U. S. NUCLEAR REGULATORY COMMISSION
REGION I

REPORT/DOCKET NOS. 50-387/92-28
50-388/92-28

LICENSE NOS. NPF-14
NPF-22

LICENSEE: Pennsylvania Power and Light Company

FACILITY NAME: Susquehanna Steam Electric Station

INSPECTION AT: Susquehanna Steam Electric Station, Units 1&2
Berwick, Pennsylvania

INSPECTION DATES: October 26 - November 2, 1992

INSPECTORS: Carl Woodard, Reactor Engineer, Electrical Section, EB, DRS — 4 Dec '92 Date

Leanne Kay, Reactor Engineer, Electrical Section, EB, DRS — 4 Dec '92 Date

APPROVED BY: William Ruland, Chief, Electrical Section, Engineering Branch, DRS — 12/4/92 Date

Areas Inspected: The status of molded case circuit breaker (MCCB) testing; the disposition of requests for engineering; the current status of certain degraded grid voltage (DGV) relay setpoints; and the root cause, safety significance, and corrective actions taken relative to a recent emergency diesel generator (EDG) loss of field (LOF) trip during testing.

Results: Outstanding MCCB testing issues were resolved; requests for engineering were being dispositioned in a timely and appropriate manner; the DGV voltage setpoint issue had been resolved; and the recent EDG trip was not safety significant. Root causes and corrective actions for the trip are being addressed. Corrective actions for the others were either planned or in progress.

1.0 SCOPE OF THE INSPECTION

The purpose of this inspection was to determine the current status of the licensee's actions to resolve certain outstanding issues involving molded case circuit breaker testing, requests for engineering services, degraded grid voltage relay setpoints, and electrical isolation, and to investigate a recent emergency diesel generator (EDG) loss of field (LOF) trip during surveillance testing.

2.0 FINDINGS

2.1 Emergency Diesel Generator (EDG) Surveillance Test

Licensee Significant Operating Occurrence Report (SOOR) 1-92-273 described the loss of field (LOF) trip of the "A" EDG during surveillance tests, on July 25, 1992. This inspection was conducted to assess the safety significance of the event, adequacy of the licensee's root cause analysis, and the corrective actions to prevent recurrence. This was accomplished by:

- Reviewing the SOORs and referenced and related documents.
- Reviewing EDG Surveillance Test Procedure SO-024-001 (up to draft 20 revision).
- Reviewing the EDG system design including the grid interface.
- Reviewing applicable sections of the FSAR and of the technical specifications.
- Discussing the event and documents with engineering, operation, maintenance, and management personnel.
- Walking down applicable portions of the surveillance test procedure to assess the logistics of the tests.
- Reviewing licensee analyses of causes and corrective actions.

The licensee had concluded that the LOF trip was caused by the grid response of the transformer tap changer's to an increase in EDG voltage during a test which paralleled the EDG to the grid. Acceptable kVAR loading on the EDG specified by surveillance test procedure SO-024-001 is $\pm$ 1500 kVAR. SOOR 1-92-273 test data printout indicated that, immediately before the LOF, the EDG was operating at approximately minus 1300 kVAR. When the transformer tap changer stepped to increase the bus voltage by approximately 40 Volts, the EDG output quickly changed to minus 2800 kVAR causing the collapse of

EDG voltage and the LOF trip. A subsequent analysis by the licensee concluded that: 1) the protective circuits responded properly to the sudden large negative kVAR loading; 2) the trip was caused by procedures, equipment and circuits that are not in effect during an accident; and 3) there were no adverse safety consequences since, at the time of the event, three of the four EDG units were available for design bases accidents.

The inspection also found that the licensee had experienced LOF trips during prior years; the tap changer was operated in the automatic mode, but had locking provisions; and the licensee has now taken steps to amend EDG surveillance test procedure SO-024-001, to reduce the acceptable load kVAR from ±1500 to ±900 kVAR. In addition, consideration was underway to perform surveillance testing with positive kVAR and to lock the transformer tap changer to prevent step voltage changes during EDG tests. The inspectors concluded that, although the licensee had not completed their evaluation, the actions in progress would address the problem.

During the walkdown inspection to assess the logistics of conducting the EDG surveillance test, the inspectors noted that synchronizing the EDG to the grid requires that the operators read a grid to bus voltage differential meter in the control room. The obvious scale on the meter is 100-0-100. However, the actual scale according to design drawing E107172-E-23 is 10-0-10. The licensee confirmed the 10-0-10 scale and pointed to almost invisible decimals on the 10.0-0-10.0 scale. From a human factors standpoint, the scale marking was poor. However, the operators were trained and a mistake in reading the meter does not represent a safety concern, since this meter serves no purpose during accident loading of the EDG.

The EDG units are designed for 0.80 power factor and are required to start and carry the inductive accident loads estimated to be at a power factor between 0.86 and 0.90. The inspectors noted that the licensee's periodic surveillance tests procedure SO-024-001 required the testing to be performed at as near unity (1.0) power factor as practical. Since testing at 1.0 power factor requires that the generator, exciter and electrical portion of the EDG produce 25% less kVAR output than would be required at 0.8 power factor, the licensee justified the testing by showing that the peak accident loads as delineated in the FSAR are significantly less than the EDG ratings and that the EDGs are tested every 18 months (outage) at 110 percent of their kilowatt ratings. According to the licensee, testing at this higher kW output requires that the EDGs produce kVA loads which envelope the peak accident kVA with margin for degradation. The testing at 1.0 power factor is satisfactory as long as the kVA output envelopes the peak accident kVA. However, this practice requires an ongoing verification of the EDG loads to ensure continued adequacy of the EDG surveillance testing.

2.2 Disposition of Electrical EWRs

The engineering process for dispositioning work requests pertaining to electrical issues was reviewed. This inspection was a followup to an issue identified in Inspection Report 92-23 regarding adequacy and timeliness of resolution of engineering work requests (EWRs).

Prior to 1990, the EWR was used for many matters of varied importance. They included requests for information, enhancement ideas, and potential problems which required engineering evaluation. The process involved a requestor generating an EWR and sending it to the appropriate engineering group. Following discussions with the requestor, the EWR would be assigned to a reviewer for prioritizing and treatment. Because the EWR process was used as the means for varied engineering tasks, the EWRs were numerous and many of them were placed in a holding status.

In the electrical group, all incoming EWRs were reviewed to determine whether an immediate response was required and then prioritized. The process included the creation of a category designated as the "ZZZ" file. EWRs assigned to this file were considered not to require further immediate attention, but they had merit and should be addressed as resources allowed. Therefore no person's initials were assigned for treatment of an issue placed in the file. Prior to 1990, approximately 133 EWRs involving electrical issues were designated to the "ZZZ" file. Other methods for managing requests included sending selected EWRs to consultants for initial review and scoping. The licensee also conducted a quarterly review of all open EWRs including those with the "ZZZ" designation. This review was to re-examine the established priority of issues and make appropriate changes to the status of any open EWR.

In mid 1990, PP&L enacted an action plan to support their Engineering Discrepancy Program. This program integrated an assessment made of engineering discrepancies by a Discrepancy Review Committee with the Organizational Effectiveness Review (OER) charter to enhance their resolution. This engineering organization realignment was discussed in a licensee presentation to the NRC documented in Inspection Report 91-13. Results of the licensee's review demonstrated the need for a deficiency tracking mechanism for engineering issues. Although the EWR process was being used for this means, deficiency management was not its intended purpose. Hence, the licensee created the Engineering Deficiency Request (EDR) program. Engineering Procedure Manual procedure QA-122, Revision 3, clearly defines and discusses the differences between EDRs and EWRs.

In the Fall of 1991, the licensee performed a review by many newly organized functional groups of the EWR backlog with the purpose of reducing the backlog and properly assigning EWRs into the EDR process. It was at this time that the "ZZZ" file was closed out. Disposition of the 133 EWRs contained in the "ZZZ" file were reviewed. Eight EWRs were dispositioned as EDRs and the remaining EWRs were either dispositioned as Design Change Notices (DCNs) or closed out based on their being identified as non-safety concerns.

The inspector reviewed several EWR dispositions including EDRs, DCNs, or closeouts. Supporting documentation for the disposition was reviewed on a sampling basis. Actions required for closeout were verified by reviewing completed Work Authorizations and performing a plant walkdown. The inspector did not identify any discrepancies.

The inspector determined that the licensee had adequately established a deficiency tracking system for engineering issues and their dispositions. The resolution of EWRs reviewed previously designated in the electrical group's "ZZZ" file appropriately addressed initial requests and were dispositioned in a satisfactory manner based on the safety significance of the request. The inspector did not identify any concerns in this area.

2.3 (Closed) Unresolved Item (50-387;388/90-24-01) regarding internal adjustments to molded case circuit breakers

NRC inspection report number 90-02 documented concerns regarding the licensee's practice of performing internal adjustments to molded case circuit breaker (MCCB) trip units. These adjustments were made to the magnetic trip setpoints internal to a limited number of 480 Vac MCCBs. The MCCB adjustments were performed in accordance with maintenance procedure MT-GT-998, Revision 7.

During a followup inspection (Report 90-24), the inspector noted the licensee had not performed any qualification testing or evaluations to ensure that the breakers satisfied the original qualification specifications. Additionally, the MCCBs were never tested following the original functional test dated July 1982, due to the lack of a formal maintenance testing program. This item was unresolved pending the licensee's re-evaluation of the breakers functional adequacy and periodic testing.

Subsequent to the followup inspection, the licensee provided a safety evaluation, NL-90-040, for the change or modification to the MCCBs. This evaluation was performed to determine whether the adjustments made, satisfied the requirements delineated in 10 CFR 50.59. The safety evaluation showed that disassembly of the MCCB did not invalidate the environmental, seismic, or any other qualification criteria related to the safety function of these breakers. The licensee concluded that an unreviewed safety question did not exist, and therefore, the adjustments were permitted per 10 CFR 50.59.

To address continued NRC concerns, the licensee permanently suspended the practice of adjusting the internal magnetic trip setpoints. This is evidenced by Procedure Change Approval Form (PCAF) 1-91-0326 for maintenance procedure MT-GE-008, Revision 8. In response to the concern that these MCCBs were never tested following the original functional tests, the licensee provided several completed surveillance records for two of the ten breakers that had been adjusted. These surveillance records indicated that, subsequent to the internal adjustments being made, the as-found overcurrent tests demonstrated that further adjustments were not needed. Breakers bounded by the surveillance program are tested every eighteen months. These surveillances include removal of the breaker, an overcurrent trip test with

verification that the breakers time-current characteristics are within the manufacturer's tolerances, and an instantaneous trip test. Breakers not included in the surveillance program are included in the preventive maintenance program. All MCCBs, safety- and nonsafety-related, are tested using the same maintenance procedure, MT-GE-008. Additionally, the licensee compiles and monitors all preventive maintenance activities associated with the approximately four hundred 480 Vac MCCBs through a program called the Preventive Maintenance Improvement Project, Package No. 020. This program tracks failures for MCCBs and associated components. No problems or replacements due to failures of the sampled breakers have occurred.

To further address NRC concerns, the licensee committed to commercially dedicate one of the breakers previously adjusted in accordance with Nuclear Department Instruction QA-15.2.14, Revision 0, "Dedication Of Commercial Grade Items" and Engineering Procedure Manual procedure QA-239, Revision 0, of the same title. Dedication criteria for this qualification test will include the recommendations provided in NRC Bulletin No. 88-10, "Nonconforming Molded Case Circuit Breakers," Attachment 1. This bulletin's attachment presents a test program to establish breaker reliability and an acceptable qualification methodology for MCCBs. This commercial dedication testing and evaluation will be used as the qualification basis for all breakers that had internal trip unit adjustments made to meet original breaker qualification.

The inspector concluded that the licensee's safety evaluation met the criteria presented in 10 CFR 50.59 and that the surveillances of the MCCBs that had received internal adjustments demonstrated proper functionality and actuation at their design trip setpoints. Further, the actions to be taken by the licensee to qualify these breakers using the dedication criteria discussed above and their commitment to notify the NRC should any breaker fail the testing were found to be acceptable. Based on these findings, the inspector concluded that the functionality of these breakers was adequately assured and the breakers were capable of performing their intended safety function. This item is closed.

2.4 (Closed) Unresolved Item No. 50-387;388/90-20-05 regarding the adequacy of the degraded grid relay setpoints

During the EDSFI review in 1990, the NRC team determined that the undervoltage relay setpoints did not provide adequate protection for all Class 1E loads at the 480 Vac levels under degraded grid conditions; the undervoltage relays were set at 84% of the rated voltage at the 4160 Vac buses. The licensee had established administrative controls to ensure that sufficient voltage was available for the required loads. At the close of the inspection, the licensee committed to develop new relay setpoints and to subsequently submit a technical specification change request to increase the relay setpoints where sufficient voltage and equipment protection would be provided.

In 1991, a followup inspection was performed, as documented in Inspection Report 91-17. This inspection verified that the relay setpoints and applicable procedures had been changed and reviewed the adequacy of the setpoint change packages in support of the technical specification change. The technical specification change request put the degraded grid relay setpoint at 93% which, when calibration error, relay drift, and potential transformer inaccuracy are considered, could allow the grid voltage to be as low as 91.2% of rated voltage before actuation. The licensee completed an evaluation to verify that adequate voltage was available at the equipment terminals under worst case conditions for the 4160 and 120 Vac loads. This evaluation demonstrated that for the 4160 Vac loads no modifications were required. However, modifications were required for the 120 Vac circuits. The inspectors determined that an evaluation of the voltages at the terminals of 480 Vac loads at 91.2% rated voltage and resolution of the undervoltage relay issues covered by engineering discrepancy reports G10091 and G10010 would require completion and NRC review for closure of this issue. In addition, the inspectors noted that the computer program used in SEA No. EE-83001, Rev. 2, "Susquehanna Steam Electric Station Units 1 and 2 Voltage Study - Class 1E Distribution System" used to evaluate voltages, inaccurately reflected the current plant configuration. The licensee committed to update the voltage study and complete the electric plant model used with a computer load flow program.

The inspectors reviewed the licensee's analyses for determining effects of degraded grid voltages on Class 1E 480 Vac systems for both units. These analyses, documented in SEA Report Numbers EE-356, Rev. 0, and EE-417, Rev. 0, appropriately assumed the design basis accident conditions and voltage criteria established in the final safety analysis report and in the technical specifications. Based on these analyses, acceptable minimum voltages were determined to be available for 480 Vac equipment.

Setpoint change packages E91-2057, 2058, 2059, 2060, 2063, and 2064 changed instrument transformer taps on the 480 Vac load centers from 468 V to 456 V to agree with the degraded grid relay setpoint changes. Subsequently, modifications were performed to increase 120 Vac voltages for the H202 analyzer circuits. The inspectors reviewed Design Change Packages 92-9011 and 92-9001 which installed new cables and reduced the 120 Vac drops that existed at the H202 analyzer panels.

The computer program previously used to model the plant as-engineered Class 1E distribution system configuration was changed. In an internal PLI letter, 71668, dated June 19, 1992, the licensee described the improved flexibility and user interface of the new programs and demonstrated the results of an up-to-date plant voltage study for the current plant configuration. SEA-EE-001, Rev. 3, originally SEA-EE-83001, "Susquehanna SES Unit 1 and 2 Voltage Study Class 1E Distribution System" was reviewed to verify that the recent plant modifications, as well as resolution of electrical concerns identified in EDR

G10091 respective of the degraded grid relay setpoint changes, were incorporated into the study. The inspectors determined these changes were accurately incorporated in the plant model and used in these analyses for the completed Unit 2 modifications. SEA-EE-001 will be updated for the respective Unit 1 modifications following completion of the current refueling and inspection outage.

The inspectors concluded that the licensee appropriately analyzed voltage conditions under worst case degraded voltage conditions. The issues identified in the engineering discrepancy reports respective of the relay setpoint changes were evaluated and modifications performed to establish adequate voltages. Based on the above review, this item is closed.

3.0 MANAGEMENT MEETINGS

At the conclusion of the inspection, Ms. Kay met with the licensee representatives listed in Attachment 1 and summarized the scope of the findings of this inspection with the exception of the EDG trip. Mr. Woodard discussed the EDG trip findings, by telephone, with Mr. Gene Stanley, Plant Manager, on November 2, 1992.

ATTACHMENT 1

Persons Contacted

Pennsylvania Power and Light Company

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