water chemistry controls. No problems or unresolved safety concerns were identified. The operators brought the reactor critical at 1:10 a.m. hours on February 16.

1.6 Cooling Tower Operations

During this inspection period, the licensee occasionally transferred a train of service water from the ocean heat sink to the cooling tower in order to maintain the cooling tower basin temperature above 40°F. The inspector observed control room activities and component status during one of the times a service water cooling tower train was in operation. This evolution is controlled by an operations procedure, OS1016.05, which sets limits and contingencies and directs normal cooling tower operations, while noting the precautions to be taken if abnormal or emergency conditions are encountered.

The inspector noted that with the train "A" cooling tower pump in operation both train "A" service water ocean pump control switches had been placed in a "pull-to-lock" position. Consequently, a control room alarm for an inoperable service water "A" train was illuminated on the video alarm system (VAS point F6963). The inspector confirmed procedural compliance in placing the plant in this configuration, but questioned why no limiting condition for operation (LCO) had been entered with two of the three available "A" train service water pumps rendered incapable of automatically starting in a "pull-to-lock" condition.

Discussion with licensee operations and licensing personnel, along with a review of the pertinent service water logic diagrams and electrical schematics, revealed that the system design prevented any automatic starts of the ocean pumps once the cooling tower was in operation. Hence, the subject pumps in "pull-to-lock" were essentially in a similar configuration to a "normal-after-stop" condition. The inspector verified that this equivalency was consistent with the plant design basis and further reviewed a licensee 10 CFR 50.59 evaluation which concluded that the ocean service water pumps could be declared operable in a "pull-to-lock" condition if manual restoration and other criteria are properly considered. The inspector also reviewed the Seabrook Updated Final Safety Analysis Report, the Technical Specification for the service water system and the plant procedure for an operability determination, OE4.5; and identified no technical concern relative to the licensee's position that the ocean service water pumps could be considered operable with their control switches in "pull-to-lock".

To further justify this position, the licensee has included in the bases of a proposed Technical Specification revision on the service water system/ultimate heat sink operability requirements (reference license amendment request 93-02, dated April 7, 1993), a discussion of ocean service water pump "pull-to-lock" configuration during cooling tower operation. LAR 93-02, which is currently under review by the NRC, is intended by the licensee to clarify some inconsistency in the application of standard Technical Specification criteria to unique plant designs, like the 600% pump capacity available in the service water system at Seabrook Station.

Although the inspector had no unresolved safety concerns regarding the observed cooling tower operation and resulting plant operability configuration, a question did arise regarding the VAS point F6963 response. Essentially to operate in accordance with OS1016.05 procedural provisions, the operators are required to ignore the "service water train A inop" alarm and the recommended actions of the VAS F6963 alarm response guidance. While not a safety issue from a system standpoint, such a situation does not provide an optimal approach to ensuring that no conflicting guidance is presented to the operations staff. Licensee operators support personnel agreed to review this issue further and clarify and/or revise the conflict in current operation guidance, with the understanding that approval of LAR 93-02 might necessitate additional review of this area in the future.

2.0 MAINTENANCE (61726, 62703, 92701, 92720)

2.1 Routine Maintenance and Field Observations

During this inspection period, the inspector witnessed maintenance activities in progress, completed field work and various component lineup and system configurations intended to support specific preventive and corrective maintenance functions. At times, the inspection was preplanned to observe certain key maintenance activities, while in other cases, random field work was observed during plant inspection-tours. In all cases, cognizant licensee personnel were interviewed to determine the adequacy of licensee work controls and of the criteria delineated to establish successful work completion. The following represent some of the maintenance/work control areas examined, with specific inspection points and issues documented:

- Plugging of tubes in the train "B" primary component cooling water (PCCW) heat exchanger (work request 93W004369)

  The inspector checked the adequacy of controls for the establishment of a foreign material exclusion (FME) area. The inspector witnessed bolt torquing in accordance with procedural requirements and observed the final condition of two PCCW heat exchanger tube plugs. Evidence of quality control inspection and hold point usage was verified, as was the establishment of appropriate post maintenance work test criteria. The inspector confirmed through interviews that all testing was accomplished in accordance with prescribed work performance sequence, but noted that the post maintenance test sheet had not been signed to document the conduct of an acceptable leak test prior to the reassembly of the heat exchanger lower head. This omission made it more difficult to determine, from the work request package, whether the mechanics were proceeding along procedurally authorized steps. Subsequently, the inspector verified that the testing/work steps had been correctly performed.

- Corrective maintenance on valve MS-V-30

  The inspector observed mechanical maintenance technicians replace packing in valve MS-V-30. MS-V-30 is a one inch manual globe valve in a branch connection to the "B" main steam header. The mechanics removed the existing packing and then stopped the job to obtain a work request scope change to replace both valve bonnet packing studs, which were seized.

  The inspector reviewed the work package and observed that the work was being performed by knowledgeable, experienced mechanics. However, the procedural step for obtaining supervisor permission to start work using the valve backseat as isolation was not signed. The mechanics contacted the supervisor who came to the work site and made the appropriate sign-off. The supervisor indicated that this sign-off should have been accomplished before the start of work. The mechanics added the new packing, completing the work in a competent manner.

- Electrical breaker controls on the train "B" 4.16 Kv switchgear (Tagging Order 94-0158)

  The inspector checked the correct position (i.e. open) and tagging of five train "B" safety-related pump breakers on February 1. As a result of the plant configuration at that time, the train "A" safety-related components were established as the operable ("protected") equipment. On February 15, with the train "B" components returned to operable status, the inspector rechecked the 4.16 Kv switchgear (1-EDE-SWG-EG) lineup to verify correct equipment and tagging status. While all components were correctly positioned, the inspector noted that a caution tag had not been cleared from the electrical breaker for chemical and volume control system (CS) pump 2B. This tag still indicated cautionary information applicable to lower modes of operation, despite the fact that the pump was running with the plant now in mode 3. A review of tagging order 94-0158 indicated that all tags, including the subject caution tag for CS-P-2B, had been removed. With this discovery that the Tagging Order status, as documented, was incorrect, the licensee issued an operational information report (OIR 94-033) to address this error.

- Main steam isolation valve troubleshooting and corrective maintenance

  Following the reactor trip, the inspector observed the troubleshooting and corrective maintenance activities performed on the main steam isolation valve (MSIV) hydraulic actuators. A detailed description of the troubleshooting plan and results are provided below in Section 2.2. The instrument and controls (I&C) technicians and technical support engineers performed well. The inspector observed extensive quality control coverage of the various maintenance aspects. The work packages contained sufficient instructions to perform the work and were properly followed. Overall, the plant staff demonstrated good teamwork, fostered a conscientious approach to perform the work correctly, and successfully repaired the MSIVs as evidenced by the satisfactory completion of the post maintenance and operability tests.

The inspector identified one minor concern regarding improper control of a tagging order. Before starting the MSIV maintenance stroke tests, the licensee formed a multidisciplinary group to review and close-out the paperwork. The inspector noted that the review group carefully ascertained the status of each item before close-out. The inspector reviewed the eleven work packages associated with MS-V-86. The inspector identified that several WRs referenced tagging order 94-0128; however, the tagging order and tagging computer were not updated to reflect the added reasons for the existing tagging controls. The inspector expressed concern to the work control supervisor that the tagging order could have been released with work outstanding. The inspector determined that operators might alternatively have used the MA4.2G work activity tracking form to track the various WRs associated with the tagging order. The work control supervisor indicated that the operators would be reminded to update the tagging order when affected by different WRs or to consider the use of a MA4.2G form as an administrative control.

The above inspection issues and findings of maintenance work control discrepancies individually and collectively do not represent a safety concern because in all cases, the actual work was performed correctly and components properly returned to operable status. However, evidence that the controlling documents (e.g., work request forms and logs, tagging orders) were either incomplete or incorrect was identified. These problems, while not safety significant, represent examples of an inattention to the details of the controlling documents in the area of field work performance. While the inspector is aware that the licensee has programs (e.g., PERT, TIDE, procedure upgrade) either in place or under development to reduce errors to a minimum, the above findings indicate that such efforts must be constantly reinforced in a manner that reaches down to and positively affects field work. In this regard, the enhancement of overall performance expected from such programmatic improvement efforts can only be realized with continued indoctrination and training and acceptance down to the first-line supervisor and field worker level.

2.2 Main Steam Isolation Valve Troubleshooting and Results

The inspector witnessed I&C technicians and technical support engineers troubleshoot and repair MS-V-86. The MSIVs are designed so that pressure from a stored nitrogen reservoir provides motive force to the top of the hydraulic actuator piston in the closed direction, while hydraulic fluid pressure acts on the bottom side of the piston in the open direction. The MSIV has two independent hydraulic trains with a common fluid reservoir and air driven hydraulic pump. To close the valve, the hydraulic fluid is drained back to the reservoir.

The MSIV hydraulic actuator vendor (Edward Valves) provided technical assistance to the licensee during troubleshooting activities. I&C technicians removed the fast and slow closure solenoid valves. The maintenance technicians drained the hydraulic reservoir fluid and removed the pan. The hydraulic fluid was filtered through a flush cloth with the result that some debris was collected. The repair team also identified some debris and a sticky residue inside the pilot valves. Samples of the fluid and debris were sent out for chemical analysis. The hydraulic pump discharge filter was found collapsed allowing contaminants to circulate through the hydraulic trains. The inspector visually examined the filter and some of the debris. The inspector reviewed the MSIV vendor manual and held discussions with the Edward Valves representative.

Based upon the licensee repair team recommendation to inspect the other three MSIV actuators for similar problems, all four MSIV actuators (excluding the main actuator piston) were disassembled, inspected, and repaired as required. The inspector observed that the maintenance workers adhered to the work package instructions. Several new work requests (WRs) and scope changes to existing WRs were properly initiated to address emergent issues. The inspector observed good teamwork between maintenance, technical support, engineering, and quality control personnel. The major repair scheme for the MSIVs follows:

- Remove the hydraulic actuator including both subsystem manifolds, hydraulic pump, and reservoir pan. The manifolds include the slow and fast speed solenoid valves, thermal accumulator, and main dump valve.

- Send the manifolds and pumps to the vendor's facility for cleaning, inspection, and repair as required. The vendor inspected the various parts for foreign material, worn parts, and machining tolerances.

- Flush the main actuating cylinders (an integral part of the valve bonnet) with a flush rig.

- Reassemble the MSIV actuators.

- Implement an extensive MSIV maintenance test program that includes several MSIV partial and full valve strokes. The licensee then verified the cleanliness of the new hydraulic fluid, and changed the fluid as needed.

The licensee repair team identified numerous equipment deficiencies associated with the MSIVs. Some of the deficiencies, in order of their potential significance, associated with MSIV 86 follow. The train "B" main dump valve disc had a burr and scoring on the outside surface and was not within machining tolerance specifications. The hydraulic fluid was contaminated with wear products, foreign material introduced during the first refuel outage (OR01) rebuild, and silicone based thread sealant. The chemical analyses indicated that the hydraulic fluid did not breakdown, but rather became sticky. The train "B" main dump solenoid pilot valve had debris in the valve seat area and air side of the valve shifting mechanism, causing fluid leakage past the seat. The hydraulic pump exhibited degraded performance due to a throttled air regulator supply and an air motor supply filter in need of cleaning. The repair team identified that the thermal accumulator had seized. The MSIV root cause analysis concluded that the most significant contributing causes for the MSIV overtravel to full closure were the sticking/binding of the main dump valve and the solenoid pilot valve seat leakage. The degraded hydraulic pump performance, seized thermal accumulator, and other deficiencies exacerbated the main dump and solenoid valve problems.

The licensee determined that MSIV 86 would still have performed its intended safety function and remained operable despite the identified deficiencies. The identified deficiencies caused the valve to continue to travel in the shut direction during the surveillance test, but were analyzed to have not prevented the valve from fast closing if called upon to do so per design during normal operation. The inspector concluded that the licensee's analysis of failure mode effects was reasonable and thus, that there was no adverse safety consequence as a direct result of the event.

The inspector concluded that the plant staff performed comprehensive and thorough MSIV maintenance troubleshooting, corrective maintenance, and testing activities.

2.3 Surveillances Activities

The inspector observed portions of the following safety-related surveillances to assess the adequacy of the procedural acceptance criteria, calibration of test instruments, qualification of personnel, interdepartmental communications, and the evidence of administrative approvals.

- Main Steam Isolation Valve Quarterly Test
- Main Feedwater System Valve Quarterly Operability Test
- 125 VDC Electrical Distribution Performance Monitoring
- Emergency Diesel Generator Monthly Surveillance
- Turbine Driven Emergency Feedwater Pump Quarterly Surveillance Test

On January 25, the inspector reviewed and observed the performance of procedure OX1430.02, "Main Steam Isolation Valve Quarterly Test." The objective of the surveillance was to perform a train "A" and train "B" test of the slow speed partial closure for each MSIV to verify valve operability through 10% of its travel from the full open position. The inspector held discussions with technical support and operations personnel, and observed a pretest briefing, conducted by the unit shift supervisor. The briefing included discussions of the precautions, prerequisites, initial conditions, potential plant response, and a contingency plan that was added to the procedure as a result of previous MSIV problems. The system engineer requested that MSIV 86 be tested last due to its previous history of problems. The unit shift supervisor decided that the surveillance procedure should be implemented as written, resulting in three of the eight MSIV trains being tested successfully prior to the MSIV 86 "B" train test. During the MSIV 86 test, the valve continued to stroke closed past the 10% mark. As part of the contingency plan, the procedure directed the locally stationed auxiliary operator to close a manual hydraulic isolation valve on the hydraulic oil vent line for MSIV 86, to prevent the MSIV from closing. The auxiliary operator was unable to close the hydraulic isolation valve due to binding between a locking plate and the valve manifold. Therefore, MSIV 86 continued to close beyond the 10% mark and into its full close position, as is discussed in greater detail elsewhere in this report.

The inspector witnessed the above activities in the field at the location of MSIV 86 and noted the following overall comments regarding test conduct. Control room operators conducted the surveillance by maintaining direct communication with the system engineer, an I&C technician, and an auxiliary operator. The inspector observed that communications were excellent between operations and the locally stationed personnel. Repeat-backs and self-checking were evident. The inspector determined that the surveillance was performed by qualified personnel and that the test instruments were calibrated.

The inspector reviewed the surveillance history and supporting test data for MSIV fast and slow closure tests that were conducted from February 8, 1990, through February 14, 1994. The surveillance procedures included OX1430.01, "Main Steam Line Isolation Valve Quarterly Stroke Test," and OX1430.02, "Main Steam Isolation Valve Quarterly Test." The inspector noted that some of the work packages contained inadequate documentation of test data. However, the final test results were not affected and the identified work package incompleteness does not represent a regulatory concern. The inspector concluded that all previous tests that were reviewed were conducted in compliance with Technical Specification 4.7.1.5, as required.

On January 17, the inspector performed a plant walkdown and identified a pressure indicator, PI-3053, which exhibited spurious indication between 1100 and 1300 psig. The inspector informed the operations work control group of the concern. The licensee determined that the observed instrument condition was a deficiency and entered it into the corrective action system. PI-3053 is used in three surveillance procedures including OX1436.07, EX1803.001, and OS1030.01. In OX1436.07, "Main Feedwater System Valve Quarterly Operability Test," the operator is required to read and record PI-3053 to ensure the pressure is adequate to determine if the feed header can be depressurized below steam generator pressure. The inspector considered it a weakness that the gage deficiency had not been previously identified by the licensee and entered into the work control system for corrective action.

The inspector verified the adequacy of portions of procedure ES1854.060, "125VDC Electrical Distribution Performance Monitoring." The inspector examined the electrolyte levels in each battery and pilot cell for the four banks of 125 VDC batteries. The majority of the cells indicated electrolyte levels between the minimum and maximum level marks. For those cells that contained levels above the maximum level mark, the inspector verified that levels were within the required technical specification limit. The inspector concluded that the electrolyte levels in the four banks of 125 VDC batteries met Technical Specification 4.8.2.1 requirements.

The inspector observed portions of OX1426.05, "Diesel Generator 1B Operability Surveillance," and OX1436.02, "Turbine Driven Emergency Feedwater Pump Quarterly Surveillance Test." The inspector reviewed the completed test data sheets and noted that all test acceptance criteria were satisfied. Quality Control hold points were recognized and implemented. The inspector noted that the test instruments were calibrated, and the communications between the technicians and operations were very good. The inspector concluded that the procedures were completed with no discrepancies noted.

Overall, the inspector concluded that in the area of the inspected surveillance activities, the operators were knowledgeable and appropriately followed procedures. No unresolved safety concerns were identified. However, the inspector did note that the contingency plan to close the manual hydraulic isolation valve during the MSIV 86 surveillance test was not effective in preventing full MSIV closure. This weakness is addressed in a larger context in section 3.1 of this inspection report.

2.4 NRC Region I Temporary Instruction 94-01: Maintenance Troubleshooting

The inspector performed a review of maintenance troubleshooting activities using Temporary Instruction (TI) 94-01 as a guide. The TI describes two events that occurred at other NRC Region I plants due to inadequate control of troubleshooting. The inspector held a meeting with technical support manager and reviewed procedures MA 3.1, "Work Request," and MA 4.5, "Configuration Control During Maintenance and Troubleshooting." The inspector observed several troubleshooting activities in progress.

All licensee personnel, to include maintenance, operations and technical support personnel, in general, use the same administrative controls for troubleshooting activities. The licensee used Regulatory Guide 1.33 and other industry standards as references when developing its troubleshooting program. The technical support manager indicated that a formal procedure is used or developed when troubleshooting involves maintenance activities that are beyond the "skills of the trade". A licensee maintenance procedure, MA 4.5, establishes the controls to maintain positive configuration control during troubleshooting, preventative maintenance, and corrective maintenance activities. MA 4.5 controls are used in conjunction with a work request (WR), in accordance with another licensee procedure, MA 3.1, or with a repetitive task sheet.

The inspector reviewed the controls for troubleshooting activities that are within the "skills of the trade". If the equipment is not in service, the operators follow technical specification requirements for system availability and maintenance workers use a work request per MA 3.1. The system engineer prepares and documents the description of work guidance in section III of the WR form per MA 3.1. The guidance often references sections of preventive and corrective maintenance procedures. Equipment configuration control is maintained by the use of a configuration modification sheet, form MA 4.5A, that documents a description of the modification and traceability of the workers who made and restored any system or component from its altered condition. The inspector noted that independent verification is required. The WR gets reviewed by a senior reactor operator, quality control, and the lead maintenance supervisor. Any changes to the initial work scope requires a WR scope change per section 4.1.2 of MA 3.1. The inspector determined that generally no maintenance troubleshooting is performed on equipment not in service without at least written WR guidance.

The troubleshooting controls for in-service equipment are documented on the troubleshooting control form, MA4.5B. The form documents the evaluation of the troubleshooting boundaries, authorization to begin troubleshooting, and step-by-step documentation format of actions planned or taken. A senior reactor operator, work group supervisor, and maintenance technician review the scope and boundary of the troubleshooting. Any configuration control changes are documented on the MA 4.5A form. The senior reactor operator determines the operational impact of lifting leads or placing jumpers, and notes precautions or limitations affecting troubleshooting. Once the root cause of an equipment problem is identified during a troubleshooting activity, a new WR is generated or a WR scope change is made to an existing WR to perform the corrective maintenance. The inspector determined that a troubleshooting log is used during maintenance troubleshooting of in-service equipment.

The inspector reviewed several past troubleshooting activities to determine the adequacy of the various controls. With only a few exceptions, the troubleshooting controls were adequate. However, some inadequate troubleshooting of main steam isolation valve equipment problems are documented in section 3.1 of this report. Additionally, NRC Inspection Report 93-13 section 2.1 discusses an inadvertent steam generator blowdown isolation that occurred during the restoration from maintenance troubleshooting of SB-V-9.

The inspector concluded that adequate maintenance troubleshooting controls exist. The type of troubleshooting controls used depends on whether or not the equipment is in-service or out of service. Also, as evidenced by the above examples, the proper implementation of these controls needs to applied appropriately on a case-by-case basis in order for the licensee's maintenance troubleshooting program to be fully effective.

2.5 Maintenance Training (URI 50-443/94-03-01)

The inspector assessed the adequacy of the qualification and training program for maintenance department personnel. During the process, the inspector evaluated the training and qualifications required to perform specific maintenance activities. The inspector reviewed and evaluated numerous repetitive task sheets, work packages, operational information reports (OIRs), LERs, training matrices, qualification guides, position guides, and job performance measures required for various maintenance activities. The inspector observed several maintenance activities and spoke with cognizant maintenance workers and supervisors. The inspector held discussions with maintenance department personnel, which included the department manager, department supervisors, first-line supervisors, training coordinators, mechanics, electricians, and I&C technicians. The inspector also held discussions with training personnel, which included the technical training manager, training supervisors, training instructors, and the Director of Training.

The inspector identified two concerns with the maintenance training and qualification program. One concern involved the licensee not fully meeting the intent of the qualification program with respect to the advancement of personnel to certain position levels. The inspector evaluated the criteria used for advancement of mechanical, electrical, and I&C technicians. The advancement criteria established in the qualification program is based on length of time in the department and the level of qualification that is held. In turn, the level of qualification is dependent on the completion of position guides, which define the specific qualifications required for a position.

The inspector noted that the position guides for the maintenance department were not utilized for advancement. In some cases, the advancement criteria had not been properly utilized in the maintenance department because of certain administrative constraints. The inspector noted that some previous utility workers entered the maintenance department as senior mechanics without holding the qualifications established in the advancement criteria. A statement in the Qualification Manual does allow the department supervisor to approve advancement when an individual fails to satisfy the qualification requirements, and the failure is due to circumstances beyond the individual's control. Then, the individual may be advanced at the discretion of the Department Supervisor. After the inspector held several discussions with the maintenance and training departments, the inspector determined that the qualification program was apparently being used as merely a guide or a goal to work toward, as opposed to a programmatic requirement. The inspector concluded that with the stated waiver in place, the qualification program has less procedural structure than may be intended by the Qualification Manual, a SORC approved document.

The second concern involves the identification of a maintenance activity that may have been performed by unqualified mechanics for some period of time. The activity involved maintenance on a battery for a portable cooling tower pump. This activity is performed during technical specification procedure OX1416.09, "Cooling Tower Portable Pump Monthly Operability Surveillance." According to the qualification program, the inspector determined that a battery qualification should be a prerequisite for those personnel performing maintenance on the portable cooling tower pump battery. The inspector noted, however, that battery qualifications are held by electricians, and not the mechanics who have been performing this maintenance. In response to the inspector's concern, the licensee has assigned qualified electricians to perform maintenance on the portable cooling tower pump battery.

Additionally, the inspector reviewed the history of OIRs and station information reports (SIRs) related to unqualified workers, who have performed tasks that required qualification.

The inspector examined several OIRs in which the licensee has identified issues involving unqualified workers. The inspector noted that the majority of these OIRs are not specifically related to the NRC questions regarding the scope of the mechanical, electrical, and I&C training and qualification programs. However, the licensee is addressing the corrective actions for the identified problems on a case-by-case basis.

During the review of the qualification program, the inspector identified that the current revision to the Qualification Manual was last reviewed on October 13, 1989, resubmitted on October 23, 1990, and approved on November 9, 1990. A subsequent periodic review was scheduled for October 13, 1991, but not performed. Thus, the inspector determined that the qualification program has not been recently reviewed and that a 1993 Quality Assurance Audit identified that the Qualification Manual had not been reviewed and revised within the required time limit. The licensee has a revised qualification program in draft form, which is currently being reviewed for final implementation and approval.

The inspector also determined that the licensee does not appear to have a method to quantitatively measure the performance of maintenance training over the past few years. No performance indicators exist to determine the amount of workers qualified in each area or the amount of training offered and training taken by the maintenance personnel. This issue, while not questioned as a regulatory mandate, does have bearing on the effectiveness and control of the maintenance training program.

The inspector found that training coordinators were assigned additional tasks that were not within their job description. The inspector believes that this additional workload could detract from time spent on training coordinator activities. The licensee has temporarily assigned a scheduler to assist the training coordinators with scheduling training courses in conjunction with the other activities of the maintenance workers. In addition, the licensee shifted the electrical training supervisor responsibilities from the mechanical training supervisor to the I&C training supervisor. This realignment was initiated to have a more equally distributed workload in the training department.

Based upon discussions held with the maintenance and training personnel and the items and areas of concern identified above, the inspector determined that there was evidence that problems may exist in maintenance training. The inspector noted a conflict between the amount of training offered and the actual scheduling of the workers for training which would not interfere with the conduct of required plant work. The maintenance manager informed the inspector that improvements need to be made to accommodate both the training and plant needs. Pending further review of the maintenance training qualification process, these concerns will be classified as an unresolved item. **(URI 50-443/94-03-01)**

3.0 ENGINEERING (37828, 71707, 92700)

3.1 MSIV Maintenance History (VIO 50-443/94-03-02)

The inspector performed a review of the MSIV maintenance history since the MSIV rebuild performed in the first refueling outage. The inspector held several discussions with various licensee personnel, reviewed the event team evaluation, root cause analyses, surveillance test results, and work packages.

<u>MSIV Maintenance History</u>

3/15/90 The main steam isolation valve (MSIV) actuator hydraulic fluid vendor (AKZO Chemicals Inc.) sent a letter to North Atlantic recommending the establishment of a fluid maintenance program for the hydraulic fluid. Akzo recommended that the maintenance program should include quarterly sampling to analyze key fluid properties. AKZO indicated that the fluid can start to degrade under temperatures greater than 110°F in the presence of moisture. North Atlantic materials requisition and engineering departments reviewed the letter. The MSIV actuator vendor manual recommended changing the hydraulic fluid every three years. The licensee did not act upon the AKZO recommendation.

5/25/90 An industry auditing group issued a significant event notice (SEN) 72 that described an event at South Texas Project 1 where Fyrquel hydraulic fluid decomposed due to high temperatures (180°F to 280°F). The fluid decomposition products clogged solenoid dump valves preventing them from operating properly. South Texas Project 1 commenced a monthly chemical sampling of the hydraulic fluid.

8/15/90 AKZO sent a letter to North Atlantic that evaluated SEN 72. AKZO again recommended to implement quarterly fluid sampling. The licensee did not implement this recommendation.

1991 During the first refueling outage, North Atlantic replaced the Unit 1 MSIV actuators with Unit 2 actuators that had been rebuilt and refurbished by the vendor (Edward Valves, formerly Rockwell). The licensee replaced the actuators because the equipment qualified life of the actuators ran out in early 1992. During the rebuild, several betterments were added such as changing the actuator pistons and using different solenoid valves. The rebuild also satisfied the five year vendor recommendation to replace the major parts. Edward Valves rebuilt the actuators at their facility.

12/10/92 During a post maintenance test, MSIV 86 train "B" travelled past the 10% shut position to 25% shut. During a partial stroke test, the MSIVs are designed to automatically move from the full open position to the 10% closed position, and then return to the full open position. The system engineer diagnosed the test anomaly as a 10% limit switch adjustment problem. Maintenance adjusted the 10% limit switch. The operators had difficulty opening MSIVs after adjustments. (Note: Since the limit switch probably could not have accounted for more than 5% error, the test anomaly was likely caused by main dump valve sticking/binding).

3/5/93 While troubleshooting the air regulator, MSIV 86-trains "A" and "B" travelled well past the 10% shut position. The B train closed the MSIV further. The hydraulic pump performed poorly when re-opening the A train. During the "B" train test, the hydraulic pump continued to run after the MSIV reached full open. The system engineer diagnosed the test anomalies as a solenoid timing problem; i.e., the slow flow valve resets before the fast close valve, causing the MSIV to travel past 10% closed in the fast close mode for a short duration. WR 93000705 was left open for further evaluation.

Technical support and engineering personnel briefed plant management on the solenoid timing anomaly. Technical support personnel felt the additional movement past 10% closed correlated to approximately 15% travel further than the 10% closed position (MSIV 25% shut), thus a plant trip or major plant transient should not occur. A procedural change was made to offset the timing problem.

5/20/93 During the conduct of quarterly testing of the "B" train, MSIV 92 went full shut in the slow close mode causing a plant trip. The MSIV took approximately six minutes to travel full shut. The licensee experienced difficulty when reopening MSIV 92 for troubleshooting. Symptoms of internal hydraulic leakage were noted, the air motor continued to run when valve was full open. (The leak was small enough that the hydraulic pump should have been able to keep the MSIV open.) Maintenance used WR 93000705 for troubleshooting. Maintenance replaced the slow and fast solenoids.

North Atlantic flushed the fast and slow speed solenoid valves and detected foreign material lodged in the slow flow solenoid valve seat. The debris likely caused the MSIV closure.

6/18/93 North Atlantic issued LER 93-09 that reported the reactor trip. The licensee committed to issue a supplement when the mechanism for introducing the debris was identified.

7/27/93 Four day unplanned outage following a plant trip due to an SSPS testing anomaly. No MSIV troubleshooting performed.

7/29/93 Edward Valves concluded that debris caused the MSIV to shut during the 5/20/93 trip.

8/9/93 In SIR 93-43, North Atlantic deferred further MSIV troubleshooting until OR03 when all four MSIV actuator reservoirs would be drained, the fluid changed and inspected, and the strainers/diffusers checked. The SIR noted that debris may have been introduced during the 1991 rebuild process.

9/22/93 Seven day unplanned outage following plant trip due to generator exciter brush/ring problems. No MSIV troubleshooting performed.

10/6/93 Issued supplement 1 to LER 93-09 committing to do further MSIV inspection during OR03.

10/28/93 During quarterly testing, additional MSIV testing anomalies occurred:

MSIV 86 train "A" and MSIV-92 train "A" went 25% closed. The licensee attributed the over travel to solenoid timing problems.

MSIV 86 train "B" travelled shut in the fast mode to approximately 70% closed, then continued to slowly close until the system engineer increased the air supply to the air motor of the hydraulic pump. The MSIV stopped travelling shut and took 23 minutes to go full open. (Normal open time is approximately 5 minutes). When the MSIV reached approximately 90% open, the pumping rate increased significantly.

Technical support identified the primary cause as the fast close solenoid valve failing to reset in the normal time. The secondary cause was identified as the control logic circuit time delay. Engineers also suspected a degraded pumping system and generated work request 93W003625 to repair the hydraulic pump or air motor. The repair was deferred until the next refueling outage.

11/1/93 Management reviewed 6 strategies to cope with the MSIV problems. At this meeting, the licensee knew debris in the hydraulic fluid caused the 5/20/93 MSIV 92 reactor trip and MSIV 86 had a "potential problem" with the fast closure solenoid leaking as evidenced by the valve going past 10% shut. The licensee decided to replace the fast closure solenoid valve in the long term. In the short term, the licensee decided to modify the test procedure to cope with the leaking fast closure solenoid until the next refueling outage.

11/13/93 The licensee revised the test procedure to use jumpers to keep the slow flow inserted, so that if the valve went past 10% shut there would be more time to respond. Also, a contingency plan of shutting the hydraulic isolation valve to stop the MSIV from travelling any further shut was written into the procedure.

1/25/94 MSIV 86 train "B" went full shut in 100 seconds with no indication of fast closure causing a plant trip. The contingency plan of shutting the hydraulic isolation valve failed due to unexpected interference when shutting the isolation valve. As a corrective maintenance measure, the licensee rebuilt all four MSIV actuators with vendor assistance. Investigation found significant wear, internal contamination, component damage, and problems introduced during the 1991 rebuild. North Atlantic determined that the MSIV 86 closure most probably resulted from solenoid seat leakage coupled with sticking/binding of the main dump valve. The degraded actuator hydraulic pump exacerbated the other problems.

2/16/94 The licensee completed unplanned MSIV outage and brought the reactor critical.

2/24/94 North Atlantic issued LER 94-01 reporting the 1/25/94 reactor trip and safety injection due to the inadvertent MSIV closure.

Licensee Root Cause Analysis

The MSIV root cause analysis performed by the licensee identified three primary root causes: an inadequate MSIV preventive maintenance program, inadequate failure analysis of previous MSIV events, and inadequate workmanship and quality assurance practices during the MSIV rebuilding process at the vendor's facility. The organizational root cause analysis identified ineffective failure analysis as the primary root cause. Two contributing factors included an incomplete management decision making process regarding MSIV problems and the need to redefine the roles and responsibilities of technical support functions.

NRC Assessment

The inspector determined that the licensee's previous efforts to diagnose and fix the MSIV equipment deficiencies were inadequate. The following assessment provides evidence of a lack of timely and effective corrective action in response to MSIV concerns.

The MSIV events from December, 1992 to October, 1993 were not adequately evaluated to identify the root cause. For example, the MSIV 86 degraded hydraulic pump and the "B" train fast closure solenoid leakage went uncorrected. After the May 25, 1993 MSIV 92 reactor trip, the mechanism of the debris introduction was not determined. Additionally, on January 25, 1994, the surveillance procedure contingency plan to close the manual hydraulic isolation valve was unsuccessful due to the lack of a component walkdown and/or equipment test to verify that the valve could be fully shut without interference.

This assessment reveals a history of inadequate corrective actions, which represent a violation of 10 CFR 50 Appendix B Criterion XVI, requiring that conditions adverse to quality be promptly identified and corrected. **(VIO 50-443/94-03-02)** Although no adverse safety consequence resulted, the inspector concluded that the event had some safety significance because the reactor trip/SI injection unnecessarily challenged the operators and plant equipment. The final compilation of corrective actions from the various licensee reviews had not been issued by the end of this inspection period.

The inspector also concluded that the past inadequate MSIV root cause determinations reflected a poor safety perspective with respect to this issue. The previous MSIV corrective actions [illegible]ed only the symptoms of the root cause.

3.2 MSIV Design and Modifications

The inspector reviewed the original design specification (248-65) and the mechanical equipment qualification file (248-65-1M) for the main steam isolation valves. The Edward Valves Company control logic diagram for the Model A-260 MSIV actuator, along with the licensee control loop and logic diagrams (e.g., 1-NHY-503667, 503668, 506565), were examined to check the MSIV quarterly test panel (CP-242 on the main control board) functions relative to the actuator solenoid, shuttle valve, pump and piston hydraulic and air controls. The inspector identified some minor component labeling and designator errors on certain drawings and a valve positioning error in the specification. These errors were minor, however, and of no consequence to the MSIV closure event. The licensee is addressing these errors in future document revisions.

The inspector noted an actuator design feature which allows for manual override to close the MSIV should all automatic signals fail. This override is mounted locally on the MSIV main dump solenoid. The inspector questioned this design feature to verify that any mispositioning of this override mechanism did not contribute to the unanticipated full closure of MSIV 86 during its quarterly testing. The inspector confirmed through interviews that engineers had checked the manual override position during the licensee's post event component evaluation. However, in reviewing a MSIV maintenance procedure (IS 0652.955), the inspector noted an inconsistency in the verification of manual override positioning for certain procedural steps. The licensee concurred that the manual override mechanism on the dump solenoid valve should be verified to be correctly positioned after all manipulations. Change no. 13 to revision 4 of the affected maintenance procedure was issued to correct the identified inconsistency. The inspector had no further questions in this area.

The inspector also reviewed two minor modifications (MMOD 93-547 and 94-0507) along with associated revisions and change authorizations, and a document revision report (DRR 94-0014), all of which reflect MSIV design changes intended to ameliorate the problems identified with the MSIV hydraulic actuation design. With respect to MMOD 93-547, which provides for slow closure of the MSIV during the period of time it is subjected to quarterly testing, the inspector evaluated operability considerations and conformance to the guidance of USNRC Regulatory Guide (RG) 1.22. The inspector verified that the licensee properly assessed the recognized inoperability of each MSIV during testing conduct and documented the acceptability in a 10 CFR 50.59 safety evaluation. However, with respect to RG 1.22, the inspector noted that certain sections of the updated FSAR, which appeared to be affected by MMOD 93-547 changes, were not being revised. The licensee issued an UFSAR change request, UFCR 94-014, on February 18, which not only addresses the inspector's concerns in this area, but also provides a comprehensive safety evaluation of the adequacy of the administrative controls implemented during MSIV testing.

Additionally, while reviewing the UFSAR and the applicability of RG 1.22 to MSIV testing controls, licensee engineers identified some inconsistencies with the testing of certain components in the chemical and volume control system (CS), as compared to the regulatory guidance and UFSAR commitments. The licensee issued UFCR 90-078 (Revision 1) to amend the safety evaluation and the bases for the acceptability of slave relay testing of the affected CS components. The inspector considers the identification and action relative to correcting the UFSAR relative to CS valve testing to represent a good initiative by the licensee organization in response to the problems related to MSIV testing. The identification of this concern was documented in a Station Information Report (SIR 94-014) which was to be reviewed for corrective measure implementation by the Station Operation Review Committee.

Based upon engineering discussion in MMOD 93-547 regarding the technical basis for changing the acceptance criteria for quarterly MSIV testing from "10% closure" to "evidence of valve movement", the licensee is considering removing the 10% closed limit switches. The control logic for the valve strokes would then require the use of additional electrical contacts for the full-open limit switches. The inspector discussed this option with licensee engineering personnel, raising questions relative to generic concerns identified in NRC Information Notice 94-08 and specific plant problems with the subject limit switches documented in a request for engineering services, RES 94-103. The inspector verified that visual confirmation of valve movement in the closing direction would be required for acceptance of the quarterly MSIV closure test. Given the MSIV design and the positioning of the full-open limit switch relative to striker arm travel as the valve closes, the inspector determined that elimination of the 10% closed limit switches would not violate any testing criteria, as long as the discussed visual and verification controls were implemented. The inspector had no additional questions on the reviewed MMODs or any associated revisions to the MSIV quarterly testing provisions.

Finally, the inspector discussed with technical support personnel the conduct of the acceptance testing for the MSIVs after maintenance rework and design change implementation were completed. The licensee conducted additional fast closure testing on the MSIVs to demonstrate redundant train capability with the slow-close solenoid/shuttle valve inserted for testing of the other train. The inspector witnessed various portions of acceptance testing and discussed any observed MSIV test anomalies with the cognizant technical and engineering personnel. In all cases, the MSIVs performed as expected and, after adjustments, in accordance with the designated operability criteria. The inspector determined that certain cases of train interdependence, exhibited during test, were test anomalies only, and did not represent design problems affecting the operability of the MSIVs.

Overall, the licensee performed a review of the MSIV design and functional performance, as discussed in the FSAR as part of the mitigation features for the Seabrook accident analyses. The inspector confirmed that licensee understanding of the MSIV safety functions is consistent with commitments and analyses documented in UFSAR. The inspector believes that the licensee engineering review of the identified MSIV problems has been comprehensive and thorough and that both the acceptance testing and the documented design descriptions have been responsive to NRC inquiries of the MSIV functional capabilities. The inspector has no additional questions in this area and identified no unresolved safety concerns or issues requiring further NRC followup.

3.3 Main Steam Safety Valve Lift

As documented in the event chronology of section 1.4 of this inspection report, a steam generator safety valve opened approximately ½ second prior to the reactor trip on January 25; both system responses resulting from the MSIV 86 closure discussed in detail in other sections of this report. Licensee post-event analysis revealed that the "A" main steam safety valve, that lifted and remained open between 26 and 27 seconds, was the one of the five code safety valves with the lowest setpoint, i.e., 1185 psig. Based upon the "A" steam generator header pressure time history during this period, it appears that a second safety valve probably also lifted and a third may have started to lift before pressure reduced below the valve reset setpoints.

Since the atmospheric steam dump valve (ASDV; MS-PV-3001) on the "A" main steam line has an automatic lift setpoint of 1125 psig, the inspector questioned why this ASDV did not actuate to relieve header pressure prior to the opening of the safety valves. The licensee conducted further analyses of the system and component response to the pressure transient and determined that the ASDV may have actually started to open. However, because of the valve design, with its slower response time, and the short duration of this pressure transient, the actuation of MS-PV-3001 would not have been expected to be fast enough to prevent lifting safety valves in the same header. Subsequently, after the safety valve lifted, the header pressure would be reduced below the automatic ASDV lift setpoint fairly rapidly.

The inspector confirmed that the licensee checked the acceptability of the as-found setpoint for MS-PV-3001 and verified evidence of adequate stroke time testing of this ASDV, as required by the IST program. The inspector also examined a plot of the pressure transient in the "A" main steam line, as compared to the corresponding time curve for the saturation pressure of the steam at the peak T(avg) in loop 1 of the reactor coolant system. Evaluation of the resulting curves supported the licensee position, and the available qualitative evidence, that the main steam safety valves lifted and reset as assumed in the licensee's analysis. The inspector had no further questions regarding the ASDV and code safety valve response to this event. No unresolved safety concerns were identified.

3.4 Operation at Reduced Power Levels with Inoperable Main Steam Safety Valves

A Nuclear Safety Advisory Letter (NSAL) was issued by the Westinghouse (W) Energy Systems Business Unit on January 20, 1994. In this letter, W identifies a potential safety issue with plant license requirements contained in Technical Specification Table 3.7-1 in that the allowed power levels with inoperable main steam safety valves (MSSV) may be nonconservative. Seabrook Technical Specification Table 3.7-1 lists the maximum allowable power range section high flux setpoint, as a percent of rated thermal power, for one, two, or three inoperable MSSVs per loop.

The technical concern involves a Loss of Load/Turbine Trip transient, which may overpressurize a main steam line with inoperable MSSVs if the allowed power levels are too high. The W NSAL provides an algorithm with which revised Technical Specification setpoint values can be calculated. While no report pursuant to 10CFR21 was issued by W relative to this potential deficiency, the NSAL does recommend actions to be considered by each affected licensee. The inspector confirmed the NRC Office of NRR was cognizant of this potential safety issue.

At Seabrook, the licensee recalculated the affected Technical Specification setpoint values in Table 3.7-1, using the W algorithm, instrument error assumptions and added conservatism. Technical Clarification, TS-011, was issued on February 7 to administratively control the maximum allowed thermal power values in accord with the revised setpoints, until a Technical Specification revision can be processed. Further, as a result of a review of past MSSV setpoint testing during the power descension into Refueling Outage 2 in September 1992, the licensee determined that this testing, which renders a MSSV inoperable, was accomplished at a power level above the newly calculated Technical Specification allowable power limits. Hence, on February 17, the licensee telephonically reported to the NRC this past unanalyzed plant condition as a non-emergency event, pursuant to 10 CFR 50.72(b) requirements.

The inspector reviewed the W NSAL, the Seabrook Technical Clarification (TS-011) and a written text of the 10 CFR 50.72(b) notification to the NRC. Licensee actions to address the identified deficiency have been both timely and conservative. The review of past operating conditions to evaluate any analyzed conditions, outside the design basis of the plant, and the subsequent report of such to the NRC provides evidence of a thorough licensee evaluation and the intent to fully comply with regulatory reporting requirements. The inspector has no additional questions or unresolved safety concerns relative to the licensee's response to this safety issue identified by W.

4.0 PLANT SUPPORT (71707, 81020)

4.1 Radiological Controls

The licensee has implemented several changes to its Radiation Protection Program, effective January 1, 1994, to comply with the revisions to 10 CFR 20. While the Seabrook Technical Specifications have not yet been directly affected by the regulatory revisions, the plant exposure limit controls, monitoring criteria and posting requirements have all been impacted and modified to comply with the current regulations. The Seabrook Station Radiation Protection Manual, Revision 21, was issued effective January 1, to comply with the new regulatory standards, along with ALARA goals and other management objectives in the radiation protection area.

During this inspection, the inspector observed general radiation worker practices and other radiation protection program controls within the radiologically controlled area (RCA). During plant inspection-tours, the inspector randomly checked contamination controls, radiation work permit (RWP) criteria and access requirements and postings to verify conformance to the provisions of the radiation protection procedure, RP 2.1 (Revision 8). On February 4, the licensee demonstrated to the NRC compliance with the "Grave Danger" area postings for the access points beneath the reactor vessel, during a general health physics tour of containment while the plant was in mode 5. During this containment tour, the position and status of the area radiation monitors were also noted.

Additionally, "high radiation" and "locked high radiation" area controls were observed elsewhere within the RCA. The inspector confirmed the appropriate posting of train "A" RHR equipment vault as a high radiation area, below the -9' elevation, as a result of placing the "A" RHR pump in operation during plant cooldown/mode 5 operations. The change in status of the mechanical penetration area from a locked high radiation to a high radiation area was also noted. Overall, the licensee appears to have implemented the appropriate measures to control personnel radiation exposures and manage other radiation protection areas in accord with the criteria delineated in 10 CFR 20. A nuclear safety assessment audit of the site radiological program was conducted by station QA personnel in February to evaluate the areas of programmatic control and implementation details of these new criteria.

The inspector identified no unresolved safety concerns as a result of direct inspection of the radiation protection program or implementation of its provisions during random inspection-tours within the plant RCA.

4.2 Security

The inspector reviewed the station security log for both the fourth quarter of CY 93, and the current quarter in CY 94, checking both the "logable" events and the resulting security force response, and evaluating trends from previous periods and over the course of the current quarter. As required, specific events were discussed with station security department managers and documented corrective action followup was spot-checked (e.g., work request 93W002599 on a vital area door, with performance testing complete on January 12). The inspector noted that closed circuit television (CCTV) camera sunglare was a numerous, repetitive documented event, requiring guard force reaction as a compensatory measure. The inspector was informed of the Nuclear Safety Audit and Review Committee (NSARC) interest in the sunglare issue and noted that Request for Engineering Services (RES 92-249) had been initiated to seek resolution of this generic problem. However, while interviews indicated that the licensee is contemplating plans to conduct improved camera design testing, the number of logable events of a CCTV nature over the last several years appears to suggest that, at present, sunglare problems will continue to dominate the frequency of compensatory measure assignments. Overall, the inspector identified no inadequate corrective actions or failures to report conditions required by 10 CFR 73 and determined that the licensee was effectively trending identified events for the appropriate component, condition and error categories.

The inspector also reviewed an Operational Information Report (OIR 93-117) discussing the identification by the licensee of the movement of Special Nuclear Material (SNM) within the protected area without the proper administrative controls. The inspector examined the SNM Inventory and Control procedure, RS0720, and evaluated the OIR conclusions and recommendations against the existing procedural controls, as well as 10 CFR 70 and 73 requirements. The inspector verified that appropriate corrective actions have been scheduled for implementation and that official notification to the NRC regarding this event is not a regulatory reporting requirement. The inspector has no further followup questions regarding OIR 93-117.

In line with a change to 10 CFR 26, the licensee has adopted an annual random Fitness-for-Duty (FFD) testing rate of 50% for existing employees in 1994 and beyond. The inspector confirmed that the licensee will continue to conduct a pre-employment FFD screening of all new hires; and thus, the 50% random screening criteria becomes applicable to new employees only after they have undergone pre-employment screening. Licensee security personnel routinely inform the resident inspector staff of FFD test failures, including those conducted for potential "new-hire" personnel. Upon any identified "new-hire" FFD failure, the subject individual is no longer considered a candidate for employment at Seabrook Station.

On January 21, 1994 the licensee submitted its Semiannual Fitness-for-Duty Report to the NRC, covering the period July 1 - December 31, 1993. The inspector reviewed the results in assessing the effectiveness of the licensee's FFD program and initiatives and identified no inconsistencies or concerns with either the requirement of 10 CFR 26 or the licensee decision to reduce the annual random testing to a 50% rate, in accord with newly revised regulation.

4.3 Emergency Preparedness

On January 31, 1994, the licensee conducted a drill of the Emergency Response Organization Notification System (ERONS) during backshift hours. This drill was an announced notification/acknowledgement exercise only and did not require responders to report to the site. Both pagers and a telephonic notification and reply network were utilized to test the capability of station personnel response to any declared emergency. The personnel contacted were requested to submit a completed questionnaire regarding travel time estimates for further licensee EP staff review. The inspector was briefed on the conduct of this drill and informed of the schedule for implementation of a full-scale exercise (i.e., responder travel to the station) in the near future.

The NRC, through the federal telephone service (FTS) contacts, conducted circuit line testing of six FTS telephones located in the Seabrook Emergency Operations Facility (EOF) during the second week of February. At the completion of these checks, the licensee verified the return to service of all affected lines, by means of an additional functional test conducted at the EOF. The inspector was involved with the coordination of this FTS 2000 network/counterpart link validation activity and discussed it with the appropriate licensee EP staff representative.

No regulatory problems on safety concerns were identified by the inspector relative to the noted ERONS and FTS line testing.

5.0 SAFETY ASSESSMENT/QUALITY VERIFICATION (40500)

5.1 Work Performance/Outage Schedule

During the unplanned MSIV outage, the inspector observed that plant management exhibited a proper safety perspective by stressing the need to identify the true root cause of the MSIV equipment problems and perform the work right the first time. When problems arose, licensee personnel stopped work to take the necessary corrective measures. The plant staff generated several corrective action documents to resolve potential deficiencies. Although the analyses of previous MSIV equipment deficiencies were deemed inadequate (see section 3.1), the inspector judged that the effort applied subsequent to the January 25 trip was comprehensive. The licensee developed an extensive list of short and long term corrective actions to improve MSIV reliability, as well as organizational performance.

Plant management evaluated the lessons learned from the unplanned MSIV outage. With an emphasis on work quality, the unplanned outage work activities generally took longer time to complete. Looking ahead to the upcoming refueling outage, plant management initiated a review of planned outage work to try to reduce the outage scope by approximately 25%. This reduction in scope would allow work completion in the planned 57 day duration. No safety concerns have been identified, at the present time, with regard to any potential reduction in the upcoming outage scope.

5.2 PERT/Performance Improvements

The inspector attended a PERT team meeting, several biweekly PERT/performance improvement meetings, an occurrence review committee meeting, a top 100 managers meeting, and reviewed the results of an NSARC meeting.

The PERT team evaluated a communications plan for the various performance improvement initiatives that are being implemented. The PERT team and NSARC identified that the plant staff does not fully understand how the different performance improvement initiatives fit together, what is the status of implementation, and how the initiatives result in better performance and support the North Atlantic strategic plan. The performance improvements include: STAR (stop-think-act-review) program, supervisory walkdown program, procedure upgrade, trip avoidance, self assessment initiatives, occurrence review committee, TIDE (teamwork in developing excellence), Values for Excellence, and commitment management program. The PERT team discussed the preparations needed to conduct the first PERT effectiveness assessment review scheduled to commence on March 1. The inspector noted improvement in communication of more important information in various media forms. The inspector concluded that the effective communication of the various performance improvement initiatives is vital to the success of these initiatives.

During the second round of department level discussions and during the NSARC review of the PERT effort, North Atlantic realized the need to further clarify the slogan "Zero Tolerance For Error". The plant manager issued further explanation in a weekly site newsletter. The inspector determined that the clarification reinforced the principles of minimizing errors by developing and utilizing lessons learned.

At a licensee top 100 managers meeting, executive level management introduced the North Atlantic strategic plan (five year plan). Plant managers were tasked to develop specific departmental business plans and to communicate the strategic plan to the rest of the organization.

In summary, the inspector viewed these activities as positive initiatives.

6.0 MEETINGS (30702)

Two resident inspectors and a reactor engineer were assigned to Seabrook Station throughout the period. The inspectors conducted back shift inspections on January 25 and February 2, 8, 9, 14, 21, 23 and 28, and deep back shift inspections on January 22, 29 and 30 and February 13.

Throughout the inspection, the inspectors held periodic meetings with station management to discuss inspection findings. At the conclusion of the inspection, the inspector held an exit meeting with the Executive Director of Nuclear Production and his staff to discuss the inspection findings and observations. No proprietary information was covered within the scope of the inspection. No written material regarding the inspection findings was given to the licensee during the inspection period.

A region-based inspector conducted an inspection of the Seabrook Station radioactive waste treatment and effluent and environmental monitoring programs during the period, January 24 - 28. The results of this inspection are documented in NRC inspection report 50-443/94-02.