

June 7, 2004

Mr. Bryce L. Shriver  
Senior Vice President and Chief Nuclear Officer  
PPL Susquehanna, LLC  
769 Salem Blvd., NUCSB3  
Berwick, PA 18603-0467

SUBJECT: SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 AND 2 - NRC  
SPECIAL INSPECTION REPORT 05000387/2004007 AND 05000388/2004007

Dear Mr. Shriver:

On April 23, 2004, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your Susquehanna Steam Electric Station Units 1 and 2. The enclosed special inspection report documents the inspection findings, which were discussed on April 23, 2004, with Mr. R. Anderson and other members of your staff.

The inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. The inspectors reviewed selected procedures and records, observed activities, and interviewed personnel.

This report documents two findings of very low safety significance (Green). These findings were determined to involve violations of NRC requirements. However, because of the very low safety significance and because they are entered into your corrective action program, the NRC is treating these findings as non-cited violations (NCVs) consistent with Section VI.A of the NRC Enforcement Policy. If you contest any NCV in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington D.C. 20555-0001; with copies to the Regional Administrator, Region I; the Director, Office of Enforcement, and the NRC Resident Inspector at Susquehanna Steam Electric Station.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) 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 Website at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Sincerely,

***/RA/WDLanning for***

John F. Rogge, Chief  
Electrical Branch  
Division of Reactor Safety

Mr. Bryce L. Shriver

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Docket Nos.: 50-387, 50-388  
License Nos: NPF-14, NPF-22

Enclosures:

- 1) Inspection Report 05000387/2004007 and 05000388/2004007
- 2) Attachment (1) Supplemental Information
- 3) Attachment (2) Special Inspection Charter, Susquehanna SES

cc w/encl:

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**U.S. NUCLEAR REGULATORY COMMISSION**

REGION I

Docket Nos. 05000387, 05000388

License Nos. NPF-14, NPF-22

Report No. 05000387/2004007  
05000388/2004007

Licensee: PPL Susquehanna, LLC

Facility: Susquehanna Steam Electric Station, Units 1 and 2

Location: 769 Salem Blvd.,  
Berwick, PA 18603

Dates: February 9-13 and April 21-23, 2004

Inspectors: R. Fuhrmeister, Sr. Reactor Inspector, Electrical Branch  
D. Werkheiser, Reactor Inspector, Electrical Branch

Approved by: John F. Rogge, Chief  
Electrical Branch  
Division of Reactor Safety

Enclosure

## SUMMARY OF FINDINGS

IR 05000387/2004007, 05000388/2004007; 2/9/2004 - 2/13/2004 and 4/21/2004 - 4/24/2004; Susquehanna Steam Electric Station, Units 1 and 2; Special Inspection Report

The report covered a special inspection by two regional specialist inspectors. Two Green non-cited violations (NCV) were identified. 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 non-cited violation for the licensee's failure to identify loose governor mounting screws on the 'A' EDG prior to January 2004. The loose mounting screws could have been identified in September and December 2003 when oil leaks were identified, documented, and cleaned without determining the source of the leak.

The finding is more than minor because, if not corrected, the loose governor mounting screws could have resulted in erratic operation of the diesel generator when needed to mitigate loss of offsite power scenarios. (4OA5)

- Green. The inspectors identified a non-cited violation for the licensee's failure to comply with work package instructions during replacement of the governor on the "D" emergency diesel generator (EDG). This violation is related to the failure to torque the connecting bolt between the governor output shaft arm and the fuel rack linkage, which resulted in the fuel rack linkage becoming detached in March, 2003, making the EDG inoperable.

This finding is greater than minor because it affected the Mitigating System Cornerstone objective of equipment reliability, in that the function of the 'D' emergency diesel generator was compromised when the fuel rack linkage separated. The finding is of very low safety significance because the other three divisional EDGs remained operable, and the 'E' EDG could have been substituted for the failed 'D' EDG. (4OA5)

### B. Licensee-Identified Violations

None.

## Report Details

### Background and Sequence of Events

In July 2000, PPL Susquehanna LLC (PPL) replaced the EGB50 electro-mechanical governor on the 'D' emergency diesel generator (EDG). The new governor was set in place and connections to the fuel rack linkage and oil cooler lines were made on July 5.

On March 18, 2003, during a monthly surveillance test on the 'D' EDG, shortly after the 'D' EDG reached 3000 kW load, the load dropped to approximately 2000 kW and leveled off. Investigation by PPL determined that the load drop was due to the bolt which attaches the fuel rack linkage to the governor output arm falling out. This event is described in detail in NRC Integrated Inspection Report 05000387/2003-004 and 05000388/2003-004.

In August 2003, PPL replaced the EGB50 electro-mechanical governor on the 'A' EDG. The new governor was set in place and connections to the fuel rack linkage and oil cooler lines were made on August 23. Torquing of the governor hold down screws was performed on August 24.

A condition report and work order were generated on September 15, 2003, to document a puddle of oil under the EGB50 governor on top of the flywheel cover. The "Fix It Now" (FIN) Team cleaned up the oil, determined that the governor oil level was adequate, and closed the work order. The source of the oil leak was not determined.

During a monthly surveillance test run on December 10, 2003, a similar puddle of oil was once again identified on top of the flywheel cover. The actions taken by the FIN Team were similar, except that the work order was left open. The source of the oil leak again was not determined.

During a monthly surveillance run conducted on January 25, 2004, the operator at the 'A' EDG noted unusual fuel rack cycling when the EDG was first loaded to 500 kW. The operator later investigated and noted an oil leak at the base of the EGB50 governor, and that the governor oil level appeared to be low. The operator noted some movement of the governor when the fuel racks went to the fuel off position during the engine shutdown. Investigation by PPL found two of the mounting screws to be finger tight, and the other two were found to be less than finger tight.

On January 29, 2004, PPL identified a flange leak on the emergency service water side of the lubricating oil cooler on the 'B' EDG. Subsequent investigation determined that about half the bolts on the west water box joint of the heat exchanger were not adequately tightened.

#### **4. OTHER ACTIVITIES [OA]**

Enclosure

40A5 Other1. Oil Leaks From 'A' Emergency Diesel Generator Governor Mounting Flangea. Inspection Scope

This inspection was conducted in accordance with NRC Inspection Procedure (IP) 93812, "Special Inspection," to assess PPL's response to a continuing problem of loose bolting on the EDGs. See Attachment 2 for charter.

The team reviewed the PPL root cause analysis for the 'A' EDG governor loose mounting screws, the condition reports relating to the issues, the work orders for governor installation, operability determinations for the loose governor mounting screws, EDG vendor manual torquing specifications, and the PPL torquing procedure and the PPL maintenance training on torquing. The team also discussed torquing process and expectations with maintenance personnel, training personnel, work planning personnel, and system engineering personnel.

The review also included condition reports for loose bolts associated with the 'B' and 'D' EDGs and their associated operability determinations. The team also reviewed the work orders generated to torque check critical components on the EDGs, and reviewed work orders for work scheduled on the EDGs later in the year.

b. Findings

Introduction. The team identified a Green NCV for the failure to identify and correct a non-conformance, as required by Criterion XVI of Appendix B to Part 50 of Title 10 of the Code of Federal Regulations (10 CFR 50).

Summary. The discovery of loose governor mounting screws on the 'A' EDG is the second instance of loose fasteners related to the governor replacement work. (The first instance occurred in March 2003, when the fuel rack linkage on the 'D' EDG became detached from the governor output shaft and is discussed in detail in Section 40A5 of this report). The first opportunity to identify the loose mounting screws occurred in September 2003, when an oil leak below the governor was identified and documented. The oil leak was cleaned up and the work order closed without identifying the source of the leak. The second opportunity occurred in December 2003, when an oil leak below the governor was again identified, documented and cleaned without identifying the source.

PPL performed a formal root cause analysis after the governor was observed to move during engine shutdown on January 25, 2004.

Description and Chronology of Degraded Condition

In August 2003, PPL Susquehanna LLC (PPL) replaced the EGB50 electro-mechanical

governor on the 'A' emergency diesel generator (EDG). The new governor was set in place and connections to the fuel rack linkage and oil cooler lines were made on August 23. Torquing of the governor hold down screws was performed on August 24. Post-maintenance testing and operability testing were conducted August 31, 2003, and the 'A' EDG was declared operable and returned to service.

A condition report and work order were generated on September 15, 2003, to document a puddle of oil under the EGB50 governor on top of the flywheel cover. The "Fix It Now" (FIN) Team cleaned up the oil, determined that the governor oil level was adequate, and closed the work order. The source of the oil leak was not determined.

Three routine monthly surveillance test runs were conducted before a similar puddle of oil was once again identified on top of the flywheel cover on December 10, 2003. The actions taken were similar, except that the work order was left open. The source of the oil leak was again not determined, and the work order was sent to planning to replace the gasket under the governor, the most likely source of the leak.

During a monthly surveillance run conducted on January 25, 2004, the operator at the 'A' EDG noted unusual fuel rack cycling when the EDG was first loaded to 500 kW. The operator later investigated and noted an oil leak at the base of the EGB50 governor, and that the governor oil level appeared to be low. The 'A' EDG was shut down and declared inoperable. The operator noted some movement of the governor when the fuel racks went to the fuel off position during the engine shutdown. PPL assembled an investigation team, and formulated a plan to check the EGB50 mounting screws for proper torque. Two of the mounting screws were found to be finger tight, and the other two were found to be less than finger tight. The mounting screws were torqued to the manufacturer recommended level.

PPL formed an investigation team which checked the governor mounting screw torques on the other four EDGs, and found them less than specified. All were retorqued to the vendor recommendation. Operability determinations were performed to evaluate the condition. Other critical components on the EDGs (starting air, combustion air, lubricating oil, fuel oil, structural components) were checked for proper bolt torques with no discrepancies identified. Since similar electro-mechanical governors are used on the high pressure coolant injection and reactor core isolation cooling turbines, their mounting screw torques were also checked. No anomalies were found.

The PPL team evaluated two apparent problems: Why were the mounting screw torques less than specified and, why did the organization fail to identify the loose governor mounting joint when oil leaks had been identified and documented twice? While the PPL team did not identify the cause of the loose screws, five potential causes were identified and corrective actions generated to address each potential cause. The PPL team attributed the failure to identify the loose joint to a combination of factors: lack of questioning attitude (the source of the leak was not identified for several months), less than adequate equipment monitoring, and a general tolerance of leaks at the station.

Analysis. The failure to identify and correct loose governor mounting screws on the 'A' EDG was a performance deficiency. This finding is greater than minor because, if left uncorrected, the problem would have become a more significant safety concern. Continued operation with loose governor mounting screws would have resulted in

additional loosening of the screws, and could have led to unstable operation of the 'A' EDG under loss of offsite power conditions. Using Phase 1 of the Significance Determination Process (SDP) for Reactor At-Power Situations, the inspectors determined that this finding is of very low safety significance (Green) because the loose governor mounting screws did not result in an actual loss of safety function of the EDGs, and did not screen as potentially risk significant for external events.

Enforcement. Criterion XVI, "Corrective Actions," of Appendix B to 10 CFR 50 requires that deficiencies, deviations and non-conformances be promptly identified and corrected. Contrary to the above, prior to January 2004, PPL Susquehanna LLC failed to identify and correct loose governor mounting screws on the 'A' EDG. Because this failure to identify and correct non-conformances was of very low significance and has been entered into PPL's corrective action program, this violation is being treated as an NCV, consistent with Section VI.A of the NRC Enforcement policy: NCV 05000387, 388/2004007-01, Failure to Identify and Correct a Non-conformance.

2. (Closed) URI 05000387, 05000388/2003004-03; Maintenance Work Instructions Not Implemented to Tighten a 'D' Emergency Diesel Generator Governor Bolt

Introduction. A Green NCV was identified for failure to comply with Technical Specification 5.4.1, related to the use of written procedures for pre-planned maintenance that can affect the performance of safety related equipment.

Description. During a monthly surveillance test run in March, 2003, the load on the 'D' EDG suddenly and unexpectedly decreased from 3000 kW to 2000 kW. During the test, EDG output is increased from 0 kW to 3600 - 4000 kW in a series of controlled steps, with specified warm-up periods at each increment of approximately 1000 kW of load. Shortly after 'D' EDG output power reached 3000 kW, power dropped rapidly to 2000 kW and leveled off.

Investigation by the PPL FIN Team found that the fuel rack linkage had become detached from the governor output shaft. A bolt that is designed to connect the output shaft to the fuel rack linkage was found to have backed out. The 'D' EDG was declared inoperable and the appropriate limiting condition for operation was entered. With concurrence of operations and engineering personnel, FIN Team personnel attempted to replace the bolt with the engine running. During the attempt to replace the bolt, 'D' EDG load rapidly increased, at which time the operator at the local controls manually tripped the engine. The bolt was installed and tightened with the engine shut down. The 'D' EDG was subsequently restarted, and successfully completed the surveillance test. After completion of the test, the 'D' EDG was declared operable and returned to service. PPL performed a root cause analysis and determined that the connecting bolt was not adequately secured during replacement of the governor in July 2000. The significance of this finding had not been determined at the conclusion of the inspection.

#### Analysis

This finding is a performance deficiency because PPL did not adequately implement

written maintenance instructions during replacement of the EDG governor. This finding is more than minor because it adversely impacted the equipment performance attribute of the mitigating systems cornerstone objective, in that, the "D" EDG was not capable of performing its safety function for a period of time in excess of the TS allowed outage time.

This finding was determined to be of very low safety significance (green), using the NRC Significance Determination Process (SDP). An SDP Phase-3 risk analysis evaluated this finding based on an EDG mission time of 14.6 hours and a fault exposure time period of approximately 3 months. The risk review identified the dominant core damage scenario to be a loss of off-site power (LOOP). The risk analysis concluded that the likelihood of core damage due to a loss of all AC power was not significantly increased while the "D" EDG was not capable of mitigating a loss of offsite power event because:

- Other EDGs remained available during that period
- The "E" EDG was available to substitute for the "D" during a portion of the period
- The "D" EDG would have been available to perform a portion of its safety function during that period

This finding is related to the Problem Identification and Resolution (PI&R) cross-cutting area because PPL did not identify this performance deficiency during their corrective action cause review for the "D" EDG in-service failure of March 19, 2003. (CR 460227)

This finding is also related to the Human Performance cross-cutting area, because maintenance technicians did not adequately implement written work instructions. As a result, the EDG was returned to service in a degraded condition, and subsequently became unable to perform its safety function.

Enforcement. Because this failure to comply with Technical Specification 5.4.1 is of very low safety significance and has been entered into PPL's corrective action program, this violation is being treated as a NCV, consistent with Section VI.A of the NRC Enforcement Policy: NCV 05000387, 388/2004007-02, Maintenance Work Instructions Not Implemented to Tighten a 'D' Emergency Diesel Generator Governor Bolt.

#### 40A6 Meetings, including Exit

On April 23, 2004, the inspectors presented the inspection results to Mr. R. Anderson and other members of the PPL staff.

Some of the information reviewed during the inspection was marked as proprietary. All proprietary information was returned to PPL at the end of the inspection. The inspectors verified that this inspection report does not contain proprietary information.

**ATTACHMENT 1**

**SUPPLEMENTAL INFORMATION**

**A. PARTIAL LIST OF PERSONS CONTACTED**

PPL Susquehanna, LLC

R. Anderson, Vice President of Nuclear Operations  
S. Kuhn, Maintenance Manager  
R. Pagodin, Station Engineering Manager  
T. Harpster, Plant Support Manager  
A. Wrape, Quality Assurance Manager  
J. Ladick, Maintenance Manager  
C. Kiger, Work Management Supervisor  
L. Brosius, Work Management Planner  
R. Bogar, System Engineer

U.S. Nuclear Regulatory Commission

S. Hansell, Sr. Resident Inspector  
F. Jaxheimer, Resident Inspector  
J. Richmond, Resident Inspector

**B. LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED**

Opened

NONE

Opened and Closed

05000387, 05000388/2004007-01    NCV    Failure To Identify Loose Governor Hold-down Bolts

05000387, 05000388/2004007-02    NCV    Maintenance Work Instructions Not Implemented to Tighten a 'D' Emergency Diesel Generator Governor Bolt

Closed

05000387, 05000388/2003004-03    URI    Maintenance Work Instructions Not Implemented to Tighten a 'D' Emergency Diesel Generator Governor Bolt

Discussed

NONE

**C. LIST OF DOCUMENTS REVIEWED**

Procedures

NDAP-OO-0706, Rev. 2, Process for Issues Involving Significant Regulatory Interaction  
 NDAP-QA-0510, Rev. 3, Troubleshooting Plant Equipment  
 NDAP-QA-0703, Rev. 5, Operability Assessments and Requests for Enforcement Discretion  
 MT-AD-509, Rev. 5, Control of Minor Maintenance Activities  
 MT-GM-015, Rev. 15, Torquing Guidelines

Work Orders

265805	297070	307580	391166	413764	445381
460312	460811	460834	469377	509261	529156
532159	544085	544746	544895	544899	544902
544904	544905	545912	545916	545917	545921

Condition Reports

460227	487998	489296	498084	498436	498439
504149	508269	508825	517302	522566	522991
523581	532012	543172	543183	543197	543376
543502	544212	544421	544621	544874	544926
546708	547357				

Miscellaneous Documents

NRC Integrated Inspection Report 50-387,388/03-04  
 Cooper Energy Services Engineering Standard SD-123  
 Cooper Energy Services Service Representative Project Report, dated 1/29/04

**D. LIST OF ACRONYMS**

CFR	Code of Federal Regulations
EDG	Emergency Diesel Generator

FIN Team	Fix-It-Now Team
IMC	Inspection Manual Chapter
IP	Inspection Procedure
kW	Kilowatt
NCV	Non-cited Violation
NRC	Nuclear Regulatory Commission
PPL	PPL Susquehanna LLC
SDP	Significance Determination Process
URI	Unresolved Item

**ATTACHMENT 2**

**Special Inspection Charter**  
**Susquehanna Steam Electric Station**

**Emergency Diesel Generator Bolts Not Fully Tightened**

The objectives of the special inspection are to determine the facts surrounding the not fully tightened bolts found on the “A”, “B” and “D” emergency diesel generators at the Susquehanna Steam Electric Station in the period of March 2003 through January 2004. Specifically, the inspection should:

1. Independently evaluate the equipment and human performance issues to assess the adequacy of PPL’s investigation and root cause evaluation as to the identification of the performance deficiency or deficiencies, extent of condition review, assessment of potential common mode failures, root cause(s) and corrective actions.
2. Independently evaluate the adequacy and quality of PPL’s response to assess emergency diesel generator operability and reliability.
3. Independently evaluate the adequacy of maintenance and engineering response and PPL’s implementation of maintenance procedures for tightening critical bolts on emergency diesel generators and other important equipment.
4. Assess whether PPL’s investigation appropriately considered maintenance training issues and effectiveness.
5. Independently evaluate the risk significance of the not fully tightened bolts on the emergency diesel generators.
6. Assess the adequacy of PPL’s plans for corrective actions for the equipment and human performance issues.
7. 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.
8. Assessment of potential tampering is not within the scope of this special inspection. This aspect will be addressed by Region 1’s Radiation Safety and Safeguards Branch.