



**North  
Atlantic**

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The Northeast Utilities System

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United States Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, D.C. 20555

Seabrook Station  
Diesel Generator Special Report

Enclosed is North Atlantic Energy Service Corporation's, (North Atlantic) report documenting the Diesel Generator failures experienced during the period of September 19 through 22, 1996. The report is being filed in accordance with Technical Specification Surveillance Requirement 4.8.1.1.3 and Technical Specification 6.8.2. Special Report.

Should you have any additional questions regarding this response, please contact Mr. Anthony M. Callendrello, Licensing Manager, at (603) 474-9521, extension 2751.

Very truly yours,

NORTH ATLANTIC ENERGY SERVICE CORP.

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# **DIESEL GENERATOR SPECIAL REPORT**

## **Seabrook Station Emergency Diesel Generator 1A**

The following Diesel Generator Special Report documents three automatic trips of Emergency Diesel Generator 1A (EDG-1A) and other related events involving EDG-1A during the period of September 19 to September 22, 1996. This report is provided pursuant to Technical Specification Surveillance Requirement 4.8.1.1.3 and Technical Specification 6.8.2. One of the trips has been determined to be a valid failure. Two trips and the other related events discussed below were determined to be non-valid tests or non-valid failures. Seabrook Station Technical Specification 3/4.8.1.1 identifies Regulatory Guide 1.108, Revision 1, dated August 1977, "Periodic Testing of Diesel Generator Units Used as Onsite Electrical Power Systems at Nuclear Power Plants" as the basis for determining valid or non-valid tests and failures. At the time of the events described in this report the plant was in Mode 1 at 100 percent power, EDG-1A was inoperable having been taken out of service for maintenance activities and EDG-1B, the opposite train Emergency Diesel Generator, was operable.

### EDG-1A TRIPS

#### Trip #1 September 19, 1996

Following corrective maintenance on the EDG-1A lube oil temperature control valve, DG-V-29A, generator slip ring stoning and access door installation, plant operators started the diesel. This start and load run was designated as a troubleshooting maintenance test to perform collector stoning and determine the effectiveness of the lube oil temperature control valve maintenance. After running for one hour and twenty three minutes, the diesel tripped from full load on high lube oil temperature. Applying the guidance of Regulatory Guide 1.108 Section C.2.e.(7), this test is a non-valid test because the diesel was being run in a maintenance troubleshooting mode to analyze the effectiveness of the maintenance. This diesel run was not intended to establish final diesel operability. It was run using the normal operating procedure for local operation. An on line maintenance plan prepared in support of this maintenance specified the performance of a maintenance run to verify proper temperature control valve operation before the performance of an operability surveillance test. The operability surveillance test is the test performed to verify problem correction.

The cause of this trip was determined to be incorrect factory setting and testing of power pills installed in the lube oil temperature control valve, DG-V-29A. Power pills are thermostatically controlled devices which respond to lube oil temperature to allow the temperature control valve to modulate lube oil flow to a lube oil cooler. Corrective measures included replacement of the temperature control valve and installation of spare power pills. According to the system engineer, the first set of replacement power pills were measured and compared with the length of the original power pills. Both sets were the same length. The length was measured to determine if an adjustment was needed on a low temperature limit screw integral to the lube oil temperature control valve. No adjustment was necessary because the power pills were the same length. Once the engine tripped, the setting on the low temperature limit screw was checked and found to be in tolerance. It was adjusted .013 inches within it's allowed tolerance with the goal of improving temperature performance, but subsequent runs with the replacement power pills did not achieve satisfactory temperature conditions.

It was then that the power pills were replaced again and a spare temperature control valve was installed. The removed power pills were tested on site and did not meet the acceptance criteria of their manufacturer. Other corrective actions included inspecting the diesel internals for signs of damage due to overheating. No damage occurred. The diesel engine lube oil high temperature switch was recalibrated. This switch was found to be within tolerance, but the 'as-found-value' was near the low end of the allowed range. The switch was adjusted higher in it's allowed range.

#### Trip #2 September 20, 1996

EDG-1A was started for an additional maintenance troubleshooting test. After running loaded for thirty two minutes, EDG-1A experienced load shedding and tripped on reverse power. This failure is categorized as a valid test and failure in accordance with Regulatory Guide 1.108 Section C.2.e.(5) because this was a successful start followed by an unsuccessful loading attempt. Even though the engine was being run in a maintenance troubleshooting mode for observation of the lube oil temperature condition, the governor systems were not worked on during this outage. Applying the guidance of Section C.2.e.(8) of Regulatory Guide 1.108, this failure could have resulted in the failure of the diesel generator unit during a test or bona fide signal and as such it is considered a valid failure. The troubleshooting maintenance run was evaluating the lube oil and generator slip ring stoning corrective maintenance. This is the first valid failure in the last twenty and the second valid failure in the last one hundred valid tests, reported on a per diesel generator basis as required by Seabrook Station Unit 1 Technical Specifications.

A root cause analysis was performed for this event. The investigation identified a number of possible components which could have caused the failure, but no conclusive root cause was determined. Thirty minutes prior to the load shed and reverse power trip, a small amount of oil was added to the governor oil reservoir. Oil contamination was suspected as a possible cause, but subsequent oil samples were satisfactory. Temporary test instrumentation was installed to monitor subsequent governor performance, however, some of the monitoring equipment did not function properly on the next diesel run. This run also ended with a load shed and a reverse power trip. (see Trip #3 below).

#### Trip #3 September 20, 1996

EDG-1A was started to troubleshoot the load shed and reverse power trip which occurred earlier in the day (Trip #2). The electrical and mechanical governor were instrumented with temporary instruments prior to the start. The breaker was closed at 22:22 and six minutes later at 22:28 the diesel load shed and tripped on reverse power from about 50 percent of rated load. In accordance with Regulatory Guide 1.108 Section 2.C.e.(7) this is a non-valid test because this was a troubleshooting run to determine the cause of the first load shed and reverse power trip. The cause of this failure like the cause of the first load shed and reverse power trip could not be conclusively determined. Temporary test instrumentation installed to monitor various parameters did not function properly. The temporary test instrumentation was inspected and adjusted. The diesel was restarted and monitored during subsequent troubleshooting runs. The load shedding did not repeat itself in any subsequent runs. The diesel synchronizing circuit developed a problem during one of the runs and is discussed below (see Other Related EDG-1A Events).

After the synchronizing circuit was repaired, the diesel was started and successfully synchronized. Temporary test instrumentation was monitored closely for any abnormal synchronizing circuit or governor indications. The diesel ran satisfactorily through it's entire range during two runs of nine hours

and twelve minutes and three hours and twenty two minutes. A governor lube oil reservoir feed and bleed flush was completed as a precautionary measure based upon the previous governor reverse power trips. An operability surveillance was then performed and completed, and EDG-1A was declared operable at 05:31 on September 22, 1996.

## OTHER RELATED EDG-1A EVENTS

### EDG-1A Synchronizing Circuit Failure

When an attempt was made to synchronize EDG-1A to Emergency Bus E-5 on September 21, 1996, the sync check relay contact provided intermittent contact closure. This failure prevented the EDG-1A output breaker from closing when connected to offsite power sources. The relay was replaced and EDG-1A testing resumed. The breaker successfully closed on all subsequent diesel runs except for one. On that occasion the operator attempted to close the breaker when the diesel generator frequency was slightly outside of the allowed range for parallel operation. The frequency was adjusted within the allowed range and the breaker was closed, paralleling EDG-1A with offsite power. The failure of the synch check relay is a non-valid failure in accordance with Regulatory Guide 1.108 Section C.2.e.(2) because the synchronizing circuit is not operative in the emergency operating mode.

### Auxiliary Lube Oil Pump Inadvertent Start

When EDG-1A was started for the maintenance troubleshooting test prior to the first trip on high lube oil temperature, the auxiliary lube oil pump inadvertently started. During the work on the temperature control valve some lube oil had been drained and replaced. It is suspected that the lube oil system was not totally vented and caused a pressure dip, starting the auxiliary lube oil pump. The diesel was shutdown and the auxiliary lube oil pump was stopped and reset. The lube oil system was thoroughly filled and vented and lube oil pressure was steady during subsequent runs. In accordance with Regulatory Guide 1.108 Section C.2.e.(7) this is a non-valid test because the test was performed in the process of maintenance troubleshooting. Additionally in accordance with Section C.2.e.(2) this would be a non-valid failure because the starting of the auxiliary lube oil pump with EDG-1A operating in the emergency mode would not be detrimental to continued operation.

## CONCLUSIONS

### Root Causes

The root cause of the load shed and reverse power trips of EDG-1A could not be conclusively determined. A formal root cause analysis using Kepner Tregoe problem analysis identified a number of possible causes. The components most likely to have caused the load shedding were instrumented and monitored during subsequent troubleshooting maintenance runs and during the final operability surveillance run. No abnormal indications were observed. The root causes of the non-valid failures, other than the non-valid reverse power trip, have been determined and corrective actions are complete to prevent recurrence of these events.

#### Required Test Interval Schedule

The valid failure documented in this report is the first valid failure of EDG-1A in the last twenty valid tests and the second valid failure in the last one hundred valid tests on a per diesel generator basis. As a result the required test interval schedule in accordance with Seabrook Station's Technical Specifications is at least once per thirty one days. However as a conservative measure, because the root cause of the load shedding on EDG-1A could not be conclusively determined, EDG-1A is being tested weekly. This schedule will continue until four successful tests have been satisfactorily completed. Additionally, North Atlantic has verified that the current test interval schedule is in compliance with Regulatory Guide 1.108. It is noted that the test interval schedule specified in Regulatory Guide 1.108 differs from Seabrook Station Technical Specification Table 4.8-1. It appears that the Technical Specification table incorporates the guidance of NRC Generic Letter 84-15. North Atlantic has initiated a corrective action document to investigate and resolve the differences in these documents.

All components identified in the root cause analysis as possible contributors to the failure either have permanent or temporary instrumentation in place and are being monitored during these runs. As of the date of this report, three successful runs have been completed. No abnormal indications were observed during these runs. At the conclusion of the four weekly test runs, EDG-1A will be returned to a monthly test interval schedule. Replacements for those components which could have caused the load shed events are pre-staged. If the problem recurs, the contributing component will be replaced and a follow up report will be submitted to the Commission to inform them of the nature of the failure.

#### Diesel Unavailability Time

The total time EDG-1A was unavailable as a result of the scheduled maintenance and the subsequent troubleshooting and repairs was seventy one hours and fifty three minutes. Please contact us if you have any questions regarding this report.