U. S. NUCLEAR REGULATORY COMMISSION
REGION I

DOCKET/REPORT NOS.: 50-387/95-18
50-388/95-18

LICENSEE: Pennsylvania Power and Light Company (PP&L)

FACILITY: Susquehanna Steam Electric Station (SSES)
Berwick, Pennsylvania

DATES: July 24 - 28, 1995

INSPECTOR: Leanne M. Harrison, Reactor Engineer — Date: 8 Sept '95.
Electrical Section
Division of Reactor Safety

APPROVED BY: William H. Ruland — Date: 9/12/95
William H. Ruland, Chief
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Area Inspected: This was an announced safety inspection to review the overall adequacy and implementation of PP&L's corrective actions for previously identified fire protection program and 10 CFR Part 50, Appendix R open items and those commitments associated with three previously issued violations.

Results: The inspector determined that PP&L's implemented corrective actions were thorough and were supported by comprehensive evaluations. Adequate quality assurance had been applied to restore design basis information on fire protection drawings. Actions taken to improve site personnel awareness and sensitivity regarding the safety function of fire doors and importance of door closure were appropriate. These reviews resulted in the closure of two open items, 50-387, 388/92-23-08 and 50-387/94-16-03.

The remaining open item, 50-387, 388/94-16-01, pertained to Simplex fire system failures and the licensee's failure to implement the required technical specification compensatory actions. This item has been updated and remains open pending completion of work items detailed in section 2.3 of the report. The licensee implemented an alternative approach for establishing continuous firewatches as a result of this open item. This approach was based on SSES's reevaluation of continuous to mean a 15-minute roving patrol. This reevaluation was conducted to reduce firewatch manpower requirements during a Simplex system failure. This approach was discussed with staff of the NRC Office of Nuclear Reactor Regulation and found acceptable.

DETAILS

1.0 PURPOSE (NRC INSPECTION MODULE 92903)

The purpose of this inspection was to assess the overall adequacy and implementation of PP&L's corrective actions for resolving previously identified violations associated with the licensee's fire protection program and 10 CFR Part 50, Appendix R. The inspection included: reviews of the quality and thoroughness of SSES's evaluations for determining appropriate corrective actions to prevent recurrence of these issues; implementation of those actions identified; and walkdowns to verify the acceptability of installed plant configurations and completion of commitments made to the NRC.

2.0 INSPECTION FINDINGS

2.1 (Closed) Violation No. 50-387,388/92-23-08 Lack of Quality in Fire Protection Design Drawings

This violation resulted from the licensee's failure to apply adequate quality assurance for design control of specific key reference drawings. These drawings were used to support evaluations of fire protection activities. The following issues were identified by an NRC inspection team in 1992.

- Discrepancies existed between as-built drawings and actual plant configurations for cable raceway fire barrier wraps.
- Misrepresentations of drawing quality level designations were made on reference drawings.
- Discrepancies had been found involving the type of fire barrier wrap materials installed and those depicted on the drawings.

These deficiencies involved two series of key fire protection reference drawings, the C-1700 series of Fire Protection Features Drawings and the E-294/295 Raceway Listing drawings established to identify those fire barriers wrapped to meet 10 CFR Part 50, Appendix R requirements. In addition, the team found that these drawings had been relied upon by PP&L in decision making processes and then propagated to engineering studies and calculations that utilized inputs from these drawings.

The licensee initiated engineering discrepancy report (EDR) no. G20053 to track and resolve the programmatic quality issues associated with these discrepancies. The EDR addressed discrepancies found within drawings and discrepancies identified between drawings and the as-built plant installations. This EDR was initiated during the 1992 inspection.

During this follow-up inspection, the inspector reviewed the adequacy and implementation of PP&L's corrective actions to address and resolve the violation. PP&L presented their corrective action plan to the NRC in a Notice of Violation Reply Letter, dated March 19, 1993. The inspector reviewed the quality and comprehensiveness of evaluations performed and corrective actions

taken to restore quality to the drawings and associated documentation regarding raceway fire barriers. This review included a walkdown of selected Unit 1 reactor building fire zones for verification of the adequacy of updated fire protection drawings.

The inspector found that the nuclear quality assurance (NQA) department had performed assessment no. 94-06, "Assessment Of The Fire Protection Features Documentation And Drawing Upgrade Project." This assessment was performed to review comprehensively, correct, and control fire protection features drawings and documentation. This project scope included review of fire wrap materials, penetration seals, suppression and detection equipment, Appendix R required lighting, and fire barriers, including walls, doors, and dampers. The inspector determined that the disposition of actions resulting from NQA's review was well-developed and coordinated with departments. Also, the resolutions of these issues, specific to raceway fire wraps, were complete and timely.

These actions included the performance of plant walkdowns by the licensee using the methodology and guidance presented in PP&L's engineering study, analysis, and evaluation SEA-EE-462, Revision 1, "Appendix R Assessment Of Findings Identified By Walkdown Of Fire Wrapped Raceways." This review documented, evaluated, and specified the actions to be taken for each discrepancy identified by the NRC and licensee. These actions included the initiation and close-out of several drawing change notices (DCNs) and non-compliance reports (NCRs). Based on the identification of discrepancies, the following documents were revised.

- Calculation DK-C-DJK-014 (EC-013-1417, Rev. 0)
  "Appendix R, Section III.G., Exemptions"

- Calculation DK-C-DJK-017 (SEA-EE-432, Rev. 0)
  "Evaluation of Unit I and II Derating of Power Cables in Raceway Wrapped in Thermo-Lag and/or Kaowool Material"

- Appendix R Deviation Request No. 17
  "Kaowool System As An Acceptable 1-Hour Fire Barrier Wrap"

These documents had been used by the licensee for evaluating fire protection activities and making important-to-safety design decisions relative to fire protection and program implementation. These documents were used to fulfill technical specification requirements for surveillances of fire protection features.

The inspector performed a walkdown of selected Unit 1 reactor building fire zones to verify the adequacy of the C-1700 series and E-294 drawings with installed plant configurations for cable raceway fire barrier wraps. This inspection effort, subsequently, verified the adequacy of the licensee's committed corrective actions. The inspector found no discrepancies between the updated reference drawings nor any differences between the as-built drawings and actual plant configurations. Fire zones depicted on the drawings were found to be the same as those presented in PP&L's Fire Protection Review

Report, as approved by the NRC. The inspector also found that the reclassification of drawings had been completed for the E-294 and E-295 series drawings. 'Quality F' designations were denoted on the drawings instead of the previous non-quality representation, as identified by the NRC team.

Based on the inspector's review of PP&L's assessments and walkdown of Unit 1 raceways, the inspector concluded that the licensee effectively had implemented corrective actions in accordance with their reply letter commitments to present accurate fire protection design requirements on the features drawings. Licensee evaluations to address identified concerns were comprehensive and of good quality. In addition, the inspector concluded that adequate quality assurance had been applied for maintaining the drawings and associated engineering studies and calculations that utilized inputs from these drawings. This item is closed.

2.2 (Open) Violation No. 50-387, 388/94-16-01 Simplex Fire System Failures

On August 2, 1994, a lightning strike rendered the Simplex fire protection system inoperable. Four other Simplex system failures, two due to lightning strikes, occurred since 1988. This event disabled fire detection and suppression capabilities throughout the plants. Subsequently, numerous technical specification (TS) limiting conditions for operation (LCO) action statements were entered as documented in licensee Significant Operating Occurrence Report (SOOR) No. 94-454. Required licensee actions included the establishment of continuous firewatches within one hour for affected fire zones. Contrary to prior licensee management expectations, the operations staff failed to vigorously implement continuous firewatches, and therefore, failed to comply with the TS requirements. Although system modifications had been made in 1990 to reduce the damage from lightning strikes on fire protection system, these corrective actions were not effective. The resident inspector noted that the licensee's response procedures for loss of the Simplex system were not detailed enough to implement the numerous and required continuous firewatches in a timely manner, given the magnitude of the fire protection system failure. In addition, the resident inspector noted that poor communications during the event contributed to the failure to meet TS requirements.

On August 29, 1994, PP&L established a formal event review team (ERT) to comprehensively review the Simplex failure events and to determine comprehensive corrective actions to prevent recurrence. The ERT determined that the initial root causes for this violation included: inadequate corrective actions for previous events; inadequate communications between operations' shift supervision and plant management; and miscommunications between shift supervision and the site fire protection engineer. Licensee Event Report (LER) No. 94-012 was initiated by PP&L to document this event.

The licensee's violation reply letter, dated October 27, 1994, presented a discussion on the root causes for the violation, restated management's expectations regarding fire protection, and corrective actions taken and planned. The planned corrective actions included the resolution of several

other contributing factors and primary causes for the Simplex failure and subsequent failure to establish required firewatches. The inspector reviewed the effectiveness of the licensee's corrective actions to resolve the ERT's issues.

The ERT determined, as also stated in the SOOR, that many actions were needed to be taken by several plant departments to address and correct the identified root and contributing causes that led to this violation. Contributing causes included, but were not limited to, the following:

- inadequate procedures available to evaluate Simplex system degradation;
- the need to streamline the process for acquiring and posting firewatches;
- inadequate sensitivity to fire protection by the Nuclear Department; and
- the need to improve training for operations control room personnel on Simplex system operation, message center information, and failure modes.

The inspector determined that the root cause analysis performed by the ERT was of exceptional quality. The inspector found that the cause and effect analytical technique and barrier analysis reasoning used by the ERT resulted in the disposition and resolution of appropriate and thorough actions to prevent recurrence of this issue. Corrective actions taken by the licensee that resulted from the ERT's review, included: the issuance of Operations Instruction (OI)-AD-013, Revision 0, "Simplex Problem/Failure Response"; a memorandum issued to all station personnel by senior site management stating their expectations regarding fire protection and its importance, direction provided to appropriate departments by senior management via a letter, dated November 8, 1994, stressing the importance of TS compliance and clear communications; and drills performed to demonstrate successful posting of continuous firewatches, within the one hour TS requirement.

The inspector reviewed OI-AD-013 that was established to provide guidance to ensure TS compensatory measures are promptly and accurately implemented following major Simplex system failures. This instruction provided shift supervision with guidance for assessing system failures and the compensatory measures for failures associated with specific fire zones. The inspector determined that the instruction was clear and matched fire area alarm failures with the associated TS requirements. The inspector verified control room operators' satisfaction with this instruction through interviews. Operator training was provided to all operating shifts via the requalification process. The inspector concluded that this instruction and the training provided to the operations staff by PP&L enhanced operators' recognition and understanding of system failure modes.

Compensatory firewatches have the ability to detect and manually initiate affected suppression systems. Twenty-six continuous firewatches were determined by the licensee to be required and posted in various fire zones within one hour following the lightning strike and subsequent Simplex system failure. Following this event, the licensee reevaluated the requirement for posting firewatches and the barriers that prohibited the establishment of these posts.

Based on these reevaluations, the licensee developed alternative means to minimize firewatch manpower and take credit for pre-action systems and heat detection systems that were not dependent on Simplex operability. The licensee concluded that a "continuous" firewatch requirement can be met by one person completing a roving patrol through an established fire area once per 15 minutes and four times within the same hour. The licensee further determined that the same person could fulfill hourly firewatch requirements in additional fire area(s) located adjacent to the fire area requiring the continuous firewatch as long as the four roving tasks are successfully completed. Additional means to reduce fire hazards, while the Simplex system is inoperable, were developed and used by the licensee in conjunction with the alternative patrol means mentioned above. The licensee noted previous NRC acceptance for allowing such roving patrols to fulfill continuous and hourly firewatch requirements by the same individual at another nuclear facility, North Anna. In addition, the licensee substantiated their alternative firewatch approach with probabilistic risk evaluations of core damage and their defense-in-depth plant design. The inspector discussed this approach with staff of the NRC Office of Nuclear Reactor Regulation and concluded that the licensee's approach was acceptable based on their reevaluations and the documented evaluations. The licensee's evaluation reduced the number of required firewatches from 26 to 11 for a complete Simplex system failure.

To validate the implementation of continuous firewatch requirements and ensure their response capability in the event of a major Simplex system failure, PP&L has satisfactorily completed three Simplex failure drills within the one hour requirement. The licensee intends to complete this type of drill for each operating shift and issue a final report once all drills have been completed. The inspector reviewed the results of the completed drills. No discrepancies were identified and compensatory measures had been adequately established.

The licensee plans to modify the Simplex fire protection system to prevent system failures (Design Change Package (DCP) No. 95-9003 and Engineering Change Order (ECO) No. 91-6068). The inspector found that the DCP consisted of three different work actions required to be completed prior to implementation of the ECO for upgrading the software logic for the Simplex system. The DCP included actions to be taken for resolving baud rate problems experienced during the transmission of information between the installed plant detectors and the control room panel, the removal of installed spare transponder cards that have experienced electrical surges in the past, and the installation of additional surge protection and alternate communication for the relay scheme. The relay scheme is located in the low level radwaste hold-

up facility, where lightning strikes have been experienced. Upon completion of the DCP work, the ECO can then be implemented that installs new EPROMs within specific transponder cards to improve the process of transmitting signals and data to the control room.

The inspector reviewed the ECO to assess the upgrade quality . The inspector found that no verification and validation requirements had been specified to the vendor by PP&L for this software upgrade. However, discussions with instrumentation and controls (I&C) technicians identified that this upgrade was a routine design upgrade by Simplex that had been installed for over five years in at least 30 other nuclear power plants and recently installed in SSES's simulator. I&C technicians also explained their plans for development and performance of in-house test procedures for validating each Simplex detection point in the plants. In addition, the technicians explained that the Simplex system was independent to all other plant systems, including the plant computer. The inspector did not complete the review of the Simplex digital modification and, therefore, reached no performance conclusions on the adequacy of the ECO work. The adequacy of the work involved with the design and implementation of ECO No. 91-6068 is subject to future NRC inspection.

The inspector concluded that the licensee's efforts, including establishment of the ERT, to determine appropriate corrective actions for preventing the recurrence of this issue were comprehensive and of excellent quality. Additional corrective actions established and implemented for resolving the root and contributing causes were appropriate and clear for:

- effectively streamlining the process for evaluating the need, acquiring, and posting firewatches;
- enhancing procedure guidance; and
- increasing the sensitivity of station personnel toward the importance of fire protection and compliance with requirements.

In addition, the licensee's completion of Simplex fire drills satisfactorily demonstrated the ability of SSES to establish all compensatory actions within an hour as required by TS.

Although this issue involved the failure to implement the required compensatory actions involving continuous firewatches, and SSES has adequately resolved this concern, all comprehensive corrective actions to prevent recurrence, as determined by the ERT and discussed in PP&L's reply letter, have not been completed. Therefore, this item remains open pending NRC review of the satisfactory completion of all necessary actions to support and complete ECO no. 91-6068 for installing the Simplex software upgrade. Specifically, those actions include work items associated with DCP no. 95-9003 for removing the installed spare transponder cards, installation of additional surge suppressors, and resolution of ongoing evaluations pertaining to baud rate changes and the associated system effects. The adequacy of the digital modification design and implementation associated with ECO No. 91-6068 is subject to future NRC review and inspection. However, that review is independent of this unresolved item.

At the exit meeting the licensee committed to send NRC, Region I, a letter presenting the necessary elements for closure of this item once all actions have been completed, as specified above. This issue has been updated and remains open pending NRC receipt and review of the above letter.

2.3 (Closed) Violation No. 50-387/94-16-03 Unit 1 Fire Doors Blocked Open

This violation resulted from the licensee's failure to implement effective corrective actions to preclude the repetition of improperly blocked open fire doors. Several examples had been identified of blocked open fire doors including the failure to establish compensatory measures and administrative authorizations.

As presented in PP&L's reply letter to the violation, dated October 27, 1994, the licensee committed to affix large labels at eye level on all station fire doors. These labels were attached to station doors to identify the doors as also being fire doors. In addition, the licensee stated that site personnel would be trained on the status control requirements for station fire doors.

The inspector verified the installation of labels on all fire doors encountered during plant tours. The plant tours included access control points and several elevations of the reactor, turbine, and control buildings/structures. The inspector did not identify any instance of unauthorized blocking of fire doors. Labels were determined to be easily recognizable and self-explanatory for prohibiting unauthorized blocking.

The inspector confirmed the licensee's commitment to provide personnel with training regarding this issue. The licensee stated that Units of Instruction for General Employee Training (GET01) and General Employee Re-Training (GET01R) were updated to present an emphasis on the safety function of fire doors, status control requirements, and the need for all individuals to be sensitive to door requirements. The information was presented in the Industry Events section of the training units.

The inspector concluded that the licensee had appropriately taken actions to improve site personnel awareness and sensitivity regarding the safety function of fire doors and importance of door closure. This item is closed.

2.4 Management Oversight

The inspector found that management had approved and committed to implement corrective actions to address and resolve previously-identified issues. These actions were taken based on thorough evaluations completed by the licensee. The inspector determined that PP&L's evaluations were comprehensive and of excellent quality to reliably control and correct the identified deficiencies. Management was found to have taken additional effort to reestablish their expectations to plant staff through the issuance of memorandums. These efforts were made to ensure that the corrective actions were implemented appropriately to resolve and prevent the recurrence of such issues. Enhanced training and procedure revisions were also supported by SSES management to

correct weaknesses identified as contributors to identified problems. In addition, licensee management was found to validate the effectiveness of certain corrective actions through the performance of drills associated with Simplex system failures and subsequent reviews of the results attained.

3.0 EXIT MEETING

The inspector met with PP&L personnel, denoted in Attachment 1 of this report, at the conclusion of the inspection on July 28, 1995. The scope of the inspection and inspection results were summarized. During this meeting, the licensee committed to provide a docketed letter to NRC Region I, presenting the necessary elements for closure of open item no. 50-387, 388/94-16-01 once all actions have been completed, as detailed in report section 2.2. The licensee agreed with the inspection results. The inspector received proprietary material during the inspection and used the material only for technical reference. No part of the material was knowingly disclosed in this inspection report.

Attachment: Persons Contacted

ATTACHMENT

Persons Contacted

Pennsylvania Power and Light Company

*T. Clymer	Surveillance Coordinator, NAS
*R. Kichline	Project Licensing Specialist
*G. Kuczynski	Manager, Nuclear Plant Services
L. O'Neill	Supervisor, Balance of Plant Systems
R. Prego	Supervisor, Surveillance Services
*G. Stanley	Vice President, Nuclear Operations
*J. Tripoli	Senior Project Engineer, Fire Protection
*R. Wehry	Project Engineer, Nuclear Licensing

United States Nuclear Regulatory Commission

*M. Banerjee	Senior Resident Inspector, Susquehanna Station
*W. Ruland	Section Chief, Region I, Electrical Section

* Indicates those in attendance at the exit meeting held on July 28, 1995.