March 2, 2001

EA-01-032

Mr. Ted C. Feigenbaum
Executive Vice President and Chief Nuclear Officer
Seabrook Station
North Atlantic Energy Service Corporation
c/o Mr. James M. Peschel
P.O. Box 300
Seabrook, NH 03874

SUBJECT: SEABROOK GENERATING STATION, UNIT 1
NRC SPECIAL INSPECTION REPORT NO. 05000443/2000-011

Dear Mr. Feigenbaum:

During the period from November 7, 2000, to January 18, 2001, the NRC performed a special inspection at the Seabrook Station to review North Atlantic Energy Service Corporation's (NAESCo's) evaluation of the emergency diesel generator DG-1B failure on November 1, 2000, during 24-hour surveillance testing. The results of this inspection were discussed on January 18, 2001, with you and other members of your staff.

NRC inspectors examined numerous activities as they related to reactor safety and compliance with the Commission's rules and regulations, and with the conditions of your operating license. The inspection consisted of a selected examination of procedures and representative records, observations of activities, and interviews with personnel. Specifically, it involved inspections of event evaluations, root cause investigation, surveillance testing, maintenance history records, vendor technical manuals, and maintenance procedures to assess the failures and equipment damage to DG-1B.

This report discusses one preliminary finding of low to moderate safety significance (white) at Seabrook Station Unit 1 that was evaluated under the significance determination process (SDP). This finding involves inadequate corrective actions associated with degraded components of DG-1B, and the failure of that diesel generator during 24-hour surveillance testing on November 1, 2000. This finding was also determined to be an apparent violation of NRC requirements because you failed to evaluate and implement effective corrective actions to address the degraded conditions. Also, you failed to establish appropriate quantitative or qualitative acceptance criteria for boroscopic inspections of the diesel generator cylinder liners.

Your corrective action deficiencies have several elements. You did not incorporate industry operating experience to modify your diesel generator tests to minimize wear. You failed to evaluate the worn cylinder liners replaced during previous outages to determine the cause of the wear. Emergency diesel generator equipment problems have not been consistently documented in the corrective action program and resolved. For the previous degraded cylinder liner problems, you relied primarily on vendor expertise and focused on component replacement

rather than evaluation and correction of the causes of the deficient conditions. Your failure to evaluate the cause of the deficient conditions permitted power block degradation to go unnoticed until an actual failure occurred to the No. 7 cylinder liner, due to similar degradation, resulting in the DG-1B engine failure during 24-hour surveillance testing on November 1, 2000. This issue was assessed using a Phase 3 SDP analysis and was preliminarily determined to be white (i.e., an issue with some increased importance to safety, which would require additional NRC inspection). The issue has a low to moderate safety significance because emergency diesel generators are an important mitigating system during a loss of an offsite power event.

Currently, NAESCo has a different view of the significance of the event. Based on evaluation of the failure mechanisms, combination of surveillance testing and maintenance run times, lube oil strainer differential pressure performance, and lubricating oil analysis, NAESCo concluded that DG-1B was capable of performing its required 24-hour mission time throughout operating Cycle 7.

Although we believe that we have sufficient information to make our final significance determination for the emergency diesel generator corrective action issue, you have the opportunity to send us your position on the finding's significance and the bases for your position in writing. Also, please inform us if you would like to schedule a regulatory conference to discuss your evaluation and any differences with the NRC evaluation. Accordingly, no enforcement is presently being issued for this inspection finding. Please contact William Ruland at (610) 337-5376 within 10 days of the date of this letter to inform the NRC of your intentions. If we have not heard from you in writing regarding a conference within 14 days, we will continue with our significance determination and enforcement decision, and you will be advised by separate correspondence of the results.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosures will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/NRC/ADAMS/index.html (the Public Electronic Reading Room).

Sincerely,

/J. Linville Acting For RA/

Wayne D. Lanning, Director
Division of Reactor Safety

Docket No: 05000443
License No: NPF-86

Enclosure: NRC Inspection Report No. 05000443/2000-011

Attachments:
(1) NRC's Revised Reactor Oversight Process

(2) Supplemental Information
(3) Partial List of Documents Reviewed
(4) NAESCO Operability Assessment
(5) Special Inspection Charter

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U. S. NUCLEAR REGULATORY COMMISSION

REGION I

Docket No:	05000443
License No:	NPF-86
Report No:	05000443/2000-011
Licensee:	North Atlantic Energy Service Corporation
Facility:	Seabrook Generating Station, Unit 1
Location:	Post Office Box 300 Seabrook, New Hampshire 03874
Dates:	November 7, 2000 - January 18, 2001
Inspectors:	Paul Kaufman, Senior Reactor Inspector, Team Leader Javier Brand, Resident Inspector Fred Bower, Resident Inspector (3-weeks) Thomas Shedlosky, Senior Reactor Analyst (1-week)
Approved by:	William H. Ruland, Chief Electrical Branch Division of Reactor Safety

SUMMARY OF FINDINGS

IR 05000443-00-11; on 11/07/00-1/18/01; North Atlantic Energy Service Corporation; Seabrook Station; Other Activities. Special Inspection of the failures of emergency diesel generator DG-1B. Findings in effectiveness of corrective actions.

The inspection was conducted by one regional inspector, a regional senior reactor analyst, and two resident inspectors. This inspection identified one potential (white) issue, which is an apparent violation. The significance of issues is indicated by their color (green, white, yellow, red) and is determined by the Significance Determination Process (SDP). (Refer to Attachment 1)

Inspectors Identified Findings

Cornerstone: Mitigating Systems

- White. An apparent violation of 10 CFR 50, Appendix B, Criterion XVI, "Corrective Action," was identified by the inspectors associated with the failure to evaluate significant conditions adverse to quality involving degraded components in emergency diesel generator DG-1B. Failure to adequately evaluate industry operating experience, identify and evaluate equipment problems, and correct deficiencies resulted in degraded component conditions of the emergency diesel generators that were potential causes that led to the DG-1B diesel engine failure on November 1, 2000. These issues represented a failure by NAESCo to implement effective corrective actions for degraded components which had safety significance. This issue has a low to moderate safety significance, based on the results of the phase 3 SDP analysis, because emergency diesel generators are an important mitigating system during a loss of off-site power event.

  Also contributing to the White finding was an apparent violation of 10 CFR 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings." NAESCo failed to establish appropriate quantitative or qualitative acceptance criteria for boroscopic inspections of the diesel generator cylinder liners. (Section 4OA3.7)

TABLE OF CONTENTS

PAGE

Report Details

Summary of Plant Status

The plant was shutdown in refueling outage OR07 during this inspection. The licensee satisfactorily completed repairs, post-maintenance testing, and 24-hour surveillance testing of the emergency diesel generators' DG-1A and DG-1B, prior commencing a plant startup.

Background

An emergency diesel generator (EDG) DG-1B was removed from service on October 25, 2000, for a planned 18-month maintenance inspection and a 24-hour Technical Specification surveillance test during the refueling outage.

Four attempts were made to run the DG-1B 24-hour surveillance test during the refueling outage. Two attempts were interrupted by encountering an increasing differential pressure across the lubricating oil strainer. The first 24-hour run attempt occurred on October 29, 2000, and was stopped due to an increase in lubricating oil strainer differential pressure. NAESCo's view is that the actual failure of the No. 7 piston and cylinder was initiated during this first 24-hour surveillance attempt, as indicated by the subsequent lubricating oil sample analysis from that run. The second attempt on October 30, 2000, was terminated because of an operational scheduling conflict. The third attempt on October 31, 2000, was stopped by the operators due to high strainer differential pressure. On the fourth attempt on November 1, 2000, control room operators initiated an emergency shutdown of DG-1B upon the receipt of high crankcase pressure and high vibration alarms. DG-1B was approximately four hours into the surveillance run, while coasting down from the emergency shutdown when the crankcase over pressurized and the crankcase relief cover assemblies lifted and displaced the crankcase exhauster hose.

The operator and mechanic, who were in the diesel generator room upon observing flames from the near the crankcase exhauster hose area and smoke immediately filling the room, evacuated the room. Control Room operators entered the fire response abnormal procedure and the fire brigade was activated and dispatched to the scene. The fire brigade inspected the Diesel Generator room and reported that there was no fire and no evidence that there had been a fire.

The NRC dispatched a special inspection team to the Seabrook Station on November 7, 2000, to inspect and assess the DG-1B failures and equipment damage that occurred during 24-hour surveillance testing between October 29 and November 1, 2000, and the subsequent failure on December 3, 2000, that occurred during a post-maintenance test break-in run.

4. OTHER ACTIVITIES [OA]

4OA3 Event Follow-up

.1 Failure of Emergency Diesel Generator DG-1B

a. Inspection Scope

The inspectors reviewed the failures of the DG-1B emergency diesel generator (EDG) that occurred between October 29 and November 1, 2000. The charter of the special inspection was to monitor and assess the root causes and corrective actions, independently evaluate the risk significance of the emergency diesel generator test failures, and determine possible generic implications. (The special inspection charter is included as Attachment 5 to this inspection report.)

The inspectors reviewed NAESCo's event evaluations, independently evaluated the risk significance of the failure, evaluated root causes, assessed corrective actions to prevent recurrence, and evaluated generic implications. The inspectors reviewed the emergency diesel generator system health reports, surveillance procedures, condition reports, work requests, diesel engine performance monitoring data, diesel generator maintenance procedures, Colt Technical Manual, Technical Specifications, industry operating experience evaluations pertaining to diesel generator surveillance testing and failures, and interviewed event evaluation team industry experts. In evaluating NAESCo's response to this event, the inspectors interviewed plant and contractor personnel, attended management meetings, and reviewed various event evaluation reports, and the root cause evaluation report. The inspectors also reviewed NAESCo's maintenance program for the EDGs, the availability of industry information, and potential precursors for this event.

Description and Chronology of Occurrence

On November 1, 2000, while conducting 24-hour Technical Specification surveillance testing of DG-1B, which is a 16-cylinder Colt Pielstick PC2.3 diesel engine, control room operators initiated an emergency shutdown of the emergency diesel generator, approximately four hours into the surveillance, upon the receipt of high crankcase pressure and high vibration alarms. The failure occurred seven minutes after the diesel engine had been reduced from the 110% loaded condition to the 100% loaded condition.

There were no adverse radiological consequences from this event. DG-1B was already out-of-service for testing, DG-1A remained operable, and off-site power was available when DG-1B failed. In addition, there were no safeguards issues due to diesel engine failure.

NAESCo formed an event evaluation team, which included a representative from the diesel generator manufacturer, as well as other technical experts, to determine the most probable cause of the failure of DG-1B on November 1, 2000. Subsequent inspection revealed damage to the diesel engine No.7 piston and cylinder liner. Damage to the

No. 7 cylinder was attributed to non-uniform thermal growth of the aluminum piston skirt which caused scuffing, scoring, and transfer of aluminum material from the piston skirt to the cylinder liner. The heat generated by the friction (galling) between the skirt and the liner bore coupled with the hot combustion gas blow-by eventually ignited oil vapor in the crankcase, lifting the crankcase pressure relief doors.

On November 9, 2000, emergency diesel generator DG-1A was inspected to determine if the cylinder liner wear conditions were also present. When NAESCo determined that the same wear conditions were present, indicating that DG-1A was susceptible to the same failure mechanism, it was taken out-of-service to repair the cylinder liners. NAESCo completely refurbished all of the cylinder liners.

On December 3, 2000, following repairs to DG-1B (including the replacement of the No.7 piston and cylinder liner, refurbishment of the remaining cylinder liners, and replacement of all the main bearings) and while conducting a post-maintenance break-in run, the diesel engine had a catastrophic failure of the No.5 main bearing. This failure occurred 25 minutes into the break-in run, and only five minutes after the load was applied.

Due to the No.5 main bearing failure, in-place machining of the No. 5 journal was performed. A total of .120" was removed from the journal. The Brinell hardness readings taken after the machining were unsatisfactory. The results were between 46 and 58 HRc (Rockwell hardness number), normal is 25 HRc, due to the localized heat stresses created when the bearing failed. The limit on how much material could be removed from the crankshaft journal was determined to be .120". After the limit was reached, any further machining would require derating the diesel engine by approximately 4% of its total rated power output.

The affected area of the No. 5 journal was heat treated twice to relieve the stresses. However, the hardness readings were still too high and considered unsatisfactory after the heat treatments, so management made the decision to replace the entire crankshaft of DG-1B.

NAESCo satisfactorily completed repairs, post-maintenance testing, and 24-hour surveillance testing of both emergency diesel generators prior commencing a plant startup. DG-1A completed its 24-hour surveillance testing successfully on November 28, 2000, and DG-1B completed its 24-hour surveillance testing successfully on January 23, 2001. In addition, the root cause analysis of the DG-1B emergency shutdown and failure that occurred on November 1, 2000, was completed on January 24, 2001, prior to unit startup.

.2 Risk Significance of Event

a. Inspection Scope

The inspectors evaluated NAESCo's engineering evaluation EE-010001, Emergency Diesel Generator B Operability During Cycle 7, dated January 26, 2001. NAESCo's engineering evaluation assessed the operability and safety significance of the DG-1B failure during the previous seventh operating cycle. The inspectors also performed an

independent risk assessment of the DG-1B failure. The inspectors evaluated the duration of the degraded condition, and the safety implications associated with the cause of the degradation. A summary of the inspectors understanding of the NAESCo operability assessment is attached to this report. (Refer to Attachment 4)

b. Findings

Independent NRC Risk Assessment of DG-1B Failure

The DG-1B failure affected the Mitigating Systems Cornerstone and was evaluated by the NRC using the Significance Determination Process (SDP). Even though DG-1B failed during the refueling outage, risk was considered to have increased during the previous operating cycle, and the issue was considered more than minor by the Phase 1 SDP because the emergency diesel generators effect multiple cornerstones. Based on SECY-00-0049, "Results of Revised Oversight Process Pilot Program," the phase 2 SDP worksheets were not used because they had not been finalized for Seabrook Station. The NRC performed a Phase 3 SDP risk assessment of the DG-1B diesel generator failure.

The emergency diesel generators (EDGs) at Seabrook are used to mitigate both internal and external plant initiating events that result in the loss of offsite power. The purpose of the EDGs is to provide a safety-related backup source of electric power to the normal non safety-related offsite power. If the offsite power source is lost, the EDGs provide power to essential plant equipment needed to remove decay heat from the reactor. In the event that both offsite power and the EDGs are lost, the safety-related batteries and certain equipment which doesn't rely on ac power can be used for a short duration (until the batteries discharge and become unavailable) to maintain decay heat removal. However, either offsite power must be recovered or one of the 2 EDGs must operate to support long term decay heat removal. There are several internal (electric faults, transformer failures, etc.) and external events (lightning, storms, earthquakes, etc.) that can result in the loss of offsite power. Therefore, the Seabrook EDGs are important equipment for mitigating core damage. The NRC's PRA models indicate that the failure of offsite power and the failure of both EDGs to operate, without recovering some source of ac power (station blackout) is the sequence which has the greatest contribution to core damage if the EDGs are unavailable.

The delta-core damage frequency (CDF) for this event was calculated using site specific data such as the plant baseline CDF, the emergency diesel generator Risk Achievement Worth (RAW), and the estimated diesel generator unavailability time. The emergency diesel generator run time information was used to estimate the calendar date when the emergency diesel generator would have a total accumulated run time of 24 hours (mission time). The EDG loaded (breaker closed to breaker open) data was used because the degradation of the EDG appears to be influenced by load, since filter d/p did not increase for several hours after the EDG was loaded. October 18, 2000, was determined to be the date where subsequent operation would not result in the emergency diesel generator operating for 24 hours. Based on estimated time to failure during the 24 hour surveillance run on October 29, 2000, the EDG would run for 15 hours and 30 minutes prior to the differential pressure across the filter exceeding 50

psid. Seabrook Station entered Mode 3 on October 21, 2000, therefore the total unavailable time for the DG-1B is approximately three days.

There was considerable uncertainty in this estimate of the duration that the DG-1B was unavailability during the operating cycle. The inspectors considered several other methods of determining the fault exposure time for the emergency diesel generator. Since DG-1B failed during the 24 hour Technical Specification endurance run, a consideration was given to establishing the fault exposure time by dividing the time from the last successful oil sample by 2 resulting in a fault exposure time of about 1½ months. While this method of determining fault exposure time (using ½ the time from the last comparable successful surveillance test) would be consistent with the revised oversight program, there was information available that supported not using this approach for this case. In this case, there was information (routine 4 hour monthly tests) available to provide a reasonable expectation that DG-1B would likely have fulfilled its mission time during a significant portion of the last cycle. A engine oil sample taken in July 2000 did not identify any abnormal engine wear again providing an indication that DG-1B would have functioned. If the NRC had used the T/2 (time from the last successful surveillance divided by 2) approach to determine the fault exposure time, the risk of this event would result in a substantial safety significant finding. The NRC concluded that the method used to determine a fault exposure time of approximately three days was a reasonable estimate of the risk associated with the degraded diesel generator.

Based on the results of the phase 3 SDP risk assessment, the delta-core damage frequency (CDF) for the diesel generator failure was determined to be about 1.3E-6.[1] Findings in this range (1E-6 to 1E-5) are considered to be (white) per the Significance Determination Process (SDP) process. Therefore, the NRC concluded that the risk associated with the failure of the DG-1B was very low-to-moderate safety significance (white).

This quantitative risk analysis indicates that the risk associated with having DG-1B unavailable for approximately three days would result in a delta-CDF risk contribution just at the very low to low to moderate risk significance threshold (Green/White). It should be acknowledged that minor adjustments to the data used to determine the risk can influence the results sufficiently to be on either side of the 1E-6 delta-CDF threshold. However, this quantitative analysis does provide important insight in making a “risk informed” decision on the risk of this condition. An emergency diesel generator unavailable for a very short duration (approximately three days) results in an increase in risk adequate to result in a finding of low to moderate risk significance (white finding). This result is indicative of the importance of emergency diesel generator availability to overall plant risk. This analysis is also indicative of the very low risk threshold for green/white findings.

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[1]The baseline CDF from the full scale Seabrook model is ~4.6E-5. The risk achievement worth for the DG-1B is ~4.53. Therefore, the delta CDF~ [(4.6E-5)*(4.53)-4.6E-5] *3 days/365days per year ~1.3E-6 (white).

While it is possible that DG-1B may have functioned for its 24-hour mission time during the past operating cycle, there exists no certainty that this was in fact the case. Additionally, had DG-1B successfully passed its 24-hour endurance surveillance test on the first attempt, it's likely that the emergency diesel generator failure mechanism would not have manifested itself during the outage and a subsequent failure would have occurred during the next operating cycle. Allowing the emergency diesel generator to remain in service in a degraded condition would have had a significant impact on risk. The random nature of this failure mechanism is significant in determining the risk associated with this condition. While it is fortuitous that the failure occurred during the outage, it could have occurred during an operating cycle. This fact, in addition to those provided below as "conservative" and "non-conservative" factors were thoroughly considered in the NRC's "risk informed" determination that this failure has a low to moderate risk significance.

It is important to recognize that this risk estimate includes several uncertainties and assumptions. Some of these factors are conservative since they would be expected to increase the estimated plant risk while other factors are considered to be non-conservative since they would tend to decrease the estimated risk. Other parameters are uncertain in that their precise impact on plant risk is not known. These factors are discussed below:

Non-Conservative Factors

1. The risk determination does not quantify or consider the risk associated with having the emergency diesel generator out-of-service while the plant was in a shutdown (below Mode 2) condition.

2. The licensee's event evaluation team determined that the failure mechanism was random and independent. The risk assessment did not include a random EDG failure during the past operating cycle.

3. The potential for a common mode failure of the DG-1A was not reflected in the assessment. The licensee's event evaluation team identified several causal factors (i.e., method for testing and maintaining the emergency diesel generators in a standby condition) that were common to both emergency diesel generators.

4. NAESCo's surveillance and lubricating oil test data were insufficient to demonstrate that the emergency diesel generator would have functioned for the required PRA 24-hour mission time during the last operating cycle. The monthly surveillance test runs were typically about 3-4 hours in length which is far less than the 24-hour run time. In fact, the emergency diesel generator operating parameters were essentially normal during the initial portion of the October 29, 2000, 24-hour run. However, the operators were required to secure the diesel generator later in the test due to elevated lubricating oil strainer differential pressure readings.

5. Lubricating oil analysis samples taken after the October 29, 2000, run indicated a significant wear particle concentration. The previous lube oil results were

obtained on July 26, 2000, for the DG-1B, which was prior to the postulated diesel generator failure.

6. NAESCo calculated that the DG-1B would have operated for close to 16 hours during the October 29, 2000, surveillance while the NRC inspectors calculated that DG-1B would have operated for 15.5 hours during this surveillance test. This minor difference affected the postulated failure date for the DG-1B. The difference was attributed to NAESCo's calculation which used an assumed value for the initial strainer d/p, whereas the NRC inspector's calculation relied solely on data recorded during the 24-hour surveillance test. NAESCo's approach introduced a non-conservative bias into their final diesel generator run time determination.

7. The final diesel generator failure event was determined to be unrecoverable, whereas NAESCo's Plant Risk Assessment (PRA) model assumed that diesel generator failures are recoverable within a specified period of time.

Conservative Factors

1. The risk assessment did not correct the assumed diesel generator failure date for the number of start cycles placed on the diesel generator after the unit entered Mode 2. The diesel generator wear would also be expected to be a function of the number of start cycles experienced. The diesel generator was started nine times between the start of refueling outage (ORO7) that started on October 21, 2000, and the diesel generator run on October 29, 2000. Not including this factor could tend to make the risk estimate over-predict the actual plant risk.

2. The emergency diesel generator was run successfully after the October 29, 2000, shutdown three times (of loaded durations between 1 and 13 hours) for a total of 19 hours 44 minutes before the test run on November 1, 2000, which culminated in the crankcase over-pressurization event. The diesel engine lubricating oil was changed and the strainer was cleaned once and replaced once between these runs. This illustrates that the diesel generator had some load capability while the cylinder/piston degradation was in progress.

Risk Assessment Summary

There are conservative and non-conservative uncertainties that affect the delta-CDF for the Seabrook diesel generator failure event. The uncertainties involved with calculation of the delta-CDF illustrate the need to apply a "risk informed" rather than a "risk based" approach in assessing the significance of this finding. Based on the phase 3, significance determination process (SDP) analysis, the NRC inspectors determined the risk associated with the failure of the DG-1B to be low to moderate safety significance, which results in a (white) finding for this event. Emergency diesel generators are an important mitigating system during a loss of an off-site power event. Currently, NAESCo disagrees with the potential (white) significance determination and considers that the significance of the event is very low.

The inspectors identified performance issues related to the corrective action process, maintenance procedures, performance monitoring, and use of industry operating experience associated with the emergency diesel generators. These performance issues are findings and contributed to the DG-1B failure at Seabrook Station on November 1, 2000.

This finding was discussed at an NRC significance determination panel to further evaluate the significance of the DG-1B event. The NRC determined that the assumptions and uncertainties contained in the NAESCo engineering operability evaluation EE-010001, Revision 00, dated January 26, 2001, associated with DG-1B during the previous operating cycle 7 did not provide adequate justification for a reduced safety significance.

.3 Equipment and Component Failures

a. Inspection Scope

The inspectors evaluated and inspected the equipment and component damage that occurred to DG-1B during 24-hour surveillance testing, interviewed event evaluation industry experts, reviewed NAESCo's event evaluation for CR 00-12025 related to the emergency shutdown of DG-1B and evaluated Ricardo Consulting Engineer's report, Failure Investigation of Colt-Pielstick DG-1B Engine at Seabrook Nuclear Power Station. The inspectors assessed NAESCo's field inspection regarding the condition of equipment affected by this event.

b. Findings

The NAESCo event evaluation team, including industry experts, performed an inspection and assessment of the emergency diesel generator which revealed damage to the No. 7 piston and cylinder. The No. 7 cylinder liner was scuffed and scored, and it revealed heavy bonding of aluminum from the piston skirt. The piston skirt exhibited galling and the cylinder liner exhibited significant bore polishing (i.e., lack of adequate surface finish). Indications of cylinder liner polishing were evident in other cylinders.

The No. 7 piston compression rings showed signs of high wear and the piston skirt revealed massive galling. The skirt was galled from the bottom of the skirt to the top compression piston ring. The skirt was grossly distorted. The No. 7 cylinder liner revealed heavy transfer of aluminum to the liner. The cylinder bore surface finish was highly polished on the ring travel regions of the liner.

The No. 13 piston also exhibited significant compression ring wear.

Cylinder Nos. 9, 15, and 16 revealed bore polishing of the liners. Profilometer measurements indicated readings as smooth as 10-20 microinches, rms.

.4 Human Factor/Procedural Deficiencies

Emergency Diesel Generator Maintenance Procedure Deficiencies

a. Inspection Scope

The inspectors reviewed mechanical maintenance procedures: MX0539.41, Emergency Diesel Generator Engine Crankcase Inspection; MX0539.36, Emergency Diesel Generator Engine Injection Nozzle Maintenance; and MS0539.18, Emergency Diesel Generator Engine Piston and Liner Maintenance. The inspectors also reviewed vendor technical manual Colt-11-206086, Operation and Maintenance Manual - Emergency Diesel Generator Systems. The Colt manual and maintenance procedures were discussed with Seabrook personnel and event evaluation team EDG industry experts. The inspectors reviewed the maintenance procedures and vendor manual to evaluate the adequacy of the procedures.

b. Findings

In Licensee Event Report (LER) 00-008-00, Emergency Diesel Generator Failure During Surveillance Testing, NAESCo identified a combination of factors, including inadequate cylinder liner surface finish caused by carbon polishing and the long duration between runs, that caused the failure of DG-1B. The recently completed 18-month maintenance inspection of DG-1B performed on October 26, 2000, did not identify any degraded cylinder liners. No deficiencies were observed during boroscope inspections of the cylinder liners or the visual inspection of lower skirt portions of the cylinder liner. Interviews of event evaluation team industry experts revealed that boroscope inspections may not be a reliable method to identify wear of cylinder liners, since it relies heavily on a very experienced visual examination individual. NAESCo failed to identify degraded (heavy wear) conditions of several cylinder liners using a boroscope during the 18-month inspection. The inspectors determined this to be a missed opportunity to have identified and evaluated deficient cylinder liner conditions prior to the DG-1B failure on November 1, 2000.

The inspectors review of the procedure for the inspection of the lower end of the cylinder liner (MX0539.41, “Emergency Diesel Generator Engine Crankcase Inspection”) and the procedure for the boroscope inspection (MX0539.36, “Emergency Diesel Generator Engine Injection Nozzle Maintenance”) found that the procedures provided requirements to inspect for debris, excessive wear, damage or indications of impending problems, but did not include adequate acceptance criteria for inspections and examinations of cylinder liners. Failure to provide adequate quantitative or qualitative acceptance criteria for cylinder liner surface finish conditions when performing inspections and examinations during maintenance activities and failure to identify any degraded cylinder liner conditions during the 18-month maintenance inspection contributed to the diesel engine failure on November 1, 2000, since degraded wear conditions (loss of surface liner honing) were found on the No. 7 cylinder liner that led to the DG-1B failure. Maintenance procedures MX0539.41 and MX0539.36 did not contain quantitative or qualitative acceptance criteria for inspecting and examining cylinder liners of the emergency diesel generators.

.5 Probable Contributing Causes of the Event

DG-1B Emergency Diesel Generator Failure of November 1, 2000

a. Inspection Scope

The inspectors reviewed NAESCo's event evaluation reports and root cause report of the DG-1B failure. The reports reviewed included the following: Event Evaluation for CR 00-11909 and CR 00-12126 Diesel Generator Lube Oil Strainer High Differential Pressure; Event Evaluation for CR 00-12025 DG-1B Emergency Shutdown 11/1/00; and, Root Cause Analysis for CR 00-12025 Organizational and Programmatic Issues That Contributed to The Diesel Generator Events. The inspectors reviewed documentation and observed portions of the NAESCo field investigation to assess root cause determination for the DG-1B failure.

b. Findings

NAESCo's event evaluation team determined that the most probable cause of the No. 7 piston and cylinder failure was non-uniform thermal growth of the aluminum piston skirt which resulted in scoring and transfer of aluminum piston skirt material onto a cylinder liner wall. Scoring and aluminum deposition on the cylinder liner affected the ability of the cylinder liner to retain lubricating oil and impacted the operation of the piston rings particularly in the lower ring travel area. The heat generated by the scuffing and scoring caused the piston skirt to grow further, resulting in increased interference with the liner and eventual failure.

The No.7 piston and cylinder failure was determined to be a random independent failure resulting from long-term degradation caused by several contributing factors. The contributing factors that led to non-uniform thermal growth and failure were postulated to be caused by the following factors: fast starts; rapid and high loading; long duration between runs; inadequate cylinder liner surface finish; piston blow-by/carbon polishing of the liner finish; and, operating the lubricating oil and jacket water system keep-warm system temperatures at the lower end of the vendor recommended temperature band.

DG-1B Failure of December 3, 2000

NAESCo is currently conducting additional event evaluations to determine the cause of the DG-1B emergency diesel engine No. 5 bearing failure that occurred on December 3, 2000. NAESCo has preliminarily determined the probable causes for the No. 5 main bearing failure was insufficient bearing crushes or localized loss of lubricating film. Also, NAESCo considered that the two diesel engine failures of November 1, 2000, and December 3, 2000 were unrelated. Since NAESCo's event evaluation was not completed by the end of this inspection, the inspectors did not evaluate the cause of the December 3, 2000, DG-1B failure.

.6 Corrective Actions

a. Inspection Scope

The inspectors reviewed and observed corrective actions associated with repair activities on both of the diesel generator engines and evaluated the planned corrective actions to prevent recurrence. The inspectors reviewed documentation and observed field repairs to evaluate the adequacy of corrective actions for the DG-1B failure.

b. Findings

NAESCo implemented a number of equipment and programmatic corrective actions to prevent recurrence of the diesel generator failures. These corrective actions include:

- Both diesel generators were partially disassembled and rebuilt to the manufacturer's specifications and tolerances regarding cylinder liner finish and piston cleanliness. In addition, replacement of the No.7 cylinder piston skirt and liner, all main bearings, and replacement of the crank shaft were performed on the DG-1B. The lubricating oil was replaced in both diesel engines.

- The loading rate for the monthly Technical Specification surveillance runs of the diesel generators has been reduced.

- The lubricating oil and water jacket keep-warm system temperatures for both diesel engines were increased. The jacket water temperature was changed from 105-110^{0}F to 145-150^{0}F. The lubricating oil temperature was changed from 120-125^{0}F to 130-135^{0}F.

- The diesel generator maintenance procedures to address cylinder liner surface condition per Colt technical manual recommendations were revised. The preventive maintenance program for the diesel generators is to be revised to include cylinder liner visual examinations.

- A Technical Specification change request is to be submitted to propose modifications to diesel generator testing requirements. NAESCo intends to propose revising the surveillance requirements for the diesel generators to allow for slow engine starts, eliminate the requirement for starts from a stand-by condition on repeat 18 month surveillance tests, and eliminate the requirement to test the diesel generator at 110% of load every 18 months.

- A design change is being evaluated to consider the installation of a slow start governor.

.7 Quality Assurance Deficiencies

a. Inspection Scope

The inspectors reviewed emergency diesel generator inspection results, surveillance testing data, and performance monitoring data to determine whether the diesel generators met design and licensing bases requirements. This inspection included a review of industry operating experience, oil sample analysis data, lubricating oil strainer differential pressure (d/p) data, lubricating oil and jacket water keep-warm system temperatures, crankcase pressure logs, exhaust temperature data, work requests, adverse condition reports, and, emergency diesel generator system health reports.

In addition, the inspectors reviewed the effectiveness of corrective actions to verify that corrective actions, commensurate with the problem or issue, were identified and implemented which included an evaluation to determine whether NAESCo considered extent of condition, generic implications, common cause, and previous occurrences, and, that adverse condition report investigations and resulting corrective actions were implemented in a timely matter commensurate with safety and risk significance.

The inspectors reviewed and discussed NAESCo's evaluations and dispositions of industry operating experience with Seabrook personnel. Specifically, Generic Letter (GL) 84-15, Proposed Staff Actions to Improve and Maintain Diesel Generator Reliability, dated July 2, 1984; GL. 93-05, Line Item Technical Specifications Improvements to Reduce Surveillance Requirements for Testing During Power Operation, dated September 27, 1993; NRC Information Notice 85-32, Recent Engine Failures of Emergency Diesel Generators, dated April 22, 1985; and, ACR M3-97-3264, Millstone Unit 3 diesel generator failure in 1997 are related to recommended surveillance testing, avoiding cold fast starts, and failures of emergency diesel generators. The inspectors reviewed the availability of industry information and potential precursors for this event.

Review of Industry Operating Experience

Even though significant problems pertaining to premature engine failures of emergency diesel generators have occurred at various facilities over the past 17 years, some of which were related to surveillance testing requirements (fast starts and fast loading) noted in the above industry documents, NAESCo elected not to change the fast starts and fast loading requirements because the installed emergency diesel generator governor design did not provide slow start capability.

Based on industry operating experience, the event evaluation team determined that the rapid starts and rapid loading surveillance testing practices which the Seabrook Station has been doing since it was licensed led to the accelerated degradation of the emergency diesel generators. DG-1B has had 405 starts since being declared operational in 1987 through November 1, 2000. DG-1A has had 368 starts since being declared operational in 1987 through October 23, 2000. The event evaluation team and the NRC inspectors determined that ineffective use of operating experience information resulted in NAESCo not pursuing changes to emergency diesel generator operating practices such as rapid loading and fast starts. Ineffective use of industry operating

experience information was identified by the event evaluation team as a major contributing cause of the DG-1B failure on November 1, 2000. NAESCo determined that historically, operating experience reviews have had a narrow focus and the perspective was to screen it out as not applicable to Seabrook Station. The NRC inspectors had also identified this as a performance issue and determined that NAESCo did not sufficiently evaluate and implement industry operating experience information regarding reduced surveillance testing requirements and reliability of emergency diesel generators.

Diesel Generator Lubricating Oil Strainer High Differential Pressure

NAESCo's event evaluation team determined that the DG-1A diesel engine lubricating oil had not been replaced since the pre-operational test period for the Seabrook Station which is approximately 14 years and contrary to UFSAR section 9.5.7.2: "The lube oil is periodically replaced to prevent excessive engine wear due to dirty oil." This issue was identified by NAESCo and documented in Condition Report 00-12057 on November 2, 2000. Even though the lubricating oil had not been replaced in 14 years, NAESCo determined that the lubricating oil was still serviceable. Also, the lubricating oil in the DG-1B diesel engine had not been replaced in approximately 13 years, until the previous refueling outage OR06 (April 1999).

Review of DG-1A diesel engine lubrication system information revealed that the system was not performing as intended as evidenced by four lube oil strainer cartridge change outs due to high differential pressure over the previous 18 month operating cycle. However, only one change out was documented on an adverse condition report. Work requests were used the other times. The inspectors identified this as a corrective action performance issue. After a review of the number of strainer change outs on DG-1A, the event evaluation team initiated CR 00-12126 to document this declining performance trend. The inspectors determined that NAESCo failed to identify and evaluate differential pressure (d/p) strainer deficiencies on adverse condition reports and was slow to characterize an adverse trend of the high d/p lube oil strainer readings and strainer cleaning, identify the cause of the clogging, and develop corrective actions. The inspectors considered this to be a missed opportunity to identify and evaluate possible diesel engine degradation and operability concerns.

The high d/p reading on the DG-1B diesel engine lube oil strainer, which was observed during the surveillance test on October 29, 2000, was caused by the unusual quantity of engine debris and wear products from the evolving No. 7 piston and cylinder damage. Because of the single strainer design of the lube oil system installed on the Colt-Pielstick diesel engines at the Seabrook Station, the strainer can load up quickly enough to affect reliable engine operation. The rate of loading of the strainer is proportional to the amount of material in the fluid and can change quickly if the engine begins generating unusual amounts of wear products. If the strainer is not cleaned, the engine would ultimately trip at approximately 50 psid due to low lube oil header pressure being less than 60 psid.

Emergency Diesel Generator Cylinder Liner Replacements

During 18 month inspections of DG-1B performed during two previous refueling outages in late 1995 and early 1999, cylinder liners revealed heavy wear, as evidenced by a polished appearance and lack of honing (crosshatch patterns) on the inside bore surface of the No. 11 liner and out-of-roundness of the No. 10 liner. The No. 10 degraded cylinder liner was replaced on November 21, 1995, and the No. 11 cylinder liner was replaced on April 17, 1999, using work requests. In each case, no adverse condition report was written. As a result, NAESCo failed to determine the cause of the degraded cylinder liners consistent with the diesel generator's importance to safety. This similar degraded cylinder liner condition found on the No. 7 cylinder liner that failed was determined to be a contributing cause of the diesel engine failure. Significant conditions adverse to quality occurred involving degraded components in DG-1B, and NAESCo failed to determine the cause of the condition and failed to take appropriate corrective actions to prevent recurrence. The NRC inspectors determined that failure to fully evaluate and implement effective corrective actions for degraded components contributed to NAESCo's failure to detect the degraded diesel engine prior to the failure on November 1, 2000.

NAESCo was not adequately tracking and evaluating the clearances and wear rates of the liners. NAESCo's actions taken to resolve the degraded cylinder liner problems relied solely on vendor expertise and focused on component replacement rather than evaluation and correction of the causes of the deficient conditions to prevent recurrence.

Diesel Engine Performance Data

Based on review of diesel engine operator logs and interviews with NAESCo personnel, the inspectors determined that NAESCo has performed limited trending of exhaust temperature and crankcase vacuum pressure of the emergency diesel generators. Recording of the diesel engine data revealed a history of increased crankcase pressure. In addition, trending of cylinder pressure efficiency data to determine if a cylinder had low horsepower may also point to high blow-by and an imminent failure mode occurring. Review of engine log data for DG-1B revealed that crankcase vacuum decreased from .5 to .2 inches H_2O, therefore crankcase pressure was slowly rising over a three-hour period prior to the crankcase over pressurization and diesel engine failure on November 1, 2000.

The event evaluation team determined that the compression gas blow-by of the piston rings caused this rise in crankcase pressure. This issue was entered into the Seabrook Station corrective action program as CR-01-00162.

Overall, these failures to adequately evaluate industry operating experience, identify and evaluate equipment problems, trend performance data, and correct deficiencies resulted in degraded component conditions of the emergency diesel generators that were potential causes that led to the DG-1B diesel engine failure. These issues represented a failure to implement effective corrective actions for degraded components which had safety significance and is an apparent violation of 10 CFR 50, Appendix B, Criterion XVI, "Corrective Action." This issue was entered into the Seabrook Station corrective action program as CR 00-12025. **(AV 50-443/2000-011-01)**

Also, the failure to establish appropriate quantitative or qualitative acceptance criteria for the cylinder liner boroscopic inspections is an apparent violation of 10 CFR 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings."

The NRC determined the risk associated with the failure of the DG-1B to be low to moderate safety significance, based on the computed results of the phase 3, significance determination process analysis for a transient with loss-of-offsite power. Emergency diesel generators are an important mitigating system during a loss of offsite power event. Therefore, the performance finding of inadequate corrective actions which was determined to be a contributing cause of the DG-1B failure, results in a potential (white) finding for this event.

.8 Conclusions

Based on review of NAESCo's event evaluation reports, cause and failure analysis reports, and the root cause analysis report the inspectors determined that the probable cause of the diesel generator failure and contributing causes appear appropriate and the investigations and assessments were carefully conducted and had identified and captured all of the performance issues that the inspectors found. In addition, the repair activities completed on both of the diesel generator engines appear reasonable.

NAESCo missed numerous opportunities to identify and evaluate emergency diesel engine degradation prior to the DG-1B diesel engine failure. Equipment problems have not been consistently documented and resolved in the corrective action program. The failure to adequately evaluate industry operating experience, identify and evaluate equipment problems, trend performance data, provide adequate quantitative or qualitative acceptance criteria in procedures, and correct deficiencies resulted in degraded component conditions that contributed to the DG-1B failure on November 1, 2000. The NRC concluded that the risk associated with the failure has very low to moderate safety significance (white).

4OA5 Other

(Closed) LER 50-443/00-008: Voluntary Licensee Event Report for Emergency Diesel Generator Failure During Surveillance Testing. This event was evaluated and discussed in detail in this report. This LER is closed.

4OA6 Meetings, Including Exit

.1 Exit Meeting Summary

The team presented the preliminary inspection results to you and other members of NAESCo management on January 18, 2001. NAESCo stated that they currently disagree with the NRC's risk significance determination position of very low to moderate safety significance (white) associated with the failure of the DG-1B. Based on evaluation of the failure mechanisms, combination of surveillance testing/maintenance run times, lube oil strainer differential pressure performance, and lubricating oil analysis, NAESCo considers that DG-1B was capable of performing its required 24-hour mission time throughout operating Cycle 7.

(1) NRC's REVISED REACTOR OVERSIGHT PROCESS

The federal Nuclear Regulatory Commission (NRC) recently revamped its inspection, assessment, and enforcement programs for commercial nuclear power plants. The new process takes into account improvements in the performance of the nuclear industry over the past 25 years and improved approaches of inspecting and assessing safety performance at NRC licensed plants.

The new process monitors licensee performance in three broad areas (called strategic performance areas): reactor safety (avoiding accidents and reducing the consequences of accidents if they occur), radiation safety (protecting plant employees and the public during routine operations), and safeguards (protecting the plant against sabotage or other security threats). The process focuses on licensee performance within each of seven cornerstones of safety in the three areas:

Reactor Safety	Radiation Safety	Safeguards
● Initiating Events	● Occupational	● Physical Protection
● Mitigating Systems	● Public	
● Barrier Integrity		
● Emergency Preparedness		

To monitor these seven cornerstones of safety, the NRC uses two processes that generate information about the safety significance of plant operations: inspections and performance indicators. Inspection findings will be evaluated according to their potential significance for safety, using the Significance Determination Process, and assigned colors of GREEN, WHITE, YELLOW or RED. GREEN findings are indicative of issues that, while they may not be desirable, represent very low safety significance. WHITE findings indicate issues that are of low to moderate safety significance. YELLOW findings are issues that are of substantial safety significance. RED findings represent issues that are of high safety significance with a significant reduction in safety margin.

Performance indicator data will be compared to established criteria for measuring licensee performance in terms of potential safety. Based on prescribed thresholds, the indicators will be classified by color representing varying levels of performance and incremental degradation in safety: GREEN, WHITE, YELLOW, and RED. GREEN indicators represent performance at a level requiring no additional NRC oversight beyond the baseline inspections. WHITE corresponds to performance that may result in increased NRC oversight. YELLOW represents performance that minimally reduces safety margin and requires even more NRC oversight. And RED indicates performance that represents a significant reduction in safety margin but still provides adequate protection to public health and safety.

The assessment process integrates performance indicators and inspection so the agency can reach objective conclusions regarding overall plant performance. The agency will use an Action Matrix to determine in a systematic, predictable manner which regulatory actions should be taken based on a licensee's performance. The NRC's actions in response to the significance (as represented by the color) of issues will be the same for performance indicators as for inspection findings. As a licensee's safety performance degrades, the NRC will take more and increasingly significant action, which can include shutting down a plant, as described in the Action Matrix.
More information can be found at: http://www.nrc.gov/NRR/OVERSIGHT/index.html.

(2) SUPPLEMENTAL INFORMATION

PARTIAL LIST OF PERSONS CONTACTED

Licensee

T. Feigenbaum, Executive Vice President and Chief Nuclear Officer
G. St. Pierre, Station Director
J. Vargas, Engineering Director
J. Grillo, Assistant Station Director
R. Sherwin, Maintenance Manager
B. Beuchel, Performance Improvement & Project Management Project Manager
J. Peschel, Manager, Regulatory Programs
M. Ossing, NRC Coordinator
J. Sobotka, Regulatory Compliance Supervisor
E. Nichols, Nuclear Technical Support Manager
L. Rau, Reliability & Safety Engineering Supervisor
H. Carmichael, Nuclear Oversight Manager

NRC Personnel

R. Lorson, Senior Resident Inspector
J. Linville, Acting Deputy Director, DRS
W. Ruland, Chief, Electrical Branch, DRS
R. Summers, Acting Chief, Branch 6, DRP

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

05000443/2000-011-01	AV	Inadequate corrective actions related to degraded conditions of cylinder liners to DG-1B.

Previous Items Closed

50-443/2000-008-00	LER	Voluntary Licensee Event Report for Emergency Diesel Generator Failure During Surveillance Testing

LIST OF ACRONYMS USED

ACR	Adverse Condition Report
BMEP	Brake Mean Effective Pressure
CR	Condition Report
D/P	Differential Pressure
EDG	Emergency Diesel Generator
GL	Generic Letter
OD	Operability Determination
SDP	Significance Determination Process
TS	Technical Specifications
UFSAR	Updated Final Safety Analysis Report

(3) PARTIAL LIST OF DOCUMENTS REVIEWED

Preliminary Investigation into the Cause of Engine Vibration at the Seabrook Nuclear Power Station, dated July 29, 1993, by Ricardo Consulting Engineers

Engineering Evaluation 96-03, Emergency Diesel Generator Vibration & Alignment, dated 3/15/96

Emergency Diesel generator System, Vertical Slice Review Team Report, dated January 1997

Root Cause Analysis for CR 00-12025, Organizational and Programmatic Issues That Contributed to the Diesel Generator Events, dated 1/24/01

EE-010001, Rev. 00, Emergency Diesel Generator Operability During Cycle 7, dated 01/26/01

Ricardo report, Failure Investigation of Colt-Pielstick EDG 1B Engine at Seabrook Nuclear Power Station, dated 11/21/00

Event Evaluation for CR 00-11909 and CR 00-12126 Diesel Generator Lube Oil Strainer High Differential Pressure, dated 11/25/00

Operators Unit journals for years 1999 and 2000

Operations Department Diesel Generator Logs for both diesels for years 1999 and 2000

DG-1B lube oil sample reports for 1998, 1999, and 2000

Generic Letter 84-15, Proposed Staff Actions to Improve and Maintain Diesel Generator Reliability, dated July 2, 1984

Generic Letter 93-05, Line Item Technical Specifications Improvements to Reduce Surveillance Requirements for Testing During Power Operation, dated September 27, 1993

NRC Information Notice 85-32, Recent Engine Failures of Emergency Diesel Generators, dated April 22, 1985

ACR M3-97-3264, Millstone Unit 3 diesel generator failure in 1997 is related to recommended surveillance testing, avoiding cold fast starts, and failures of emergency diesel generators

MX0539.41, Rev. 01, Change 02, Emergency Diesel Generator Engine Crankcase Inspection

OX1426.01, Rev. 08, Change 14, DG 1A Monthly Operability Surveillance

OX 1426.21, Rev. 01, Change 05, Diesel Generator 1B 18 Month Operability And Engineered Safeguards Pump and Valve Response Time Testing Surveillance

OX 1426.23, Rev. 00, Change 03, Emergency Diesel Generator 1B 24 Hour Load Test and Hot Restart Surveillance

ES00-1-42, Diesel Generator "B" Lube Oil System Flush Procedure, dated 11/20/00

MX0539.37, Revision 01, Emergency Diesel Generator Engine Cylinder Head Maintenance

MX0539.44, Revision 00, EDG Crankshaft Alignment

MX0539.42, Rev. 02, Emergency Diesel Generator Post Maintenance Testing (Power Cylinder Run In)

MS0539.18, Rev. 03, Change 04, Emergency Diesel Generator Engine Piston and Liner Maintenance

(4) NAESCo OPERABILITY ASSESSMENT

Brief NRC Summary of the NAESCo Operability Evaluation

NAESCo's staff performed an operability assessment of the DG-1B failure, which is documented in engineering operability evaluation EE-010001, Emergency Diesel Generator B Operability During Cycle 7, dated January 26, 2001. NAESCo determined that prior to refueling outage OR-07, there was no indication of a degrading trend in DG-1B performance. This was based on evaluation of the failure mechanisms, combination of surveillance testing/maintenance run times, lube oil strainer differential pressure performance, and lubricating oil analysis. NAESCo concluded that DG-1B was operable during operating cycle 7 based on the following information:

- DG-1B successfully completed 19 monthly Technical Specification (TS) surveillance tests during the operating cycle.
- During the outage, three Engineered Safety Features (ESF) tests were successfully conducted.
- The lubricating oil analysis results for DG-1B indicated no adverse trends associated with samples taken on August 1999, November 1999, February 2000, May 2000, and July 2000. The first indication of engine degradation was in the oil sample taken after the first 24-hour run attempt on October 29, 2000.
- The lubricating oil strainer differential pressure remained within a normal range of 2 to 4 psid throughout operating cycle 7. No lubricating oil strainer cleaning or replacements were required during the operating cycle.
- Results of engine signature analysis did not identify any significant, abnormal operating conditions in any cylinders during the operating cycle or during the refueling outage.

Conclusion

NAESCo concluded that the DG-1B did not fail until after it was taken out-of-service for the refueling outage and specifically on October 29, 2000. Therefore, based upon DG-1B successfully performing its surveillance requirements and operating satisfactorily during maintenance runs prior to October 29, 2000, NAESCo concluded that DG-1B would have been capable of running at load for longer than its required 24-hour mission time if it had been called upon to do so during the seventh operating cycle. Therefore, NAESCo concluded the risk significance to be very low based on the minimum bounding loaded run time calculations and sensitivity cases in their operability analysis.

(5) SPECIAL INSPECTION CHARTER

MEMORANDUM TO: Paul D. Kaufman, Leader
Special Inspection

FROM: Wayne D. Lanning, Director **ORIGINAL SIGNED BY:**
Division of Reactor Safety

SUBJECT: SPECIAL INSPECTION CHARTER - SEABROOK NUCLEAR POWER STATION

A special inspection has been established to inspect and assess the "B" emergency diesel generator (EDG) failures and damage that occurred at Seabrook Nuclear Power Station between October 29 and November 1, 2000. The special inspection team will include:

Leader:	P. Kaufman, Region, Senior Reactor Inspector, DRS
Members:	F. Bower, Resident Inspector, DRP
	J. Brand, Resident Inspector, DRP
	T. Shedlosky, Senior Reactor Analyst, DRS

This special inspection is in response to notification, by telephone from the senior resident inspector, of the third test failure resulting in damage to the EDG on November 1. The basis for the special inspection is to monitor and assess the licensee's root cause evaluation and corrective actions, independently evaluate the risk significance of the EDG test failures, and determine possible generic implications.

The special inspection was initiated in accordance with NRC Management Directive 8.3 (draft), NRC Incident Investigation Program. The inspection will be performed in accordance with the guidance of Inspection Procedure 93812, Special Inspection. The report will be issued within 45 days following the exit for the inspection. If you have questions regarding the objectives of the attached charter, please contact Michele G. Evans at (610) 337-5224.

Attachment: Special Inspection Charter

Special Inspection Charter

Seabrook Nuclear Power Station

"B" Emergency Diesel Generator Damage During Testing

The objectives of the inspection are to determine the facts surrounding the damage which occurred during testing to the "B" Emergency Diesel Generator (EDG) at Seabrook. Specifically, the team should:

- Confirm the adequacy of the licensee's investigation and root cause evaluation of the EDG test failures and damage.

- Confirm the adequacy of the licensee's corrective actions and extent of condition review for the EDG test failures and damage.

- Independently evaluate the risk significance of the EDG test failures and damage and confirm adequacy of the licensee's risk evaluation.

- Determine possible generic implications associated with the EDG test failures and damage.

- Document the inspection findings and conclusions in an inspection report within 45 days of the exit meeting for the inspection.