10CFR2.201

PHILADELPHIA ELECTRIC COMPANY

NUCLEAR GROUP HEADQUARTERS

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January 8, 1993

Docket Nos. 50-352
50-353

NUCLEAR SERVICES DEPARTMENT

License Nos. NPF-39
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U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Subject: Limerick Generating Station, Units 1 and 2
Reply to a Notice of Violation
NRC Combined Inspection Report Nos. 50-352/92-81
and 50-353/92-81

Gentlemen:

Attached is Philadelphia Electric Company's (PECo's) reply to a Notice of Violation for Limerick Generating Station (LGS), Units 1 and 2, which was contained in the NRC Combined Inspection Report Nos. 50-352/92-81 and 50-353/92-81 dated December 4, 1992.

The Notice of Violation addresses items identified during an Electrical Distribution System Functional Inspection (EDSFI) pertaining to the DC loading calculations, and the surveillance testing of DC batteries and degraded voltage relays.

The attachment to this letter provides a restatement of the violations identified during the EDSFI which was conducted between August 31, 1992 and October 2, 1992 at LGS, Units 1 and 2, and PECo's Nuclear Group Headquarters followed by our reply.

An extension of the due date for this reply to January 8, 1993 was agreed to during a discussion between Messrs. R. M. Krich (PECo) and C. J. Anderson (USNRC, Region I) on January 4, 1993.

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If you have any questions or require additional information, please do not hesitate to contact us.

Very truly yours,

G. J. Beck, Manager
Licensing Section

Attachment

cc: T. T. Martin, Administrator, Region I, USNRC w/ attachment
T. J. Kenny, USNRC Senior Resident Inspector, LGS w/ attachment

Reply to a Notice of Violation

Restatement of the Violations

As a result of the inspection conducted on August 31 through October 9, 1992, and in accordance with the "General Statement of Policy and Procedure for NRC Enforcement Actions," 10CFR Part 2, Appendix C (Enforcement Policy)(1992), the following violations were identified:

A. 10CFR50, Appendix B, Criterion XI, requires, in part, that "A test program shall be established to assure that all testing required to demonstrate that structures, systems, and components will perform satisfactorily in service is identified and performed in accordance with written test procedures which incorporate the requirements and acceptance limits contained in applicable design documents. Test results shall be documented and evaluated to assure that test requirements have been satisfied."

Contrary to the above, the design requirements and acceptance limits were not properly translated into test procedures, in that:

1. On and before October 2, 1992, the additional Class 1E batteries loads shown on calculation No. 6900E.22, Revision 1, calculation No. 6600E.09, Revision 4A, Appendix IX, and for the HPCI pump discharge valve were not incorporated into the surveillance procedures, Technical Specifications and FSAR.

2. On and before October 2, 1992, the design requirement for a minimum battery voltage of 108Vdc stated in design calculation No. 6470E.26, Revision 3, was not incorporated in the Technical Specification surveillance test procedures. The existing surveillance test procedures used a less conservative value of 105Vdc to demonstrate that 125/250 Vdc batteries will perform satisfactorily in service.

3. On September 29, 1992, the test technician failed to notify the shift supervisor immediately when the as-found time delay of 12 seconds was measured for the 93% degraded voltage with simulated LOCA signal present. This value exceeded the Technical Specifications limit of 11 seconds.

These items collectively constitute a Severity Level IV violation (Supplement I).

REPLY

Admission of Violation

Philadelphia Electric Company (PECo) acknowledges the portions of the violation identified in Items A.1 and A.2 above as discussed immediately below. However, PECo does not acknowledge the portion of the violation identified in Item A.3 above as discussed following the reply to Items A.1 and A.2.

Reason for the Violations

Item A.1

PECo has completed a Root Cause Analysis of the situation that led to the documents that reflect the station Class 1E battery load profiles (e.g., Technical Specifications, Surveillance Test procedures and the Updated Final Safety Analysis Report) not being revised once additional loads were identified. This review was coupled with a detailed examination of the interrelationships between the existing DC System calculations. Following is a summary of that review, with a specific discussion of the "additional" Class 1E battery loads specified in Violation A.1.

The Limerick Generating Station (LGS) batteries were originally sized by the Architect/Engineer (A/E), Bechtel Power Corporation, in calculation No. 6600E.03, "Sizing the 125/250 VDC Station Batteries," Revision 0, dated March 8, 1976. Various revisions to this calculation were made prior to the issuance of a subsequent calculation, 6600E.09, "125/250 VDC Load Study," Revision 0, dated June 14, 1983.

These calculations did not include the loads identified in Violation A. 1 for the reasons explained below, but did specify the minimum voltage of 105Vdc. These calculations were based on determining a composite battery load profile. That is, the battery loads for design basis events were combined to establish a single load profile that was intended to bound the battery loads that would be expected during specific design basis events. This composite profile was developed assuming that the batteries would be required to provide DC power without charging for a duration of four (4) hours after a Loss of Coolant Accident (LOCA). Also, due to the calculational methods at the time, the determination of battery loads assumed longer loading durations than would actually occur. Accordingly, the resultant composite load profile is conservative relative to the actual load profile that would occur during specific plant transients and accidents.

The following is a discussion of the reasons for not evaluating each of the loads identified in Violation A.1 relative to the composite load profile.

Circuit Breaker Spring Charging Motor Loads (Calculation No. 6600E.09, Appendix IX)

Calculation No. 6600E.09 stated that inrush current due to spring charging motors was not included because of the relatively short duration of the applied load. No further review of this assumption was conducted until document turnover from the A/E to PECo at the end of the plant construction phase in 1991. The A/E, as required by its procedures, conducted a review of all electrical calculations prior to turnover. This review resulted in questions and responses that were tabulated in Attachment IX to the subject calculation and added in Revision 4A, dated December 19, 1991 (i.e., Revision 4 in the PECo Document Control System). As a direct response to these questions, a decision was made to perform an analysis which would show that the addition of the loads from spring charging motors would not impact the existing battery capacity.

The results of this analysis indicated that since the documented battery load profile was developed using equipment loads derived from a composite of postulated worst case design basis events, the effects of the spring charging motor loads on the battery duty cycle were considered but not included due to the relatively small increase in load. Our review at that time concluded that sufficient margin existed in the documented load profile to account for a spike (i.e., less than a one (1) amp-hour increase) in battery loading caused by the spring charging motors.

Due to the fact that the composite load profile did not represent a specific event, engineering reviews and assessments resulting from the identification of additional battery loads for specific accident sequences were difficult to perform. Therefore, the use of a composite load profile coupled with the engineering judgement that sufficient margin was available when additional specific loads were identified, was determined to be the basis for the conclusion that a load profile revision was not required. Recent evaluation of this issue has concluded that the spring charging motor loads do not impact the documented load profile (e.g., Technical Specifications Section 4.8.2.1.d) since these loads are non-concurrent with other loads in the same time frame and are less then the motor operated valve loads; however, we have determined that they should have been identified within the calculation and addressed accordingly.

High Impedance Fault (Calculation 6900E.22)

Calculation 6900E.22, "Verify the 125/250 VDC Battery Size," Revision 0, dated May 23, 1989, was specifically developed to demonstrate that the station batteries were capable of handling their load requirements, along with an undetected high impedance fault in the 120Vac circuits supplied by the station non-Class 1E inverters. This issue evolved from the Independent Design and Construction Assessment (IDCA) of LGS Unit 2 that was performed by an independent contractor, and was reviewed and evaluated by the NRC as documented in a number of Inspection Reports. Specifically, the NRC requested additional information in Inspection Report No. 89-201, dated August 23, 1989, regarding the consideration of a high impedance fault with respect to the issue identified in IDCA Design Observation Report No. DOR-87.

PECo's response to this item was transmitted to the NRC by letter dated October 23, 1989. As stated in our response, the results of the calculation indicated that there is adequate end-of-life capacity of the vital batteries considering an undetected high impedance fault. At that time, it was considered that this additional load was not required to be included in the battery design basis since no regulatory basis for doing so was identified. Therefore, no subsequent revision to the loading profile and/or the Technical Specifications was determined to be necessary.

High Pressure Coolant Injection (HPCI) System Valve HV55-*F105 Load

The HPCI system valve, HV-55-*F105, load was not included in the early revisions of calculation No. 6600E.03 since the valve was not originally required to operate to mitigate the consequences of a design basis accident. Subsequently, concerns associated with the Anticipated Transient Without SCRAM (ATWS) issue were raised. The A/E developed a modification that revised the control logic to include the opening of valve HV55-*F105 (i.e., HPCI system injection into the feedwater line) during HPCI pump initiation thereby providing another injection path for HPCI into the reactor vessel to mitigate the consequences of an ATWS event. Communications between the A/E's HPCI control design engineer and 125/250Vdc design engineer did not address the fact that the load from the subject valve in the battery load profile was being changed to the first minute of battery discharge. In addition, the A/E Load Change Process at that time did not adequately consider a change in the battery duty cycle as a load change. Therefore, since this valve was already a connected load, the impact of the change to the control logic on the documented battery load profile was not considered.

As part of the PECo self-assessment process, an internal Safety System Functional Inspection (SSFI) of the HPCI system was conducted in January and February, 1992. One of the action items resulting from that internal review raised the same issue regarding valve HV55-*F105. The A/E response, approved by PECo, indicated that valve HV55-*F105 was not required to operate for a design basis accident. This response was based on an inadequate review of calculation No. 6600E.03.

During the assessment of LGS with respect to the Station Blackout rule, calculation No. 6900E.12, "Battery Capacity Study for Station Blackout," was issued to perform a battery capacity study. This calculation correctly included valve HV55-*F105 in the one (1) minute loading of the battery profile.

The above discussions show that there were procedural deficiencies that resulted in a less than adequate evaluation of the impact of changes to calculations or design analyses on the Technical Specifications, Surveillance Test procedures, and the Updated Final Safety Analysis Report (UFSAR). In addition, the fact that the HPCI system valve load was not originally included in the appropriate calculation as recognized during the internal SSFI was compounded by an inadequate review of the calculation during resolution of the SSFI action item. However, the results of recent evaluations concluded that the existing composite battery load profile continues to bound all of the additional loads identified above.

Item A.2

During the early stages of construction at LGS, battery sizing calculation No. 6600E.03 was developed. This calculation was required to support the electrical analysis reflecting a design basis accident (DBA) scenario which included a Loss of Offsite Power (LOOP) coincident with a LOCA and a four hour DC (i.e., battery) load duty cycle. The size of the batteries was determined using the results of calculation No. 6600E.03 with input from Specification 8031-E-13, "Batteries and Battery Racks," which provided criteria for conservatively sizing the batteries (i.e., cell discharge levels, temperature effects, aging factors, design margin, etc.). By comparison, the end-of-discharge voltage (i.e., 105Vdc) was obtained based simply on the Manufacturer's recommendation that each battery cell not be discharged below the value of 1.75 volts-per-cell.

When DC control cables were to be installed, calculation No. 6470E.26, "Calculate the Maximum Control Circuit Cable Length for Switchgear and DC MCC's," Revision 0, dated August 8, 1983, was developed to determine the longest possible circuit length for a given size cable. This calculation used the value of 108Vdc as the minimum battery voltage at the battery terminal. This would assure the proper equipment voltage for the worst case circuit lengths. Calculation Nos. 6600E.03 and/or 6470E.26 should have provided a basis for the difference between the 105Vdc battery sizing end-of-discharge voltage and the 108Vdc minimum battery voltage, such that sufficient information would have been available to reconcile the 108Vdc value with the Technical Specifications acceptance criterion of 105Vdc. However, this was not accomplished at that time since the battery size was not impacted by the control cable length calculation.

On January 12, 1989, IDCA Design Observation Report No. DOR-087 was initiated to address a concern that the maximum control cable lengths determined by calculation No. 6470E.26 were questionable since the battery sizing calculation No. 6600E.03 places the end-of-discharge voltage at 105Vdc. The emphasis of this concern was the maximum cable length and not the discrepancy between voltage values in the two calculations. In the response to this DOR, the 108Vdc was determined to be correct based on original data, load values, and design margins. The battery manufacturer (i.e., C&D Batteries) concurred with this conclusion. Therefore, calculation No. 6470E.26 was considered acceptable.

The use of the composite load profile discussed above has complicated both our capability to analyze battery capacity and our capability to demonstrate the adequacy of voltage at the connected loads. The composite profile does not represent a specific design basis event but combines features of several design basis events to yield a bounding load profile. It also contains conservative design basis requirements that have not been updated as a result of changing regulations. Specifically, the composite profile reflects a four hour duty cycle duration based on consideration of a postulated station blackout coupled with a requirement to start and load an Emergency Diesel Generator (EDG) during the last minute of the four hour profile. By comparison, the current LGS design basis load profile for the batteries during a station blackout as specified in 10CFR50.63 is only one hour.

Given the degree of conservatism in the composite load profile described above, we have concluded that successful performance of the Technical Specifications surveillance test, i.e., a battery discharge voltage of greater than or equal to 105Vdc, ensures that the battery voltage for the load profile resulting from any specific design basis event will be at or above the required 108Vdc. Therefore, the Technical Specifications acceptance voltage of 105Vdc is the appropriate value to confirm battery operability.

Corrective Actions and Results Achieved

Item A.1

Revisions to the existing calculations (i.e., 6600E.03, 6600E.09, and 6900E.22) will be completed for the LGS Class 1E batteries, specifically to correct the inconsistencies between the calculations. In addition, a new calculation will be performed to redefine the current composite load profile as individual load profiles for specific types of events. These actions are scheduled to be completed by September 30, 1993.

The results of the above efforts will be reviewed against the UFSAR, Technical Specifications, and Surveillance Test(s) to determine the need, if any, for revisions. Applicable processes will be followed in the evaluation of any proposed changes.

Item A.2

As was cited in response to the battery load profile issue (i.e., Violation A.1 above), existing calculations will be revised for the LGS Class 1E batteries, specifically to correct the inconsistencies between calculations. In addition, the new load profile calculation identified in response to Violation A.1 above will define the battery terminal voltage. These actions are scheduled to be completed by September 30, 1993 coincident with the resolution of Violation A.1.

Calculations to verify adequate voltage at required components fed from the 125Vdc distribution panels are also being performed and will be completed by December 31, 1993. The results of the above battery profile calculation will be used as input to these voltage drop calculations.

As an interim measure, the existing battery profile surveillance test procedure will be revised to include the HPCI valve, spring charging motor, and high impedance fault loads that are not currently included in the battery profile identified in the Technical Specifications. This revised Surveillance Test will demonstrate that adequate voltage is available for operation of required loads in accordance with the existing maximum cable length calculations. This procedure revision will be completed before performance of the next battery profile surveillance test currently scheduled for February 1, 1993.

Corrective Actions Taken to Avoid Future Non-compliance

Item A.1 & Item A.2

The Root Cause Analysis performed on these issues identified that procedures in place at the time of occurrence did not specifically address the issues identified (e.g., the load change procedure did not address changes to the battery duty cycles). We have reviewed the applicable PECo procedures currently in place and have concluded that the existing procedures are sufficient to avoid future non-compliance with one exception as described below.

1. The existing procedure for control of calculations requires:

    a. a calculation cover sheet that cross references other calculations that supply or use information from the subject calculation, and

    b. obtaining station interface review of calculations affecting procedures.

2. The existing procedure for electrical load change control requires identifying a load change as not only an addition or deletion but as a change in duty cycle.

3. The procedure for control of calculations did not adequately address the impact of changes to calculations on the UFSAR and Technical Specifications, and any associated Surveillance Test procedures. Therefore, this procedure will be revised by July 30, 1993 to ensure that this impact is properly evaluated.

To address the inadequate review associated with the HPCI valve identified during the internal SSFI, a sampling of other SSFI responses will be reviewed by March 30, 1993 to assess their adequacy. We will determine if further actions are required based on the results of this review.

Date When Full Compliance Was (Will Be) Achieved

We have determined that the existing composite battery load profile is bounding with respect to the additional loads identified in violation and a minimum battery voltage of 108Vdc. However, as a confirmation, a new calculation will be performed by September 30, 1993 to redefine the composite load profile as individual battery load profiles for specific types of events. With respect to the procedural deficiencies identified, we have determined that current procedures are sufficient to address the deficiencies with the exception of the procedure for control of calculations which will be revised by July 30, 1993.

Reply to Item A.3

On September 29, 1992, Instrumentation and Controls (I&C) Technicians were performing Surveillance Test (ST) procedure ST-2-092-324-1, "4KV EMERGENCY D14 BUS UNDERVOLTAGE CHANNEL FUNCTION TEST," which was observed by an NRC Inspector. During the test a problem occurred wherein the test equipment lost electrical power and a non-validated relay time delay reading was observed to be outside of the required limits as specified in the ST procedure. The NRC Inspector was concerned that the I&C Technicians did not communicate to the Main Control Room (MCR) Shift Supervisor that the relay time delay reading was outside of the required limits and that the relay was therefore inoperable. Based on the results of an investigation into the test evolution, we have concluded that the I&C Technicians properly performed the ST procedure, that the I&C Technicians adequately communicated with the Shift Supervisor, that there was no valid as-found time delay reading measured for the prescribed degraded voltage, that the failed test equipment status was communicated to the Shift Supervisor, that the failed test equipment was the source of the relay time delay reading being outside of the required limits, and that the Technical Specifications (TS) were complied with. Below are further details surrounding the test evolution and the results of our investigation.

On September 29, 1992, at 0920 hours, the ST procedure was being performed and the MCR Operator was informed that the channel under test was being placed in an inoperable condition in accordance with procedure step 6.3.2. TS Section 3.3.3, ACTION b in conjunction with TS Table 3.3.3-1, ACTION 37 requires that with the channel inoperable, the channel (i.e., the breaker) must be placed in the tripped condition (i.e., racked out) within one hour. The ST procedure clearly states this requirement in steps 5.3.4, 6.3.2, and 6.3.4, and the MCR Operator was made aware that the TS ACTION was entered prior to and during performance of the test. The I&C Technicians performing the test and the MCR Operator were aware of the TS ACTION during the test performance. Two relays were successfully tested when a problem was encountered with the test equipment during testing of the third relay.

During the testing of the third relay, step 6.4.2 was performed to establish a test voltage between the required limits of 111.2 and 112.2 volts AC as specified in Table 1 of the ST procedure. This voltage is established to ensure that the relay remains in the tripped condition during the test. This voltage is recorded in Table 1 in accordance with step 6.4.3. At the beginning of Section 6.4 (i.e., the section which contains instructions for testing the third relay) a "NOTE" instructs the I&C Technicians to repeat the test steps if the voltage established in step 6.4.2 drifts out of the prescribed limits and causes the elapsed time of the relay trip to exceed the acceptable limit. The test section may need to be repeated since voltage changes in the power supply source will result in changes to the elapsed time of the relay trip. The voltage changes can result from load changes within the rest of the plant. Maintaining the voltage within the required limits is essential to obtain an accurate time delay reading for the relay trip. It is not uncommon for the I&C Technicians to repeat the performance of the individual relay tests due to voltage drifting. Because of this "Note," the test voltage was periodically checked by the I&C Technicians during the performance of the test to ensure the validity of the test results (i.e., the relay time delay reading.)

During the performance of step 6.4.12, relay a time delay reading of approximately 12 seconds was observed by the I&C Technician. The ST procedure specifies an acceptable limit of 11 seconds. Immediately after the reading was observed, the I&C Technician attempted to re-check the test voltage; however, the voltmeter screen was blank. The I&C Technician then re-checked the timer and discovered that its screen was also blank. The I&C Technician then attempted to re-start the test equipment; however, the test equipment failed to respond. Therefore, the I&C Technician could not re-check the established test voltage needed to validate the time delay reading of 12 seconds.

This I&C Technician is a highly trained and experienced individual who has performed this test over one hundred times previously and was aware that this relay time delay had not been found outside of the required limits in the past. Based upon his on-the-job training (OJT) and expertise, the I&C Technician was confident that the time delay reading just observed was invalid, and that the failed test equipment was the source of the inaccurate reading and would either have to be repaired or replaced. Complying with the "Note" at the beginning of Section 6.4, the I&C Technician then contacted his co-worker in the MCR who informed the MCR Operator and the Shift Supervisor that the test equipment had failed, and that the test for the third relay would have to be terminated at step 6.4.12 until the test equipment could be repaired or replaced. Permission to stop the test at step 6.4.12 and to remove the test equipment in accordance with Section 7.0 of the ST procedure was then granted by the Shift Supervisor. The test equipment failure occurred approximately five minutes into the test. The I&C Technicians knew that the testing would have to be completed within the 45 minute time limit specified in ST procedure step 5.3.4, or that the breaker would have to be racked out by operations personnel in accordance with the TS ACTION.

The I&C Technicians returned to the shop and verified that the timer and voltmeter had blown fuses. It was determined that a replacement voltmeter could not be obtained within the prescribed time limits and the I&C Technicians then notified the MCR Shift Supervisor that the TS ACTION would have to be taken. This notification was made within the 45 minute time limit specified in the ST procedure. It was at this time that the I&C Technician learned that the breaker was already being racked out as a result of a conversation between the Shift Supervisor and the NRC Inspector. An investigation of this event concluded that the NRC Inspector had in effect proceeded past step 6.4.12 to step 6.7.20.1, which instructs the I&C Technicians to immediately notify Shift Supervision if a <u>valid</u> "As Found" reading exceeds its required limit. Step 6.7.20.1 is performed only after the I&C Technician has observed that the elapsed time for the relay trip has exceeded its required limits and that the test voltage has remained within its required limits, (i.e., to ensure that the relay time delay reading is valid).

A replacement voltmeter was obtained on the same day and the ST procedure was performed again. The results of the test verified that all of the relay setpoints were within the TS limits and were operable. The readings for the first two relays were identical during the performance of the two tests indicating that the test equipment failed during testing of the third relay. The results also verified that the test equipment was the reason for the time delay reading on the third relay exceeding the required limits during the first test, and that the first reading was inaccurate.

In conclusion, the I&C Technicians properly communicated with the MCR Operator and Shift Supervisor and complied with management's expectations, the appropriate TS ACTIONs were taken within the required time period, and that the third relay was capable of performing its intended function throughout the event. Additionally, the I&C Technicians had taken the proper action by stopping the test at step 6.4.12, contrary to the statement made in paragraph 2 on page 32 of Inspection Report Nos. 50-352/92-81 and 50-353/92-81 which implies that the Technician should have performed step 6.7.20.1 before the initial time delay reading for the third relay was confirmed to be valid.

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