

U. S. NUCLEAR REGULATORY COMMISSION  
REGION I

REPORT/DOCKET NOS. 50-387/93-08  
50-388/93-08

LICENSE NOS. NPF-14  
NPF-22

LICENSEE: Pennsylvania Power and Light Company  
2 North Ninth Street  
Allentown, Pennsylvania 18101

FACILITY NAME: Susquehanna Steam Electric Station

INSPECTION AT: Allentown, Pennsylvania  
Salem Township, Pennsylvania  
King of Prussia, Pennsylvania

INSPECTION DATES: August 16 - 20, 1993

INSPECTORS: Richard S. Paroby, Reactor Engineer Co-op

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11/16/93  
Date

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11/16/93  
Date



Areas Inspected: The inspection reviewed PP&L corporate design engineering organization and activities, site technical support, installation and testing of plant modifications, and the motor-operated valve program for both units.

Inspection Results: The licensee has recently completed a reorganization of the Engineering Department. This has improved the department's efficiency and reduced its overall workload. Also, some reduction in personnel was involved. Engineering programs and issues are well integrated with the PP&L Nuclear Department strategic goals and business plans. A revised Engineering Deficiency Report system has shown improvements in areas related to operability and reportability determinations. The licensee's GL 89-10 program was put on hold in early 1993, in order to revise the engineering methodology used to perform thrust calculations and to determine correct switch settings.



## DETAILS

### 1.0 ENGINEERING AND TECHNICAL SUPPORT PROGRAM ACTIVITIES (37700)

#### 1.1 Engineering Organization

A two year planned transition was being implemented in accordance with the Organizational Effectiveness Review (OER) to restructure the engineering organizations into functional category groups and eliminate the alignment along basic engineering disciplines. The realigned engineering organization consists of the System Engineering, Nuclear Technology, Modifications, and Nuclear Fuels groups.

This realignment is designed to improve utilization of engineering resources, reduce the overall engineering workload, increase work efficiency, and increase individual ownership and technical responsibility of engineering tasks. Before the reorganization, the system engineers were working approximately 25-30% overtime. After the reorganization was substantially completed, system engineers averaged about 5-8% overtime. The reorganization also increased interactions between the engineering organizations and the site and improved the level and effectiveness of communications between those groups. There is improved engineering support of site activities and an increased safety perspective on the part of both engineering and site groups. The engineering programs and issues within the reorganized department are well integrated with the PP&L Nuclear Department strategic goals and business plans.

As of August 1993, the reorganization was physically in place. The OER implementation plan projected two years to complete the reorganization and to make final adjustments as necessary. On November 9, 1993, the licensee indicated that the reorganization was structurally in place. However, minor organizational enhancements will be ongoing as necessary to adjust to changing work loads and functional requirements. Ongoing procedure revisions and upgrades will require organizational effectiveness reviews that may result in additional refinements in the engineering organization.

#### 1.2 Self Assessment Processes

The licensee conducted a Self-SALP in May 1993, and made a formal presentation of the results to Region I management. This self-assessment:

- reviewed the licensee's own assessments, audits, significant events, third party reviews, and past NRC inspections to determine strength and weaknesses;
- focused on management;



- acknowledged the need to manage employee concerns, and;
- acknowledged need to pursue better engineering training, improvements in system performance, and in management of deficiency resolutions.

### 1.3 Control of Design Changes and Modifications

#### Reactor Vessel Water Level Instrumentation Modification Installation

PP&L recently developed a plant modification to install new reactor vessel level instrumentation designed to overcome potential water level indication inaccuracies caused by the evolution of non-condensable gases from the level instrument reference legs. The inspectors reviewed the modification package and observed the progress of equipment installation. System engineers were knowledgeable on details of the modification and closely monitored its installation. An appropriate level of QA/QC inspections were designated to observe the installation and to verify that the specified levels of work quality were present. The work practices observed by the inspectors were well controlled and the installed equipment met the specifications and requirements contained in the modification work packages. Post installation tests were included with the modification package and they specified the appropriate functional and preoperational tests for the new instrumentation.

### 1.4 Engineering Deficiency Reports (EDRs)

As detailed in NRC inspection reports 50-287;288/92-14, 50-287;288/92-28 and 50-287;288/93-04, the licensee's EDRs lacked detailed information related to plant events, did not identify potential generic implications of events, and did not directly address the potential impact of EDRs on technical specifications operability criteria. Also, the reportability evaluation process for nonconforming conditions was not adequately defined.

In recognition of these concerns, PP&L formed an Engineering Discrepancy Management Task Group to examine the EDR process in depth and to make recommendations for improvement. This task group identified improvements in the processes of reporting, resolving, tracking, and closing EDRs. A new Nuclear Department Administrative Procedure, NDAP-QA-0740, was issued to document the improved Engineering Deficiency Report process.

Since many EDRs are resolved through the installation of a plant modification, the licensee allows one refueling cycle to close an EDR after it is issued. The goal was not to extend more than 5% of the EDRs beyond one refueling outage. A small number of EDRs were extended beyond this goal. The licensee documented justifications for extending these EDRs. In all cases, these justifications were reasonable for extending the due date. The inspectors verified that the modifications associated with the extended EDRs were being prepared and were scheduled for installation the following refueling outage. In most cases, these extensions involved minor modifications; however, some major modifications were also



extended. For example, modifications associated with EDR #G10091, "Single Failures that Affect Operability of Equipment Required for Accident Mitigation and Cause Degraded Bus Voltages," were extended twice; once to November 19, 1993, and then again to the end of the sixth refueling outage in Unit 2 to allow for installation. Although delayed, modifications associated with EDR #G00088, "Recirculation Pipe Jet Impingement on MSIV Operator and Other Targets," were still within the deadline for a commitment made to the NRC, and modifications associated with EDR #G10112, "Maximum Allowable Torque Switch Settings," still met the licensee's schedule for implementing their Generic Letter 89-10 program.

The licensee also has a goal to have less than 20% of all EDRs open for more than 180 days. The inspectors noted that approximately 60% of all open EDRs were more than 180 days old. The inspectors also noted that 80% of the EDRs opened in the past 12 months and 43% of those opened in the previous 12 months were open primarily due to the unavailability of a refueling outage to facilitate installation. However, this situation is not consistent with the goal to expect only 20% of the EDRs to be open for more than 180 days. Overall, the licensee is making an effort to close EDRs as soon as possible and the process for processing and resolving engineering deficiencies appears adequate and timely.

The inspectors interviewed SSES control room personnel to obtain an onsite perspective of the new EDR process. One Shift Supervisor noted that improvements have been noticed under the revised system, especially with the way EDRs are now communicated to the control room supervisors. Operability concerns are communicated more quickly to the control room from PP&L headquarters and Shift Supervisors are brought into EDR problems at a much earlier point in order to get SRO insights.

## **2.0 NRC BULLETIN 93-02, "DEBRIS PLUGGING OF EMERGENCY CORE COOLING SUCTION STRAINERS"**

NRC Bulletin 93-02 required licensees to examine their practice of using fibrous materials in temporary filters within the containment during refueling, and the storage of temporary filters during operation when the containment is closed. Immediately following a LOCA, fibrous materials could become dislodged and be transported to the suppression pool where a sufficient accumulation of fibre could contribute to a partial loss of net positive suction head (NPSH) in emergency core cooling system (ECCS) pumps during the post-LOCA recirculation phase of containment cooling. PP&L responded to the Bulletin stating that they did not use temporary filters and, therefore, would not have this problem. However, they reported their ongoing assessment of the impact on ECCS suction strainers of debris and corrosion products adhering to permanently installed fibrous material (e.g., insulation) that could become dislodged as a result of a pipe break.

PP&L issued a voluntary licensee event report (LER) 93-007-00, regarding the potential blocking of ECCS suction strainers from containment debris. Within the LER, PP&L explained the methodology and assumptions used to analyze "jet impingement" conditions inside containment after a pipe break. The analysis concluded that some amount of fibrous insulation could find its way to the suppression pool and cause partial plugging of the ECCS suction strainers. The inspectors discussed the scenario outlined in the LER and the licensee demonstrated how the event described was plausible.

The licensee subsequently issued a modification to replace fibrous insulation considered susceptible to shredding during a steam line break in the most vulnerable areas of the containment. The modification would replace the old material with a mirror-type canned metal insulation. The inspector observed several areas where the insulation had been replaced inside the containment and noted that the new insulation contained no fibrous material. Discussions with PP&L engineers and a review of modification package 93-3058E indicated that all the fibrous insulation would be replaced in the containments buildings at both Units 1 & 2. This work is expected to be completed over the next several outages.

The licensee is also in the process of issuing a procedure to backflush potentially blocked ECCS strainers with nitrogen from a 2400 psig source during an accident. The procedure is to be issued when the fittings needed to connect the nitrogen bottles are received on site.

### **3.0 NRC GENERIC LETTER (GL) 89-10, SAFETY-RELATED MOTOR-OPERATED VALVE TESTING AND SURVEILLANCE PROGRAM UPDATE**

During September 23-27, 1991, the NRC conducted a team inspection (report 50-287/91-80; 50-288/91-80) to assess the GL 89-10 program at the Susquehanna Steam Electric Station (SSES). In general, the team found the existing MOV program to be acceptable. However, there were unresolved and open items related to specific aspects of the program.

PP&L has assessed their program in light of some of the questions raised during the team inspection and several 10 CFR Part 21 issues that were identified after the team inspection. This inspection identified that PP&L has completely changed the MOV program to address the NRC questions and to address issues such as the Part 21 identified by Liberty Technologies that affected MOV test results and VOTES equipment inaccuracies.

In February 1993, PP&L recognized that their MOV program would not meet the entire intent of GL 89-10, and began to revise the program. In March 1993, a new program was started to address the following significant issues:

1. VOTES 10 CFR 21 Notification on test equipment inaccuracies
2. SSES Power Update
3. MOV Weak Link Evaluations
4. Degraded Voltage Calculations

5. New Allowable Thrust Methodology
6. Spring Pack Deficiencies
7. Torque Measurements
8. Trending by VOTES
9. Limitorque 10 CFR 21 Notification on High Temperature Effects on AC Motors
10. Valve Design Factors
11. Rising Rotating Stem Torque
12. Detailed Valve-By-Valve Schedule

PP&L deferred all GL 89-10 testing during the period from about November 1992, through April 1993, for the following reasons:

1. There were a significant number of design and implementation-related issues. These issues affected both the allowable thrust range and the determination of the actual thrust developed. Therefore, the program as it existed did not provide a conclusive measure of valve performance.
2. There was minimal testing during this time period (6 VOTES & 4 dynamic tests).
3. All available manpower was spent revising the Program (rather than performing testing and analyzing tests results).
4. During this period of time, the program was in transition. The design methodology, VOTES software, method of applying VOTES tolerances, and method of assessing VOTES test results was changed. Not testing during this transition period eliminated the possibility of using wrong criteria for testing and analyzing the results.

The new program now in place at Susquehanna provides answers to the aforementioned open items. The following delineates problems identified by the team inspection and the licensee's current method for resolving each item, in accordance with PP&L's new GL 89-10 program. Section numbers in parenthesis below refer to the sections in NRC inspection report 50-387/91-80; 50-388/91-80 where each item appears.

#### DESIGN BASIS REVIEWS (SECTION 2.2)

##### Complete detailed evaluations of minimum voltage available to MOVs by January 1992.

The degraded grid voltage analysis that was in place at the time of the team inspection has been replaced by a newer version (as a result of the EDSFI). The degraded voltage calculated had concluded that the voltage at the motor terminals were very low. The degraded voltage calculations were revised using the new degraded grid analysis that removed excess conservatism.

## MOV SIZING AND SWITCH SETTINGS (SECTION 2.4)

Complete the remaining operator sizing and switch setting calculations by spring of 1992.

This has not yet been completed by PP&L; however, it is addressed within engineering deficiency report (EDR) #630034, which consolidated all known EDR's pertaining to GL 89-10 in April 1993, due to the revision of the GL 89-10 program. EDR #630034 was written to address and resolve all of the significant program issues delineated above.

Evaluate the 0.3 valve factor during design basis testing and make changes, as required.

This item is not yet completed; however, PP&L has evaluated the 0.3 valve factor and has concluded that industry and SSES data suggests that the use of a valve factor of 0.3 may not be conservative in all cases. Their study recommended that a valve factor of 0.5 should be used for all flex wedge gate valves.

Document justification for using a 0.15 stem friction coefficient.

This item is not yet completed; however, after PP&L reviewed three test programs, "EPRI MOV Flow Test Project RP-3433-15," "EPRI Rate of Loading Effects Testing Program RP-3433-12," and "EPRI Stem to Stem Nut Lubrication Test Report RP-3433-10," they concluded that programs identified a coefficient of friction for their lubricant (Moly 101) was in the range of 0.10 to 0.13, and, therefore, the use of 0.15 friction factor was conservative for sizing motor operators.

Develop specifications to procure structural limit analysis for GL 89-10 valves.

Specification M-1509, "Specification for MOV Weak Link Analysis," has been issued to address the procurement of the analysis on all valves installed at SSES. Also, a Design Standard, MDS-05, "MOV Weak Link Evaluation Criteria," has been issued to specify the requirements when determining MOV maximum allowable thrust/torque and accelerations that includes the valve, actuator, and motor.

Adjust torque switch settings to account for rate of loading (load sensitive behavior), as appropriate.

After reviewing SSES and industry testing, PP&L has concluded that an allowance of 5% should be included in the MOV sizing calculation to compensate for rate of loading.

Review each torque switch setting, following design basis testing, and make adjustments if required.

This is part of EDR 630034, and will be incorporated when the EDR is complete.



Resolve differences between voltages assumed for certain MOVs and those stated in the UFSAR (Unresolved Item No. 50-387, 50-388/91-80-01).

Licensing Document Change 1879, revised Section 8.3.1.9 of the UFSAR to allow the use of voltages greater than 80% in mechanical sizing evaluation of MOVs. This now conforms with the guidance of GL 89-10, and this item is considered closed.

Review the Limatorque study on ambient temperature effects on ac motors and incorporate into switch setting calculations, if applicable.

The inspector reviewed PP&L study, VE-010, "Assessment of Elevated Temperature Effects on AC MOVs," which concluded that all MOV motors at SSES have an inherent torque reduction, based on the 10 CFR 21 condition identified by the Limatorque Corporation. The results of this study, along with other emerging issues, have been incorporated into MDS-01 actuator sizing calculations. To date, Unit 1 has been completed and Unit 2 is being addressed. Approximately twenty modifications have been identified for MOVs at Unit 1.

Review the effect of valve stroke time limits on decreased motor speed (Unresolved Item No. 50-387, 50-388/91-80-02).

There are 24 dc MOVs at SSES. 16 are equipped with Reliance motors and the remaining 8 are equipped with Peerless motors. PP&L plans to replace 4 of the Reliance motors with Peerless. The inspector reviewed Service Order #S-16098-5 that was issued to Limatorque Corporation on April 15, 1992, to supply information to PP&L, regarding dc motor speed at reduced voltages. The current status is that Limatorque has provided the results of the completed motor tests conducted by Peerless; however, Reliance has not yet completed testing. This item remains open pending incorporation of the motor speed data into the stroke time calculation.

#### MOV TESTING (SECTION 2.5)

In inspection reports 50-387/91-80 and 50-388/91-80 the NRC requested the licensee to provide a justification for the use of the parent/candidate approach to testing for valves that are not practicable to test prior to using this approach.

PP&L has developed VE-009, "MOV Dynamic Test Scope," that delineates the definition of a testable or non-testable valve and explains the criteria for how a prototype test may be used to demonstrate the operability of an identical valve. The procedure is comprehensive and discusses the rationale for the parent/candidate approach to testing of valves that are not practicable to test.

## MOV MAINTENANCE AND POST-MAINTENANCE TESTING (SECTION 2.7)

### Review frequency for grease sampling and MOV Overhaul

The inspector reviewed SSES's program for maintenance and overhaul of MOVs. The inspector concluded the following:

- Stem and stem nut lubrication is routinely done during 18-month grease sampling. The inspector examined several valves inside of containment and confirmed the stems had been cleaned and relubricated.
- PP&L conducted an 18-month interval lubrication program to identify trends and to assess the adequacy of the interval using new and better grades of grease. The licensee analyzed the grease samples and also sent them to a contractor for independent analysis. The inspector reviewed the analyses of several grease samples and observed good agreement between the consultants' analysis and PP&L's analysis.
- The inspector concluded that there is now a schedule in place for overhaul of actuators based on the results of the grease analysis.

### Revise the maintenance procedure to require the use of spring pack tester to check for spring pack relaxation during overhauls.

PP&L is not using a spring pack tester; however, the procedure has been changed to make more careful measurements during overhaul periods. These measurements are recorded and compared to an as-left condition of the spring pack.

### Justify any deviations from vendor-recommended maintenance schedules.

The inspector verified this has been done in draft procedure, "Preventive Maintenance Improvement Project," package number 130, "Limitorque Valve Motor Operators NRC GL 89-10 VOTES Tested." PP&L stated this package would be issued within the next six months.

## FAILURES, CORRECTIVE ACTIONS, AND TRENDING (SECTION 2.8)

### Complete the review of the Preventive Maintenance Improvement Program by the end of 1991.

The inspector reviewed package number 131, "Limitorque Valve Motor Operators Butterfly Valve Type," and package number 132, "Limitorque Valve Motor Operators Incompatible for VOTES Testing." PP&L is making progress in issuing the Preventive Maintenance Improvement Program, which was put on hold during the period while PP&L was rethinking GL 89-10 requirements.

## Conclusions

The inspector concluded that PP&L recognized that the program that existed in February 1992, did not meet the intent of GL 89-10 and halted the entire program and revised it. However, they did not inform the NRC of their actions. PP&L and NRC have had discussions on the extension of the GL 89-10 program at SSES. It appears that PP&L will be asking for an extension of their schedule in accordance with Supplement 6 of GL 89-10. The extension will be to the end of 1995. During this inspection the NRC was informed of the changes. Notwithstanding, PP&L used the correct approach to enhancing their testing program for testing MOV's. The management involvement and an aggressive approach toward completing the program by the end of 1995, if the extension is granted, were evident.

### **4.0 EXIT MEETING**

An exit meeting was conducted August 20, 1993, at the Susquehanna Steam Electric Station to summarize the purpose, scope, and findings of the inspection. The inspector's findings and conclusions were discussed at this meeting. Those in attendance are listed in Attachment 1. At that meeting, the NRC staff focused on its concern that the licensee did not inform the NRC that significant changes were made in the implementation of the Generic Letter 89-10 MOV program, and some minor inconsistencies in the implementation of EDRs were noted. The licensee acknowledged the inspection findings at the exit meeting.



## ATTACHMENT 1

### Persons Contacted

#### Pennsylvania Power and Light Company

- H. Clarke, Design Basis Document Project Manager
- \* T. Clymer, Nuclear Quality Assurance Coordinator
- \* T. Dalpiaz, Manager, Nuclear Maintenance
- \* J. Fritzen, Supervisor, Modifications Installation
- M. Golden, Supervisor, System Engineering Programs and Testing
- \* J. Gutshall, Supervisor, Valve Maintenance
- J. Kenney, Supervisor, Nuclear Licensing
- G. Kuczynski,
- \* J. Maertz, Senior Results Engineer
- \* D. McGann, Supervisor, Nuclear Compliance
- \* J. Meter, Compliance Engineer
- G. Miller, Manager, Nuclear Technology
- \* B. Saccone, Acting Manager, Nuclear Systems Engineering
- J. Stefanko, Manager, Nuclear Fuels
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#### United States Nuclear Regulatory Commission

- \* S. Barber, Senior Resident Inspector
- \* P. K. Eapen, Chief, Systems Section, DRS
- \* D. Galvin, DOE Intern
- \* R. Paroby, Co-op, Systems Section, DRS

\* Designates those in attendance at the exit interview on August 20, 1993.

