February 16, 2007

Mr. Gene St. Pierre
Executive Vice President and Chief Nuclear Officer
Seabrook Station
North Atlantic Energy Service Corporation
P.O. Box 300
Seabrook, NH 03874

SUBJECT: SEABROOK GENERATING STATION - NRC SPECIAL INSPECTION REPORT NO. 05000443/2006016

Dear Mr. St. Pierre:

On January 11, 2007, the NRC completed a Special Inspection at the Florida Power and Light Corporation's (FPL's) Seabrook Generating Station to evaluate the August 30 and 31, 2006, failures of the "A" and "B" emergency diesel generators. The results of the NRC team inspection were discussed on January 11, 2007, with you and other members of your staff. The enclosed report (Enclosure 1) presents the results of that inspection.

The NRC team examined activities 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 selected examination of procedures, representative records and equipment, interviews with personnel, and observations of activities per the NRC team's charter (Enclosure 2).

This report discusses a finding that has been evaluated under the risk significance determination process (SDP) as having very low safety significance (Green). This finding was determined to be a violation of NRC requirements. However, because of its very low safety significance and because it has been entered into your corrective action program, the NRC is treating this finding as a non-cited violation (NCV), consistent with Section VI.A.1 of the NRC's Enforcement Policy. If you deny the NCV, you should provide a response with the basis of your denial, within 30 days of the date of this inspection report to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Region I, the Director of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001, and the NRC Resident Inspector at Seabrook Station.

In accordance with 10 CFR 2.390 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/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

John F. Rogge, Chief
Engineering Branch 3
Division of Reactor Safety

Docket No: 50-443
License No: NPF-86

Enclosures: 1) NRC Inspection Report No. 05000443/2006016
2) NRC Special Inspection Team Charter Memo
3) NRC Special Inspection Team Charter

cc w/encl:
J. A. Stall, FPL Senior Vice President, Nuclear & CNO
M. Warner, Vice President, Nuclear Support Services
R. S. Kundalkar, FPL Vice President, Nuclear Engineering
M. Mashhadi, Senior Attorney, Florida Power & Light Company
M. S. Ross, Managing Attorney, Florida Power & Light Company
J. M. Peschel, Manager, Regulatory Programs
M. Kiley, Plant General Manager, Seabrook Station
J. Dent, Assistant Plant Manager
K. Wright, Manager, Nuclear Training, Seabrook Station
R. Poole, FEMA, Region-I
Office of the Attorney General, Commonwealth of Massachusetts
K. Ayotte, Attorney General, State of New Hampshire
O. Fitch, Deputy Attorney General, State of New Hampshire
D. Harnish, Assistant Attorney General, State of Maine
R. Walker, Director, Radiation Control Program, Dept. of Public Health, Commonwealth of MA
C. Pope, Director, Homeland Security & Emergency Management, State of New Hampshire
J. Giarrusso, MEMA, Commonwealth of Massachusetts
D. O'Dowd, Administrator, Radiological Health Section, DPHS, DHHS, State of New Hampshire
Administrator, Bureau of Radiological Health, State of New Hampshire
J. Roy, Director of Operations, Massachusetts Municipal Wholesale Electric Company
T. Crimmins, Polestar Applied Technology
R. Backus, Esquire, Backus, Meyer and Solomon, New Hampshire
Town of Exeter, State of New Hampshire
Board of Selectmen, Town of Amesbury
S. Comley, Executive Director, We the People of the United States
R. Shadis, New England Coalition Staff

M. Metcalf, Seacoast Anti-Pollution League

Distribution w/encl: **(VIA E-MAIL)**
S. Collins, RA
M. Dapas, DRA
P. Krohn, DRP
B. Norris, DRP
G. Dentel, DRP - Senior Resident Inspector
S. Nelson, DRP - Resident OA
J. Lamb, RI OEDO
H. Chernoff, NRR
E. Miller, NRR, PM
V. Nerses, NRR, PM
T. Valentine, NRR
J. Giantelli, NRR
Region I Docket Room (with concurrences)
ROPreports@nrc.gov
A. Blough, DRS
J. Rogge, DRS
L. Scholl, DRS
W. Cook, DRS
DRS file

SUNSI Review Complete: JFR (Reviewer's Initials)

DOCUMENT NAME: C:\FileNet\ML070510065.wpd
After declaring this document "An Official Agency Record" it will be released to the Public.
To receive a copy of this document, indicate in the box: "C" = Copy without attachment/enclosure "E" = Copy with attachment/enclosure "N" = No copy

OFFICE	RI/DRS		RI/DRS		RI/DRP		RI/DRS			
NAME	LScholl/LLS		JRogge/JFR		PKrohn/PGK		WCook/WAC			
DATE	02/15/07		02/16/07		02/15/07		02/15/07			

OFFICE										
NAME										
DATE										

OFFICIAL RECORD COPY

U. S. NUCLEAR REGULATORY COMMISSION

REGION I

Docket No:	50-443
License No:	NPF-86
Report No:	05000443/2006016
Licensee:	Florida Power and Light Energy Seabrook, LLC (FPL)
Facility:	Seabrook Station, Unit 1
Location:	Post Office Box 300 Seabrook, New Hampshire 03874
Dates:	September 18, 2006 - January 11, 2007
Inspectors:	L. Scholl, Senior Reactor Inspector, DRS, Team Leader G. Dentel, Senior Resident Inspector, DRP M. Patel, Reactor Inspector, DRS W. Cook, Senior Reactor Analyst, DRS (in-office)
Approved by:	John F. Rogge, Chief Engineering Branch 3 Division of Reactor Safety

Enclosure

SUMMARY OF FINDINGS

IR 05000443/2006016; September 18, 2006 - January 11, 2007; Seabrook Station, Unit 1; Other Activities, Event Followup IP 93812. Special Inspection of the August 2006, failures of emergency diesel generators "A" and "B". A violation of 10 CFR 50 Appendix B was identified in the area of corrective actions to prevent recurrence of a significant condition adverse to quality.

The inspection was conducted by two regional inspectors and the senior resident inspector with support from a regional senior reactor analyst. One Green finding was identified during this inspection and was classified as a non-cited violation. The significance of most findings is indicated by their color (Green, White, Yellow, Red) using Inspection Manual Chapter (IMC) 0609, "Significance Determination Process" (SDP). Findings for which the SDP does not apply may be Green or be assigned a severity level after NRC management review. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 3, dated July 2000.

A. NRC-Identified and Self-Revealing Findings

Cornerstone: Mitigating Systems

- Green. The inspectors identified a Green non-cited violation (NCV) for the licensee's failure to comply with 10 CFR 50, Appendix B, Criteria XVI, Corrective Action. The analyses of previous "B" emergency diesel generator (EDG) voltage regulator failures were inadequate in that they failed to identify corrective actions to prevent recurrence. Specifically, as a result of the inadequate evaluation of the cause for the December 7, 2005 event, the "B" EDG voltage regulator failed and resulted in a generator overvoltage condition during a surveillance test on August 31, 2006. The licensee entered the issue in their corrective action program, performed a root cause evaluation and implemented voltage regulator hardware changes to prevent recurrence of the overvoltage condition.

  The finding is more than minor because the voltage regulator failure affected the Mitigating Systems Cornerstone attribute of Equipment Performance and affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events. The function of the EDG is to provide alternating current power to safety systems following a loss of offsite power event. The finding was determined to be of very low safety significance since the EDG was inoperable for a short period of time and the failures were intermittent in nature. The finding has a cross-cutting aspect in the area of problem identification and resolution (sub-category evaluation) in that Seabrook failed to perform adequate analyses of previous events and as a result did not identify appropriate actions to prevent recurrence (Section 4OA3).

B. Licensee-Identified Violations

None

Report Details

Background

On August 28, 2006, emergency diesel generator (EDG) "A" was removed from service for planned maintenance. On August 30, a satisfactory post-maintenance test was performed on the EDG by performing a slow start and a subsequent one hour, full-load run. This test was followed by a fast start test later that day. During the fast start test the diode failure warning light illuminated. Test recorder traces showed normal generator output voltage and frequency. However, data obtained at test points within the EDG voltage regulator indicated there were anomalies with the gate firing circuit output pulses to the silicon controlled rectifiers (SCRs) on the rectifier chassis. As a result, the "A" EDG was declared inoperable pending additional troubleshooting and repairs.

When one of the two EDGs becomes inoperable, Technical Specification (TS) 3.8.1.1.b. requires the remaining EDG be tested within 24 hours. As a result, a fast start surveillance test was performed on EDG "B" on August 31, 2006. During this test, the diode failure light illuminated and the EDG output voltage failed high and could not be controlled in the automatic mode. After approximately one minute, the "B" EDG was shut down and declared inoperable. With both EDGs inoperable, a plant shutdown was performed as required by TS. The event was reported in accordance with 10 CFR 50.72(b)(2)(I) as the initiation of plant shutdown required by Seabrook's Technical Specifications.

The licensee determined that the "A" EDG was inoperable, but available to power the electrical bus in the event of a loss of offsite power. The bases for this determination was that even with the light illuminated the voltage regulator was able to maintain the generator output voltage at the required level. The diode failure light is activated when an imbalance in phase currents to the rectifier chassis are detected. The imbalanced currents are not necessarily indicative of an actual diode failure. The voltage regulator manufacturer was consulted and agreed with the licensee's conclusion that the EDG would be able to operate satisfactorily, even at full generator load.

To maintain the "A" EDG available during this period, troubleshooting was performed first on the "B" EDG. During troubleshooting of the "B" EDG voltage regulator the licensee determined that capacitor C5 in the power chassis had failed. Capacitors C1 through C7 were subsequently replaced and, following satisfactory post-maintenance testing, the "B" EDG was declared operable on September 1, 2006.

As a result of troubleshooting efforts on the "A" EDG the licensee determined that the apparent cause of the diode failure light was a defective T5 transformer and/or gate firing circuit board. Both of these components, as well as several inductors and capacitors within the voltage regulator, were replaced. After satisfactory post-maintenance testing, EDG "A" was declared operable on September 2, 2006.

On September 27, 2006, the "A" EDG experienced another diode failure light illumination during a surveillance test. The cause was determined to be the K-1 contactor. The K1 contactor, R1 resistor, and T12 transformer were all replaced and EDG "A" was declared operable on October 1, 2006, following a satisfactory post-maintenance surveillance test.

As a result of these events, which all involved failures with the EDG voltage regulators, the licensee assembled a team to perform a detailed root cause analyses to determine the cause for the failures. Additionally, the "B" EDG had a history of intermittent voltage regulator problems, including two overvoltage events in 2005. A second objective of the root cause team was to determine why corrective actions from previous events were not successful in preventing the August 2006 failures.

On September 18, 2006, an NRC Special Inspection Team (SIT) commenced this inspection to assess Seabrook's personnel and plant equipment response to the event. The decision to perform this special team inspection was based on deterministic criteria in NRC Management Directive 8.3 and the initial risk assessment. Specifically, the condition involved repetitive failures of safety-related equipment (EDG static exciter/voltage regulators) with potential generic implications. The initial risk assessment characterized the conditional core damage probability to be in the low E-6 range, which is within the overlap region for no additional or special inspection.

EDG Static Exciter/Voltage Regulators (SEVR) Operational Overview

The SEVR excitation system controls the EDG output voltage by controlling the amount of current flowing in the generator field winding. This is accomplished by supplying the three phase alternating current (AC) output from the EDG to the input of a rectifier chassis. The rectifier chassis output provides the source of direct current (DC) to the generator field winding. The level of DC current is adjusted by varying the firing angle of three SCRs in the rectifier chassis. The firing angle is controlled by the gate firing control board which adjusts the firing angle to maintain a desired generator output voltage. Normally, the rectifier bank supplies about 90 amps to the generator field at a no-load condition and 175 amps for a full-load condition. The model of SEVR at Seabrook has two independent, redundant rectifier chassis which can be selected using a transfer switch within the voltage regulator enclosure.

4. OTHER ACTIVITIES (OA)

4OA3 Event Follow-up

.1 Failure of Emergency Diesel Generators "A" and "B"

a. Inspection Scope

This inspection was conducted in accordance with NRC Inspection Procedure (IP) 93812, "Special Inspection," to assess the licensee's response to the failures of the "A" EDG that occurred on August 30, 2006 and September 27, 2006, and "B" EDG failure that occurred on August 31, 2006. The team assessed the licensee's immediate actions and evaluation of the EDG failures. The team performed an independent assessment of the apparent causes for the EDG failures by reviewing troubleshooting data, maintenance records, surveillance tests, voltage regulator recorder traces, the vendor manual and industry technical reports for the specific model voltage regulator in use at Seabrook Station. The team also interviewed engineering personnel involved in

troubleshooting and cause determination activities. The team also reviewed information associated with previous events that may have been precursors to the recent failures.

The team reviewed the licensee's root cause evaluation, including the causal analyses, extent-of-condition review, and corrective actions for equipment and human performance issues. The team also reviewed a root cause investigation report for the August 31, 2006, overvoltage event that was performed for the licensee by an engineering consultant working with the voltage regulator vendor.

The team reviewed the above information to assess whether there were any generic implications or commonalities among the 2006 EDG failures and previous failures, in particular the 2005 "B" EDG overvoltage events. The scope of this review included related CRs, WOs, and causal evaluations. The team also reviewed industry operating experience associated with voltage regulator failures with a focus on the model installed at Seabrook.

The team reviewed the plant technical specifications and emergency action level (EAL) entry conditions specified in plant procedures to verify that licensee actions were consistent with the technical specifications and emergency plan requirements. The team also reviewed the licensee's bases for considering the "A" EDG available when the diode failure light was illuminated.

The team evaluated the risk significance of the failure of both EDGs and assessed the adequacy of the licensee's risk evaluation.

b. Assessment of Licensee Actions and Root Cause Evaluation

The team found that the troubleshooting, repairs, and testing for the August 30 and September 27, 2006, failures of the "A" EDG were appropriate. Based on the troubleshooting results following the August 30 failure, the T5 transformer, which was suspected to be the cause, was subsequently sent to a test laboratory and was found to have a cold solder joint on one terminal which resulted in the lead coming loose when handled. Based on the troubleshooting results following the September 27 failure, the licensee determined that the diode failure light was caused by an intermittent failure of the K1 contactor. Inspection of the removed K1 contactor found some pitting on the main contacts, as well as interference between the movable contacts and the associated arc chutes. A circuit analyses showed that such an intermittent condition could result in the observed data on the voltage regulator recorder traces and in the illumination of the diode failure light.

The troubleshooting and repair efforts for the "B" EDG following the August 31, 2006, failure resulted in the identification of defective capacitors which were replaced. Based on a satisfactory retest, this appeared to address the failure cause and the EDG was returned to service. However, due to the recurring intermittent failures, the licensee continued to investigate the issue by the establishment of a root cause evaluation team. Previous failures were generally focused on the rectifier chassis and the associated selector switch. The team found the current root cause evaluation to be broader in

scope and incorporated several methods to explore possible causes. These methods included in-plant testing, circuit analyses and simulations, detailed component failure analysis, and mock-up testing performed by the voltage regulator vendor. Many of the components used in the mock-up were those that had been removed from the Seabrook voltage regulators. The use of outside expertise was good and their conclusions were well documented and included detailed bases. The results of the licensee's evaluation were that the causes for the two "A" EDG failures (diode failure lights) were the T5 transformer and/or the K1 contactor.

The root cause for the "B" EDG overvoltage events were attributed to a higher than expected impedance in the flyback diode portion of the rectifier chassis circuitry. The high impedance caused one of the SCRs to become latched on during the transient conditions experienced during a fast start of the EDG. Mock-up testing demonstrated the latched condition occurred intermittently when the high impedance existed and no latching occurred when the impedance was low. Contributing causes included the degraded capacitors and imbalances in the voltages to the gate firing circuit and imbalances in the SCR currents. In-plant testing following repairs and balancing of the of the "B" EDG regulator circuitry showed significant improvements in the voltage regulator performance during runs which monitored numerous test points within the regulator. Performance of the "B" EDG more closely matched that of the "A" EDG, which did not have a history of intermittent overvoltage events. The licensee evaluation also correlated the overvoltage events on the "B" EDG with particular rectifier chassis.

Overall, the team concluded the root cause evaluation was a thorough investigation that identified the equipment failure root and contributing causes. The investigation also included a good evaluation of the plant process and program weaknesses that resulted in previous EDG failure investigations not identifying and implementing corrective actions to prevent recurrence. Specifically, station processes and procedures did not require a critical review of previous events and failure analyses to ensure all possible causes had been addressed.

The team found that appropriate corrective actions were implemented or planned to address both the technical and organizational root causes and contributing causes. Corrective actions included the replacement of numerous hardware components (transformers, capacitors, inductors, contactors and rectifier chassis) in the voltage regulator circuits of both the "A" and "B" EDGs, the performance of additional periodic monitoring of regulator circuitry, revisions to the corrective action and maintenance rule program relative to repeat failures, and the establishment of a performance monitoring and/or component replacement program to identify and replace components prior to failure.

The team concluded that the cause of the "A" EDG diode failure light event did not have any commonality with the overvoltage events experienced on the "B" EDG. The overall performance of the "A" EDG voltage regulator was generally good until the August and September 2006 events and has been satisfactory since.

The team did not identify any issues associated with compliance with TS or EALS. A plant shutdown was initiated as required by TS. The team reviewed the licensee's basis for considering the "A" EDG available when the diode failure light was illuminated and determined there was a reasonable basis for the conclusion. Since the "A" EDG would have been able to power the safety-related electrical bus with the diode failure light on, the EAL entry condition for an Unusual Event was not met.

c. Risk Significance of the Event

The Senior Reactor Analyst (SRA) performed a risk assessment, consistent with Management Directive 8.3, for the August 31, 2006, failure of the EDGs. The risk assessment, in conjunction with deterministic criteria being satisfied, supported Region I's decision to conduct a Special Inspection for this event. The assessment was conducted using the Seabrook Standardized Plant Analysis Risk (SPAR) model, Revision 3.11, and its associated Graphical Evaluation Module, in conjunction with the Systems Analysis Programs for Hands-On Integrated Reliability Evaluations (SAPHIRE) Version 7.0, Revision 24. The following assumptions and conditions were used in the risk assessment:

- The "B" EDG was last run successfully (under fast start conditions) on July 23, 2006. The fault exposure time was conservatively based upon T/2, T being equal to 38 days. Therefore, the exposure time assumed for this assessment was 19 days (456 hours).

- Based upon no operator action having been taken to attempt to restart and run the "B" EDG, no operator recovery credit was used in the analysis.

- The "B" EDG failure-to-run probability was set to TRUE, vice 1.0, to account for the unknown cause for the failure to run and the potential impact on the EDG common cause failure probability.

- Based on the "A" EDG being functional, no adjustments were made to its failure probability.

Based on the information known on or about August 31, 2006, the conditional core damage probability (CCDP) for this event was approximately 1E-6. The dominant accident sequence for this condition involved a loss of off-site power initiating event, with a coincident common cause failure of the 1A EDG, failure of the supplemental emergency power system (SEPS) diesel generators, failure to restore either an off-site power source or emergency diesel generator within 4 hours, and a reactor coolant pump (RCP) seal failure. The low 1E-6 CCDP for this condition represented a low to potentially moderate risk significant consequence. As part of that inspection, additional risk evaluations were performed as documented in the "Analysis" section of the following non-cited violation.

d. Non-Cited Violation

The team identified the following non-cited violation associated with the EDG failures.

Introduction: Seabrook experienced a "B" EDG failure on August 31, 2006, due to ineffective corrective actions for a previous December 7, 2005, EDG failure. This finding was determined to be of very low safety significance (Green) and was characterized as a NCV of 10 CFR 50, Appendix B, Criterion XVI, "Corrective Action."

Description: On August 31, 2006, Seabrook experienced an overvoltage event on the "B" EDG during surveillance testing which was required as a result of the "A" EDG being declared inoperable following a post-maintenance test on August 30, 2006. The "B" EDG had experienced five overvoltage events and a KVAR swing event caused by intermittent failures within the voltage regulator. In addition to the August 31, 2006, event, recent similar failures occurred in April 2005 (NRC IR 05000443/2005005) and December 2005 (NRC IR 05000443/2006002). The cause of the April 2005, event was determined to be the rectifier bridge or possibly the gate firing card. The alternate rectifier bridge was selected and the EDG returned to service following a satisfactory test run. After the December 2005, event the licensee concluded misoperation of the gate firing card was the problem and following installation of a new card the EDG was returned to service. Following the August 31, 2006, event the licensee's initial investigation determined that degraded power chassis capacitors were the cause of the failure. Seabrook replaced the capacitors and declared the "B" EDG operable on September 1, 2006.

In October 2006, the licensee performed additional troubleshooting, testing (in-plant and at the voltage regulator vendor facility), and analyses to provide assurance that there were no additional unidentified problems that could have been the cause of the August 2006 event. These efforts found that the power chassis capacitors were not the likely cause of the overvoltage event but that a higher than normal impedance in the flyback diode portion of the rectifier circuit was the root cause. Possible contributing causes included the degraded capacitors as well as an imbalance of the T-5 transformer output phase voltages and gate firing pulses.

Corrective actions, including those for the most recent events, had generally involved replacement of rectifier chassis or gate firing cards, followed by limited retests to support returning the EDG to operation. These actions were not successful in identifying and correcting the cause and therefore did not prevent recurrence. Likewise, contributing causes (voltage imbalances and degraded capacitors) were not identified and corrected. Although results of followup off-site testing and inspection of suspected defective components did not confirm the components were likely causes, no additional cause efforts were initiated in 2006, until the August failures. The failure to take appropriate corrective action to prevent the recurrence of the "B" EDG failure on August 31, 2006, is a performance deficiency.

Analysis. This finding is greater than minor because the failure to ensure the operability of the "B" EDG affected the Mitigating Systems cornerstone attribute of equipment performance and the objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Traditional enforcement does not apply because this condition did not have any actual safety consequence, or potential for impacting the NRC's regulatory function, and is not the result of any willful violation of NRC requirements. The finding was evaluated in accordance with IMC 0609, Appendix A, "Significance Determination of Reactor Inspection Findings for At-Power Situations." The Phase 1 screen identified this deficiency to be of very low safety significance (Green) because the inoperability of the "B" EDG was of an intermittent nature and at no time did the failure condition exist for a period of time greater than the TS allowed outage time.

Based upon the intermittent failure of the "B" EDG only being revealed during fast start surveillance testing, the Senior Reactor Analyst (SRA) conducted an additional risk assessment to support and confirm the Phase 1 screen results. The SRA used the Seabrook Standardized Plant Analysis Risk (SPAR) Model and Graphical Evaluation Model (GEM), Revision 3.21, to further assess the risk impact of this intermittent EDG condition. The SRA made the following modeling assumptions:

- Based upon the last successful fast start of the "B" EDG on July 23, 2006, the exposure time used was 40 days (July 23 to August 31, 2006).

- The root cause of the "B" EDG failure was determined to be unique to the "B" EDG and did not adversely impact the "A" EDG reliability and availability. Consequently, the common cause failure probability for the "A" and "B" EDG remained unchanged (EPS-DGN-CF-RUN maintained at the nominal value of 5.729E-4)

- Based upon the "B" EDG surveillance test results (fast starts only) from August 2005 to October 2006, the failure probability for the "B" EDG was revised to 0.25 (nominal failure to run probability, 2.068E-2) to more accurately reflect the condition of the "B" EDG and its observed reliability since the last corrective maintenance performed on its voltage regulator rectifier chassis.

The SRA determined that this condition represented a change in core damage frequency (CDF) of approximately 4E-7, for the 40-day exposure period. The dominant sequences for this conditional risk assessment involves loss of offsite power initiating events, coincident with the failure of all emergency AC sources, operator failure to recover offsite and emergency power in four hours, and the subsequent failure of the reactor coolant pump seals resulting in a loss of coolant accident. Accordingly, the Phase 3 risk assessment confirms the Phase 1 screening result (Green). The licensee's risk assessment compared favorably with the Phase 3 result. The finding has a cross-cutting aspect in the area of problem identification and resolution (sub-category evaluation) in that Seabrook failed to perform adequate analyses of previous events and as a result did not identify appropriate actions to prevent recurrence.

Enforcement: 10 CFR 50, Appendix B, Criterion XVI, "Corrective Action" requires that for significant conditions adverse to quality, the cause of the condition must be determined and corrective actions taken to prevent recurrence. Contrary to the above, prior to August 31, 2006, Seabrook did not implement corrective actions to prevent recurrence of an overvoltage condition on the "B" EDG. Specifically, on April 24 and December 7, 2005, Seabrook experienced failures of the "B" EDG due to voltage excursions. Seabrook addressed one potential cause by replacing the rectifier chassis for the April 2005 event and then for the December 2005 event Seabrook replaced the gate firing circuit board which was determined to be the cause for that event. On August 31, 2006, the "B" EDG experienced an additional failure due to a voltage excursion. Corrective actions for the August 31 failure included initially replacing several degraded capacitors, retesting the EDG and returning it to service. After additional root cause evaluation efforts the licensee determined that a high impedance in a portion of the rectifier chassis circuitry to be the root cause of the voltage excursions for all three of the 2005 and 2006 events, a condition which was subsequently corrected. Because the finding was of very low safety significance and has been entered into Seabrook's corrective action program (CR 06-10146), this is being treated as a NCV consistent with Section VI.A.1 of the Enforcement Policy: NCV 05000443/2006016-01, Inadequate Corrective Actions Result in a Repeat Failure of the "B" EDG.

4OA6 Meetings, Including Exit

.1 Exit Meeting Summary

On January 11, 2007, the NRC team presented the inspection results to Mr. G. St. Pierre, and other members of the Florida Power and Light Corporation. No proprietary documents were reviewed during the inspection.

ATTACHMENT

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

FPL

R. Jamison, Design Engineering
M. Kiley, Assistant Maintenance Manager
G. Kotkowski, Engineering Supervisor
N. Levesque, Engineering Supervisor
M. O'Keefe, Regulatory Compliance
J. Peschel, Manager, Regulatory Programs
G. St. Pierre, Site Vice-President

NRC Personnel

P. Krohn, DRP
J. Rogge, DRS
G. Dentel, Senior Resident Inspector, Seabrook
B. Norris, Senior Project Engineer

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened and Closed

050000443/2006016-01	NCV	Inadequate Corrective Actions Result in a Repeat Failure of the "B" EDG. (Section 4OA3)

Discussed

05000443/2006002-03	NCV	Inadequate Corrective Actions Result in a Repeat Failure of the "B" EDG

LIST OF ACRONYMS

AC	Alternating Current
Amp	Amperes (unit of electrical current)
CCDP	Conditional Core Damage Probability
CDF	Core Damage Frequency
CFR	Code of Federal Regulations
CR	Condition Report
DC	Direct Current
EAL	Emergency Action Level
EDG	Emergency Diesel Generator
FPL	Florida Power and Light
GEM	Graphical Evaluation Model
IP	Inspection Procedure
kVAR	Kilovars (1,000 VARS)
NCV	Non-cited violation
NRC	Nuclear Regulatory Commission
RCP	Reactor Coolant Pump
SAPHIRE	Systems Analysis Program for Hands-On Integrated Reliability Evaluation
SCR	Silicone Controlled Rectifier
SDP	Significance Determination Process
SEPS	Supplemental Emergency Power System
SEVR	Static Exciter Voltage Regulator
SIT	Special Inspection Team
SPAR	Standardized Plant Analysis Risk
SRA	Senior Reactor Analyst
TS	Technical Specifications
UFSAR	Updated Final Safety Analysis Report
WO	Work Order

DOCUMENTS REVIEWED

Procedures

OX 1426.01, DG 1A Monthly Operability Surveillance, Rev. 08
OX 1426.19, Aligning DG 1B Controls for Auto Start, Rev. 03

Engineering Documents

Updated Final Safety Analysis Report
TR 1011218, Basler SER-CB Voltage Regulators for Emergency Diesel Generators, Dec. 2005
MPR-3002, August 31, 2006 Overvoltage Event-Summary Report of Root Cause Investigation Rev. 1

Electrical Drawings

1-NHY-310971, Diesel Generator Excitation, Rev. 0
1-NHY-310857, Emergency Diesel Generator I-A Stop Circuit Schematic Diagram, Rev. 8
1-NHY-310102, Diesel Generator IA Static Exciter Voltage Regulator Schematic Diagram, Rev. 10

Condition Reports

CR 06-10146 CR 06-06156 CR 06-11199 CR 06-01979 CR 06-01977 CR 06-06156
CR 05-14567 CR 05-14748 CR 05-08122 CR 05-14594 CR 03-07082 CR 02-11586
CR 02-13494 CR 98-19132 CR 02-12142 CR-05-05540 CR 95-46791 CR 99-06904
CR 99-06970 CR 05-15104 CR 02-14058 CR-06-05186 CR 00-13671 CR 01-07312

Work Orders

WO 632792 WO 632791 WO 632790 WO 632789 WO 632039 WO 632039 WO 630943
WO 630940 WO 630938 WO 630937 WO 629429 WO 629391 WO 403720 WO 238799
WO 238796 WO 957901 WO 403720 WO 516080

Other Misc. Documents

MPR 341313004, Material Purchase Requisition for Rectifier Chassis Assembly, 11/12/1993
Test Report No. TR62870-06N, Test Report on Performance Evaluation of Rectifier Chassis P/N 9112104100 and Gate Firing Board P/N 9112006100, Rev. 0 and Rev. 1
RVE 00000193, Request for Vendor Evaluation for Rectifier Chassis Assembly, 08/09/2002
Purchase Requisition 341313-004, Rectifier Chassis Reconditioning, 11/18/1993
Root Cause Analysis Report for CR 06-10146, Both Diesel Generators Inoperable
Instruction Manual, Static Exciter Regulator Model SER-CB, Change 1
Fairbanks Morse Owner's Group Maintenance Guidelines-Voltage Regulator and Excitation System Maintenance Recommendations, Rev. 0

SPECIAL INSPECTION TEAM CHARTER

September 18, 2006

MEMORANDUM TO: John F. Rogge, Manager
Special Team Inspection

Larry L. Scholl, Senior Electrical Inspector, Leader
Special Team Inspection

FROM: A. Randolph Blough, Director **/RA/**
Division of Reactor Safety

Brian E. Holian, Director **/RA by David Lew acting for/**
Division of Reactor Projects

SUBJECT: SPECIAL TEAM INSPECTION CHARTER -
SEABROOK NUCLEAR POWER STATION

A special inspection team (SIT) has been established to inspect and assess an event that occurred on August 31, 2006, at the Seabrook Nuclear Power Station. On that day, Seabrook operators initiated a plant shutdown per Technical Specification (TS) 3.8.1.1 due to two inoperable emergency diesel generators (EDGs). The shutdown was necessitated by problems in the voltage regulation circuitry of both the "A" and "B" EDGs.

The licensee shutdown the plant due to anomalous alarms and indications associated with the EDGs. Specifically, the licensee received a diode failure alarm during a fast start of the "A" EDG for post-maintenance testing. Subsequently, the licensee tested the "B" EDG, during which a diode failure alarm was received and the "B" output voltage went high. There were two previous problems with "B" EDG voltage regulation in 2005. This SIT will also determine if these earlier problems had any commonality with the August 2006 EDG issues.

The special inspection will commence on or about September 18, 2006, with on-site review of the licensee's root cause evaluation (RCE) team activities by the Seabrook Senior Resident Inspector. Division of Reactor Safety electrical specialist inspectors will continue on-site inspection activities during the week of November 13, once the licensee's RCE activities are complete. SIT membership will include:

Manager: John Rogge, Chief, Electrical Branch

Leader: Larry Scholl, Senior Electrical Inspector

Full Time Member: Manan Patel, Electrical Inspector

Part Time Members: Glenn Dentel, Senior Resident Inspector
William Cook, Senior Risk Analyst

Enclosure

Region I, in consultation with the Offices of Nuclear Reactor Regulation and Nuclear Security and Incident Response, is initiating this special team inspection in accordance with NRC Management Directive 8.3, “NRC Incident Investigation Program.” The decision to perform this special team inspection was based on deterministic criteria in Management Directive 8.3 and the initial risk assessment. Specifically, the condition involved repetitive failures of safety-related equipment with potential generic implications. The initial risk assessment characterized the conditional core damage probability to be in the low E-6 range, which is within the range for a special inspection.

The inspection will be performed in accordance with the guidance of NRC Inspection Procedure 93812, “Special Inspection,” and the inspection report will be issued within 45 days following the exit meeting for the inspection. If you have any questions regarding the objectives of the attached charter, please contact Randy Blough at 610-337-5126.

Enclosure: Special Inspection Charter

Special Inspection Team Charter

Seabrook Nuclear Power Station

Seabrook Emergency Diesel Generator (EDG) Voltage Regulator Failures

Information regarding the event: On August 28, 2006, the “A” EDG was removed from service for planned maintenance and declared inoperable. During a slow start maintenance run on August 30, the “A” EDG came up to rated speed and voltage, and was loaded to the E5 safety bus for one hour. During a fast start run on the evening of August 30, the “A” EDG initially came up to rated speed and voltage (not loaded). However, a diode trouble light illuminated on the local EDG panel during the run. Because of the potential operability implications of this light, the licensee decided to shut down the “A” EDG and scheduled a run of the “B” EDG, as required by Technical Specifications (TS). Concurrently, licensee personnel began troubleshooting activities on the “A” EDG. During a subsequent fast start operability run on August 31, the “A” EDG came up to rated speed and voltage (not loaded) with no anomalous indications. The licensee further refined its troubleshooting activities by developing a plan which identified seven likely causes.

Later the same day, the “B” EDG was tested per TS and initially came up to rated speed, but output voltage failed high. The “B” EDG was promptly shutdown and declared inoperable per TS 3.8.1.1 on August 31, at 2:15 p.m. TS’s required the restoration of one EDG to an operable status within two hours, or a plant shut down to hot standby within the next six hours. Based on the lack of a clearly definable success path, FPL Seabrook management initiated a plant shutdown per the TS at 3:30 p.m. on August 31. The plant reached Mode 3 (hot shutdown) at normal operating temperature and pressure at approximately 9:00 p.m. on August 31.

On September 1, at approximately 2:00 p.m., following replacement of several failed capacitors on "B" EDG and satisfactory post maintenance testing, the "B" EDG was declared operable. On September 2, at approximately 7:00 p.m., following replacement of several components in the voltage regulation circuit (capacitors, an internal transformer, inductors, and a gate firing card), the "A" EDG was declared operable.

Throughout the event, the licensee considered the “A” EDG functional. All off-site power lines and the supplemental emergency power system (a separate EDG capable of supplying a safety bus) were available. Additional details are provided in the Preliminary Notifications (ML062440470 and ML060970334).

Enclosure

Objectives of the Special Inspection: The objectives of the special inspection are to evaluate the circumstances associated with the event described above. Specifically, the inspection should:

a. Independently assess the apparent cause(s) that contributed to the EDG failures including any relation to previous maintenance, surveillance tests, equipment or component issues, trending data or precursor events.

2. Evaluate the licensee's root cause evaluation (when available), including causal analyses, extent-of-condition reviews, and corrective actions for equipment or human performance issues, as applicable.

3. Determine if any generic implications or commonalities exist among the EDG failures, including, at least, the recent "A" and "B" EDG failures and the 2005 "B" EDG failures.

4. Review compliance with technical specifications and emergency action level entry conditions including the availability fo the "A" EDG to provide electrical power to a safeguards bus prior to repair activities. Update risk estimates of conditional core damage probability, as appropriate.

5. Document the inspection findings and conclusions in a special inspection report in accordance with Inspection Procedure 93812 within 45 days of the exit meeting for the inspection.