U.S. NUCLEAR REGULATORY COMMISSION
REGION I

DOCKET/REPORT NOS.: 50-277/95-24
50-278/95-24

LICENSEE: PECO Energy Company

FACILITY: Peach Bottom Atomic Power Station, Units 2 and 3
Delta, Pennsylvania

DATES: September 18-22 and September 25 to October 4, 1995

INSPECTOR: Leonard G. Cheung 10/25/95
Leonard Cheung, Sr. Reactor Engineer Date
Electrical Engineering Branch
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APPROVED BY: William H. Ruland 10/25/95
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Areas Inspected: An announced inspection to review licensee corrective actions for resolving two generic engineering issues: 1) Unresolved Item 94-10-01 for the multiple failures of normally-energized ASCO Model 206 solenoid valves; and 2) Unresolved Item 95-11-01 for the problems associated with daisy-chaining of 120 Vac power supplies. This inspection also included a review of: 1) licensee management oversight of engineering issues; and 2) three technical issues related to the fire suppression system in the cable spreading room (CSR).

Results: The licensee had taken extensive corrective actions for the two generic issues. The inspector determined that these corrective actions were thorough and appropriate, therefore these two unresolved items were closed. The licensee had good management oversight of engineering issues. Of the three technical issues related to the fire suppression system in the CSR, one issue was resolved, and two issues became unresolved items. These unresolved items are: 1) 95-24-01, Peach Bottom fire protection program and the impact of inadvertent discharge of CSR carbon dioxide system on the installed safety equipment; and 2) 95-24-02, the appropriateness of Peach Bottom's response to an inadvertent carbon dioxide discharge alarm.

DETAILS

1.0 PURPOSE AND SCOPE OF INSPECTION (37550)

The purpose of this inspection was to review licensee corrective actions for resolving two generic engineering issues. These generic issues are: 1) Unresolved Item 94-10-01 for the repetitive failures of normally energized ASCO Model 206 solenoid valves; and 2) Unresolved Item 95-11-01 for the problems associated with daisy-chaining of the 120 Vac power supplies. This inspection also included reviews of: 1) licensee management oversight of engineering issues; and 2) technical issues related to the fire suppression system in the cable spreading room.

2.0 FOLLOWUP OF PREVIOUS INSPECTION ITEMS

The inspector reviewed licensee corrective actions taken to resolve two unresolved items associated with two generic issues to determine if they were appropriate and thorough. Items were closed where the inspector determined that corrective actions would prevent recurrence.

2.1 (Closed) Unresolved Item 94-10-01 pertains to the generic issue of multiple and repetitive failures of ASCO normally-energized safety-related solenoid operated valves (SOV). This item was identified during the June 1994 inspection (94-10) and had been updated in Inspection Reports 94-21, Section 4.3 and 94-25, Section 5.0. The affected SOVs were ASCO Model 206 solenoid valves, used for normally energized applications, mostly in the emergency service water (ESW) supply to room coolers. However, four of these SOVs were used for the cooling water supplies to the four emergency diesel generators (EDG).

ASCO Model 206 SOV is a three-way, lever-operated, solenoid valve. Energization of the solenoid moves the iron core, which moves a lever, which opens the normally closed port to the common port, and closes the normally opened port. The early version of this model was a lubricated type, i.e., a lubricant (Dow Corning 550 silicone oil) was applied by ASCO to the moving surface. The later version of Model 206 was a non-lubricated type. No silicone oil was used in the manufacturing process. ASCO designated this model as X206 to differentiate this from the lubricated type.

The licensee-documented record indicated that the first failure of ASCO Model 206 normally-energized SOV occurred in February 1989. During a test when the SOV was deenergized, it did not switch port position. Subsequently, the licensee replaced the SOV and sent the failed valve to PECO Laboratory to determine the failure mechanism.

PECO Laboratory could not duplicate the failure condition. However, the laboratory analysis indicated that this valve contained degraded Dow Corning 550 lubricant. Subsequent to the PECO Laboratory test, the licensee sent the failed solenoid valve to ASCO for further evaluation. ASCO could not duplicate the failure condition either. ASCO's conclusion was that the solenoid valve was functional, and that the valve failure was probably due to poor air quality. Therefore, ASCO did not report to the NRC under 10 CFR Part 21.

The licensee stated that, subsequent to the February 1989 failure, there were about 10 additional failures of normally-energized ASCO Model 206 solenoid valves during the following years. The licensee also learned that other utilities (Georgia Power, Southern California Edison, Carolina Power and Light, and Southern Company Services) also had multiple failures with ASCO Model 206 SOV at their nuclear facilities. The licensee joined the nuclear utility group and met with ASCO in an attempt to resolve this issue. However, no definite root cause was identified by the group.

In 1992, the licensee replaced all normally-energized ASCO Model 206 SOVs (about 30 for both units) with non-lubricated type (Model X206) SOVs, and incorporated an "air blow" requirement for pilot solenoid valve tubing during valve maintenance to minimize instrument air containments.

In June 1993, Peach Bottom experienced the first non-lubricated type SOV failure. During 1993, multiple failures of the non-lubricated type SOV were identified. Following the first SOV failure in June 1993, the licensee formed a station team to evaluate this issue. The team consisted of system managers, component engineers, and nuclear engineers. The team's conclusions were: 1) to replace the four SOVs that were used for the cooling water supplies to the four EDGs with AVCO Model U0103 solenoid valves, and 2) electrically and mechanically disconnect other solenoid valves in the ESW system to cause the air-operated valves (AOV) to be permanently in the failed-open position.

For Item 1 above, the licensee issued ECR 94-07947 for like-in-kind replacement evaluation. The inspector reviewed this evaluation entitled, "Diesel ESW Solenoid Valve Replacement," and found it appropriately addressed important characteristics such as port size, material, pressure and temperature rating, seismic effect and C_v. The lower C_v of the AVCO solenoid valve was appropriately justified. After the AVCO solenoid valves were installed, these valves were tested weekly for 6 weeks. The valves functioned properly. The inspector also saw the installed AVCO valves and did not observe any abnormalities.

For Item 2 above, the licensee issued two ECRs to disconnect the electrical wiring and pneumatic tubing for the affected solenoid valves, ECR 94-07505 for Unit 2 and ECR 94-09687 for Unit 3. The AOVs associated with the affected solenoid valves (10 valves in each unit) were used to supply service water to the ECCS/RCIC room coolers. The increase in service water flow through the room coolers was evaluated in EWR A0840680, dated June 16, 1994, safety evaluation TPA 2-33-08 (Unit 2) and TPA 3-33-05 (Unit 3). EWR A0840680 also discussed the effect of increased erosion/corrosion of the cooler piping, associated with permanently failing the service water supply valves to the open position. The increased erosion/corrosion was an economic issue rather than a safety issue. The inspector reviewed the two ECR packages, EWR A0840680 and the two safety evaluations, and found that they appropriately addressed the impact of disconnecting the solenoid valves electrically and mechanically.

The inspector also discussed with the licensee PECO's role in reporting the multiple and repetitive failures of the solenoid valves. The inspector was shown Peach Bottom's reportability criteria which did not require the licensee to report to the NRC regarding the solenoid valve failures. However, the licensee stated that they would consider future equipment failure issues when developing the new reportability criteria for the new 10 CFR 21, which becomes effective in October 1995.

The inspector concluded that the licensee's corrective actions taken to resolve this issue were thorough and appropriate to prevent recurrence. Therefore, this item was closed.

2.2 (Closed) Unresolved Item 95-11-01 pertains to problems associated with daisy-chaining of 120 Vac power supplies. During the June 1995 inspection, the inspector was concerned with the event that occurred on May 7, 1995, when the 3B core spray initiation logic system inadvertently lost power as technicians performed the logic system functional testing (LSFT) of the core spray system. The loss of power was immediately detected by the control room operators and the adverse condition was promptly corrected. The licensee's investigation of this event indicated that the problem was caused by a drawing error in the electrical diagram, compounded with the lack of attention to detail by the clearance procedure writer. During the June 1995 inspection, the inspector also found additional drawing errors on several logic and electrical drawings. The inspector raised the following two concerns regarding this issue: 1) the quality of controlled electrical drawings used in the determination of clearances. Specifically, if drawings are not correct, what verification and validation steps are needed prior to use; and 2) the understanding of the possible impact on other systems when core spray logic is tested or maintained, and the tracking of associated TS LCOs. The inspector believes that confusion may be introduced, in part, due to using the term CS logic when it may be more appropriate to use a broader term such as engineered safety system logic.

To address the first concern, the licensee promptly assembled a multi-disciplined task force to assess the drawing error conditions. This six-member team had members from electrical design, instrumentation and control (I&C), maintenance planning, plant engineering and operations.

The task force selected the high pressure coolant injection (HPCI) panel diagrams for review and verification. The task force was able to verify about 85% of the HPCI panel wiring. Certain wiring was inaccessible or impractical to be disassembled for verification. Based on the amount of errors (14 errors total) identified, the team extrapolated the accuracy of the wiring diagrams to be 98.6%. The team concluded that the wiring drawings contained a certain degree of inaccuracy. However, existing procedures and processes were in place which, when used properly, would prohibit drawing inaccuracies from becoming contributing factors to events. The task force team made four recommendations to improve configuration control of the wiring drawings:

1) Increase frequency (from Category C1 to Category A2) for revising critical wiring drawings. This recommendation was later determined to be impractical and was not implemented. Proper justifications were provided.

2) Revise management directive to require increased frequency for updating as-built drawings of panel wiring changes. Implementation of this recommendation was still in progress. Limerick and Chesterbrook engineering were also involved with the implementation.

3) Provide guidance to design and drafting (through revision of Standard NE-C-400) to avoid using daisy-chain for 120 Vac power supplies in future plant modifications. Implementation of this recommendation had been completed.

4) Management of electrical and I&C design engineering should encourage their engineers to recommend updating drawings to "as-built" when performing design change documentation (DCD) dispositions. This recommendation was implemented.

All drawing errors identified by the task force team and the NRC (during the June 1995 inspection) were corrected through Action Requests A0938109 and A0938138.

In addition to the above corrective actions for improving the quality of electrical drawings, the licensee also took extensive steps to improve their design, clearance, and tagging processes to minimize or eliminate potential problems associated with daisy-chaining of 120 Vac power supplies. These corrective actions included: 1) issued "Operations Clearance and Tagging Guide 9"; 2) provided training on daisy-chaining of neutral wiring in 120 Vac power supplies to clearance procedure writers and reviewers; 3) restricted personnel who were allowed to perform technical reviews of clearance procedures to three designated and highly trained technical reviewers.

The inspector reviewed "Operations Clearance and Tagging Guide 9." This 14 page document contained extensive explanations and detailed instructions on potential problems caused by daisy-chaining the neutral wiring of 120 Vac power supplies. It also contained an 18-item check list, requiring both clearance procedure writer and reviewer to sign off this check list, and to walkdown the affected components. In additions, this document also provided the following specific instructions: 1) when lifting leads, wiring must be traced back to the fuse and the end of the logic; 2) when print errors are identified, and before the as-built conditions are documented to support clearance approval, an independent walkdown and discussion of changes should take place between the writer and reviewer to gain agreement on the actual field conditions; 3) when panel wiring drawings are used, an independent walkdown and review of the drawings should be done.

The inspector interviewed a clearance procedure writer and a designated technical reviewer, and found them to be very familiar with "Operations Clearance and Tagging Guide 9."

The inspector concluded that the licensee's corrective actions were extensive and had included sufficient verification and validation steps to minimize the effect of electrical drawing errors. The first issue was resolved.

For the second issue, the licensee conducted a thorough evaluation for the effect of losing the power supply to the other logic channel during testing of one core spray logic channel. The evaluation indicated that loss of one logic channel would cause the plant to enter limiting condition for operation (LCO) under Technical Specification Sections 3.2.B and 3.5.A.2. The licensee revised the alarm response cards on July 25, 1995, to provide more guidance to the operators upon receipt of the core spray logic power failure alarm. The licensee also revised, on August 8, 1995, abnormal operation Procedures AO 57B.12-2 and AO 57B.12-3. The revised procedures required the operators to enter LCO under Technical Specifications Section 3.2.B, prior to opening the power feed to the core spray logic during the investigation of dc electrical grounds. The licensee completed a training program for the operators on loss of logic power alarms. This training program was included in the licensed operator requalification training, which was conducted on April 10, 1995, and May 12, 1995. Another training program on logic power circuits and the impact of deenergizing these circuits was also provided to the system managers in three sessions, conducted on May 23, 24, and 30, 1995.

The inspector concluded that the licensee's corrective actions for resolving the second issue were extensive and very thorough. Therefore, this item is closed.

3.0 CARBON DIOXIDE DISCHARGE IN CABLE SPREADING ROOM

In January 1982, the licensee completed a study of the effect of fire suppression system actuation in the cable spreading room (CSR). The study was based on a test conducted at Three Mile Island (TMI) Unit 1 in 1976. This test indicated that when carbon dioxide (cardox) was discharged to the CSR, the responses for most instruments were extremely erratic. These abnormalities began a few seconds after the cardox discharge and lasted for up to 30 minutes. The licensee's study determined that the instruments in the CSR could not be relied on following a cardox discharge. Subsequently, the licensee completed several plant modifications and issued Station Procedure SE-2 to address this issue. Entry condition No. 2 of this procedure (currently Revision 6) stated that the discharge of cardox into the CSR may cause the control equipment of several safety systems to respond in an uncontrollable or unreliable manner. The inspector asked if, during a design basis accident, a single failure in the fire protection system could cause inadvertent actuation of the cardox system. The licensee referred to Peach Bottom licensing basis and stated that Peach Bottom license did not postulate a failure in systems other than those systems used for accident mitigation. The inspector confirmed this licensing basis with the NRC Project Manager.

While working on the above issue, the licensee noticed that there were two cases where voltage fluctuation caused fire suppression system actuation elsewhere at Peach Bottom. Because of this condition, a concern was raised: during a design basis accident plus loss of off-site power (LOOP), can the voltage fluctuation cause an inadvertent actuation of the cardox system in the CSR? In response to this concern, the licensee completed a review of the record of fire alarms in the CSR. The review indicated that voltage fluctuations caused by load-testing of EDG E2 did not lead to actuation of the CSR fire alarm.

Peach Bottom CSR fire alarm system consisted of two channels, both powered by the same power source (bus E124). The cardox system would be actuated when both channel alarms were energized. The inspector reviewed the electrical drawings and confirmed that bus E124 received its power from 4kV bus E23. During a LOOP, bus E23 was powered by emergency diesel generator (EDG) E2. Each time when E2 was load-tested, bus E23 was subjected to voltage fluctuation similar to a LOOP condition. The inspector reviewed the report of the above study and agreed that this issue was resolved.

Assuming the statement in Procedure SE-2 was true, the inspector asked the licensee whether Peach Bottom fire protection system design met 10 CFR 50 Appendix A, Criterion 3 (GDC 3), which required the fire fighting systems to be designed to assure that their inadvertent operation did not significantly impair the safety capability of systems and components important to safety.

In response to this question, the licensee stated that Peach Bottom did not commit to GDC 3. However, Peach Bottom fire protection program has similar requirements (Item No. 5 - fire suppression system A.5), which Peach Bottom partially committed to, but did not address the impact of inadvertent discharge of CSR cardox system. The licensee agreed to evaluated this issue and to address the result in their fire protection program. This item is unresolved pending the licensee's completion of their evaluation and subsequent NRC review (50-277/95-24-01; 50-278/95-24-01).

The inspector raised a concern on Station Procedure SE-2. This procedure requires the operators to respond to the cardox discharge alarm regardless whether the CSR has a real fire or not. The required responses included manually scramming both units, running back recirculation flow to minimum on both units, going to the HPCI alternate shutdown panel to initiate safe shutdown process. Since the licensee had not performed a thorough study, based on quantified data, regarding the true consequence of the cardox discharge into the CSR, these responses may be over-reactive to an inadvertent actuation or alarm of the cardox system. The 1982 study completed by the licensee was a qualitative analysis. No quantified data (such as concentration of cardox, and distances of equipment from discharge paths) were available at that time. In 1991, EPRI issued a test report (EPRI NP-7253) on this subject, with quantified data, that could be used to perform a more realistic analysis.

In response to this concern, the licensee stated that although the above actions could cause unnecessary transients in the reactor systems, safe shutdown of the plant could still be achieved. Therefore, they were reluctant to perform the additional analysis. NRC Region I will review this issue to determine if further NRC action is warranted. This item is unresolved pending completion of the NRC review (50-277/95-24-02;50-278/95-24-02).

4.0 MANAGEMENT OVERSIGHT OF ENGINEERING ISSUES

The inspector reviewed the licensee management involvement in resolving engineering issues to assess oversight effort in this area.

The licensee developed the Performance Enhancement Program (PEP) in September 1993. This program was to identify and evaluate plant issues, including engineering issues, and to track the issues until completion. This program was controlled by Administrative Procedure LR-C-10.

As a result of the May 7, 1995, event which caused the inadvertent loss of power supply to B channel core spray initiation logic, the licensee issued PEP#I0003950 to determine the root causes and appropriate corrective actions for resolving this issue. Similarly, after the first failure of the non-lubricated ASCO Model 206 solenoid valves, the licensee issued PEP#I0000517 for the same purpose. These documents contained engineering evaluations (consisted of nine individual evaluations for the first issue, and two evaluations for the second issue) and the recommended corrective actions. The inspector's review of these two documents indicated that the engineering evaluations were thorough and technically sound, and the recommended corrective actions were appropriate. Particularly noteworthy was the complete dated-record in chronological order for each completed action. This provided an easy road map to verify each completed corrective action.

The Peach Bottom licensing department was responsible for monitoring the progress and status of all PEP issues. The inspector's interview with the licensing department manager indicated that Peach Bottom generated an average of about 50 PEP issues per month. Each week, the licensing department manager briefed the plant manager (using computer-generated charts) on the status of all outstanding PEP issues (there were four levels of PEP issues). PEP issues greater than 45 days old would receive special attention from upper management. The inspector reviewed the PEP issue status report, dated September 14, 1995, and found this report contained very informative data for the outstanding issues.

The inspector concluded that the PEP had provided management with a good tool for monitoring and tracking the progress of engineering issue resolutions, and that management had a good understanding of the progress on these issues.

5.0 EXIT MEETING

The inspector met with the licensee personnel, denoted in the Attachment, at the conclusion of the inspection on September 22, 1995, and summarized the scope and results of the inspection. No proprietary materials were reviewed during this inspection. The licensee did not dispute the inspection findings at the exit meeting.

On October 4, 1995, the inspector informed Mr. A. Wasong of PECO Energy Company during a telephone conversation that, after additional document review, there were two unresolved items associated with cable spreading room fire suppression system issue.

ATTACHMENT

Persons Contacted

PECO Energy Company

J. Armstrong	Senior Manager, Plant Engineering
P. Babiuk	Engineer, Component Engineering
F. Cook	Senior Manager, Design Engineering
A. Fulvid	Manager, Nuclear Quality Assurance
M. Hammond	Manager, Electrical design
D. McGuire	WWOCT, Operations
T. Mitchell	Director, Site Engineering
W. Nelle	Lead Assessor, NQA
R. Smith	Experience Assessment Engineer
A. Wasong	Manager, Experience Assessment

U.S. Nuclear Regulatory Commission

R. Lorson	Resident Inspector
W. Ruland	Chief, Electrical Branch, DRS
W. Schmidt	Senior Resident Inspector

All of the above personnel attended the exit meeting on September 22, 1995.