August 13, 1984

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
COMMONWEALTH EDISON COMPANY	)	Docket Nos. 50-454 OL 50-455
	)	
(Byron Station, Units 1 and 2)	)	

TESTIMONY OF NRC STAFF WITH RESPECT TO EQUIPMENT SUPPLIED TO BYRON BY SYSTEMS CONTROL CORPORATION

Q1. Please state your names and positions with the NRC.

A1. (Mr. Hayes) My name is D. W. Hayes. I am Chief of a Reactor Projects Section in Region III.

(Mr. Connaughton) My name is K. A. Connaughton. I am a Resident Inspector (reporting to the Senior Resident Inspector) at the Byron Station.

(Mr. Muffett) My name is James Muffett. I am a Reactor Inspector in the Division of Reactor Safety, NRC Region III.

Q2. Have your professional qualifications previously been submitted in this proceeding?

A2. (Mr. Hayes) Yes. A copy of my professional qualifications is attached to the "Testimony of NRC Staff on Allegations Resolved (In

Part or In Whole) by the Reinspection Program or Otherwise Relevant to the Reinspection Program," filed on July 2, 1984.

(Mr. Connaughton and Mr. Muffett) Yes. Copies of our professional qualifications are attached to the "Testimony of NRC Staff on Remanded Issues With Respect to the Reinspection Program," filed on July 2, 1984.

Q3. What is the purpose of this testimony?

A3. (Panel) During inspections conducted since the close of the licensing hearings in August 1983, the staff became aware of uncorrected weld deficiencies on equipment supplied by SCC. This testimony discusses information acquired since the close of the licensing hearings in August 1983 regarding the extent of corrective actions taken relating to Systems Control Corporation (SCC) equipment and presents the Staff position on the adequacy of the equipment.

In Attachment A to its letter from Cordell Reed to James G. Keppler dated January 26, 1981 (attached), the Applicant stated that (1) for SCC equipment, source inspections had been conducted for all safety related equipment shipped since February 1980 and that source inspections would be conducted on all future shipments of SCC work and (2) with respect to SCC work shipped from May 1977 to February 1980, in each case of deviation from specified technical requirements, items of nonconformance had been identified and

documented on nonconformance reports. In view of these statements, the Staff did not expect to find uncorrected weld deficiencies.

Q4. Briefly state what actions were taken as a result of the Staff becoming aware of the uncorrected weld discrepancies mentioned in the response to the previous question.

A4. (Panel) Because of these findings, the Staff conducted a special inspection that focused on CECo's corrective actions relating to all identified deficiencies with SCC equipment, including those corrective actions described in the January 26, 1981 response. Details and findings of this inspection were documented in NRC Inspection Report Nos. 50-454/84-32, 50-455/84-25. As a result of the Staff findings from this inspection, the Applicant has recently initiated further efforts to establish the acceptability of equipment supplied by SCC. These efforts are described in the testimony of Kenneth T. Kostal, following Tr. 10159, and the testimony of Bradley F. Maurer, following Tr. 10158. The Staff has also requested and received additional information from the Applicant in the course of the Staff's inspection effort.

Q5. Please describe the scope-of-work/equipment supplied by Systems Control Corporation.

A5. (Panel) SCC was a supplier of both safety-related and non safety-related electrical, instrumentation, and control components. More specifically, SCC supplied electrical cable trays and associated fittings, cable tray hangers (supports), local instrument panels

(racks), portions of the main control boards, and certain vertical panels. SCC procured materials for cable trays, fittings and hangers and fabricated these items. For local instrument panels, main control boards and vertical panels, SCC procured materials, designed and/or fabricated the structures and installed appurtenant electrical, mechanical, instrument, and control components manufactured by others (e.g., valve manufacturers, instrument manufacturers). The scope of SCC work was defined by Sargent and Lundy engineering specifications F/L 2815 for cable trays, fittings and cable tray hangers, F/L 2809 for local instrument panels (racks), and F/L 2788 for the main control boards and vertical panels.

Q6. Did the Applicant establish, in February 1980, an independent inspection program for equipment supplied by SCC?

A6. (Mr. Hayes and Mr. Connaughton) Yes.

Q7. Why was it necessary to establish that program?

A7. (Mr. Hayes and Mr. Connaughton) SCC began shipping safety-related local instrument panels to Byron in December 1979. On February 11, 1980, Region III received an anonymous allegation that welding on local instrument panels supplied by SCC did not conform to engineering specifications. As a result of discussions between Region III and the Applicant concerning this matter, the Applicant's Byron site QA organization conducted surveillance inspections of local instrument panels on February 14, 1980 and determined that the

majority of welds inspected were deficient. On February 15, 1980 the Applicant issued CECo Nonconformance Report (NCR) No. F-474 which identified a generic problem with welds on local instrument panels supplied by SCC. To resolve this generic problem the Applicant established a program of independent inspection of local instrument panels.

Q8. What was involved in the independent inspection program, in terms of (1) the equipment shipped prior to initiation of the program, and (2) the equipment shipped subsequent to initiation of the program?

A8. (Mr. Hayes and Mr. Connaughton) The independent inspection program which began on February 15, 1980 required the inspection of all safety-related local instrument panels supplied to Byron by SCC. Local instrument panels shipped prior to that date were inspected at Byron by Pittsburgh Testing Laboratory (PTL) and either repaired and reinspected onsite or sent back to SCC for repairs. Local instrument panels initially shipped from SCC after February 15, 1980 were inspected by PTL prior to shipment. Local instrument panels being reshipped from SCC (following repair) after February 15, 1980 were also inspected by PTL prior to shipment. Ultimately, all safety-related local instrument panels were independently inspected by PTL and accepted.

Q9. Was this independent inspection program as described in the Applicant's January 26, 1981 response to item of noncompliance (50-454/80-04-01; 50-455/80-04-01)?

A9. (Mr. Hayes and Mr. Connaughton) No. The response letter stated that all safety-related equipment shipped from SCC since February 1980 had been inspected by PTL inspectors at SCC prior to shipment (i.e., source inspected). During the special inspection referred to previously, the staff learned that the only items subject to 100% source inspection from February 1980 to January 26, 1981 were safety-related local instrument panels. Other safety related equipment shipped to Byron during that period (i.e., one hanger, numerous cable pans and fittings, two sections of the Byron Unit 2 main control board (MCB) and four DC fuse panels) were not source inspected. However, the MCB sections and DC fuse panels were inspected at the Byron site.

The Applicant's January 26, 1981 response letter also stated that all future shipments of safety-related equipment would be subject to source inspection. Source inspections were performed on at least a sample of each SCC shipment subsequent to January 26, 1981.

Q10. Was PTL responsible for the failure to conduct inspections in accordance with the January 26, 1981 response letter?

A10. (Mr. Hayes and Mr. Connaughton) No. PTL did as directed by the Applicant.

Q11. Please summarize which safety related equipment supplied by SCC was subject to inspections by anyone other than SCC personnel and which equipment was not subject to such inspections.

A11. (Mr. Hayes and Mr. Connaughton) All local instrument panels were inspected by PTL.

All main control boards and vertical panels were inspected by Sargent and Lundy and partially inspected by Westinghouse. The results of these inspections were analyzed by Westinghouse or Sargent & Lundy.

A number of cable pans, fittings and hangers were inspected by Peabody Testing Services, Industrial Contract Services, the Applicant's quality assurance personnel, Hatfield Electric Company, Sargent and Lundy and PTL.

An undetermined number of cable pans, fittings and hangers have not been inspected by personnel other than SCC inspectors.

Q12. Finding D-105 of the Licensing Board's Initial Decision states as follows: "Applicant discontinued new purchases from SCC in January 1978. As a result of Region III's findings, Systems Control has been barred from procurement activity on safety-related purchases indefinitely." Commonwealth Edison Company (Byron Nuclear Power Station, Units 1 and 2), LBP-84-2, 19 NRC 36, 133-134 (1984). Do you believe that this finding needs to be qualified?

A12. (Mr. Connaughton) Yes.

Q13. In what way do you believe Finding D-105 needs to be qualified?

A13. (Mr. Connaughton) As discussed in Inspection Report 50-454/84-32; 50-455/84-25, CECo did not issue new purchase orders after January 1978. However, from January 1978 through May 1984 CECo did procure additional items from SCC by adding safety-related items to existing purchase orders via change orders. In particular, change orders were utilized either to increase the quantities of previously specified items or to add item types which had been specified in amendments to existing engineering specifications for which SCC had previously been awarded bids.

Q14. What has the Staff determined to be required in order to provide reasonable assurance of safety with respect to SCC supplied equipment?

A14. (Panel) SCC supplied equipment was the subject of a number of Nonconformance Reports (NCRs). These NCRs, including several issued in late 1983 and early 1984, lead us to believe that the SCC QC inspections as well as licensee corrective actions had not been effective. Due to these NCRs, the Staff formulated a position that CECo had to demonstrate that all SCC supplied equipment in the as-built condition is able to withstand as-built loads while conforming to applicable codes.

Q15. What steps has the Staff taken to determine the acceptability of the Main Control Boards?

A15. (Mr. Muffett) I reviewed the Westinghouse analysis of this equipment as described in testimony of Bradley Maurer. This analysis includes a Finite Element Analysis of the equipment, and an engineering evaluation of the welds.

Furthermore, Sargent & Lundy submitted comments to Westinghouse. Those comments generally concerned details of the analytical methodology used by Westinghouse. I have reviewed the Sargent & Lundy comments and Westinghouse replies and found the comments valid and the replies acceptable.

Q16. What are the results of this analysis?

A16. (Mr. Muffett) This analysis demonstrates that the stresses in the members and the stresses in the welds are within the code allowables. (As used in this testimony, "code" refers to either the American Institute of Steel Construction (AISC) or the American Iron and Steel Institute (AISI) codes, as applicable.) Accordingly, the equipment is acceptable.

Q17. What steps has the Staff taken to determine the acceptability of the DC fuse panels (1DC10J, 1DC11J, 2DC10J and 2DC11J)?

A17. (Mr. Muffett) I have reviewed a number of documents relating to the four fuse panels. They include the Sargent & Lundy seismic qualification of DC fuse panels, weld maps of the DC fuse panels, static and dynamic analyses and the weld evaluation of DC fuse panel 2DC10J, and Wyle seismic test report of DC fuse panel 1DC10J.

Q18. Were any welding discrepancies on the DC fuse panels discovered in inspections subsequent to SCC QC inspection?

A18. (Mr. Muffett) Yes.

Q19. What is the nature of discrepancies on the DC fuse panels?

A19. (Mr. Muffett) Discrepancies on the four DC fuse panels included lack of fusion, craters, undercut, porosity, underrun, and underlength. Also, missing stitch welds were identified between the end weld connections on one diagonal brace of one panel (2DC10J).

Q20. How were the DC fuse panels originally evaluated?

A20. (Mr. Muffett) The DC fuse panels were originally evaluated using a dynamic test performed by Wyle Labs on panel 1DC10J.

Q21. After the weld discrepancies discussed in Answer 17 were discovered, what steps were taken to determine whether the dynamic test of panel 1DC10J remained valid to demonstrate the structural adequacy of the remaining panels?

A21. The discrepancies on all four panels were evaluated. For two of the panels it was determined that the original Wyle dynamic test remained valid. I agree with this conclusion. However, the deficiencies on panel 2DC10J were such that the original Wyle dynamic test of panel 1DC10J were not valid for panel 2DC10J. Therefore, a detailed engineering analysis of panel 2DC10J was performed.

Q22. What are the results of this analysis of panel 2DC10J?

A22. (Mr. Muffett) All stresses in the members and in the welds are within code allowables. The highest stress in a weld (in the center cross brace area) is only 38% of the code allowable. Therefore, the structural adequacy of the DC fuse panels has been demonstrated.

Q23. What steps has the Staff taken to determine the acceptability of local instrument racks?

A23. (Mr. Muffett) I have reviewed a number of documents relating to the local instrument racks. These documents include "Evaluation of 17 Local Instrument Panels Inspected by S&L," "Determination of Total Weld Length, Area, and Discrepancies for SCC Panels 1PL54J, 1PL71J, 1PL78JA, 1PL60JA," "Seismic Qualification of Local Instrument Panels" and Wyle Laboratories "Seismic Qualification Test Report of a Local Instrument Rack."

Q24. Were any welding discrepancies discovered in inspections of local instrument panels subsequent to the SCC QC inspection?

A24. (Mr. Muffett) Yes.

Q25. What were the nature of these discrepancies?

A25. (Mr. Muffett) The welding discrepancies discovered included overlap, craters, undercut, arc strikes and under length. No missing welds or cracked welds were discovered.

Q26. How was the structural adequacy of the local instrument racks demonstrated?

A26. (Mr. Muffett) Two methods were employed to demonstrate the adequacy of the racks.

The first was to compare the "as-built" conditions of the racks with the two racks which had been dynamically tested by Wyle Laboratories and demonstrate their equivalence. The second method was to develop a detailed computer model of an eight foot rack and utilize the finite element method to determine forces, moments and stresses in the members and the welded connections.

Q27. What were the results of these two methods?

A27. The first method demonstrated that the panels were dynamically equivalent (based on total effective weld). The second method showed that the most highly stressed connection was stressed to 10% of code allowable. When the greatest strength reduction from a discrepancy found anywhere on these racks is applied to the most highly stressed weld, a factor of safety of approximately 8 relative to the code still exists. Therefore the structural adequacy of the local instrument racks has been demonstrated by both of these methods.

Q28. What steps has the Staff taken to determine the acceptability of the ladder trays and fittings?

A28. (Mr. Muffett) I reviewed Sargent & Lundy Calculation (12.2.140 Revision 0 and Revision 1) "Ladder Type Cable Tray Weldment Evaluation."

Q29. Were any welding discrepancies discovered in inspections of ladder trays and fittings subsequent to SCC QC inspection?

A29. (Mr. Muffett) Yes.

Q30. What is the nature of these discrepancies?

A30. (Mr. Muffett) These discrepancies include lack of fusion, craters, underlength, and overlap.

Q31. How was the structural adequacy of ladder trays and fittings demonstrated?

A31. (Mr. Muffett) Detailed engineering evaluations were performed using weld maps of the individual connections from a sample of the populations of ladder trays and fittings.

Q32. What were the results of this analysis?

A32. (Mr. Muffett) The conclusions drawn by S&L in this analysis were that: (1) the worst strength reduction found in the sample of straight ladder trays could be applied to any connection on the straight ladder trays and the trays would still meet code allowables with respect to the design load; (2) the worst strength reduction found in the sample of ladder fittings could be applied to any

connection on any ladder fitting and the fitting would still meet code allowables with respect to design load.

Q33. Do you agree with these conclusions?

A33. (Mr. Muffett) Generally, yes. However, I have one reservation.

Q34. What is this reservation?

A34. (Mr. Muffett) In some instances the pipe rung of a ladder tee or cross intersects the side channel at an angle of 45°. I believe that the S&L method for determining the strength of this connection should be refined to take into account the reduction in effective throat at the 45° intersection.

S&L has been notified of this concern and is presently recalculating the strength of these connections. I anticipate that the reanalysis will be reviewed by the Staff by August 20, 1984.

Q35. What steps has the Staff taken to determine the acceptability of the solid bottom cable trays and fittings?

A35. (Mr. Muffett) I reviewed two documents concerning the cable trays and fittings. These documents are S&L calculation (8.20.1-3) "Effect of Missing Stiffener on Cable Tray Design" and S&L calculation (12.2.139) "Cable Tray Fittings."

Q36. Were any welding discrepancies discovered in inspections subsequent to SCC QC inspections?

A36. (Mr. Muffett) Yes.

Q37. What were the nature of the welding discrepancies?

A37. (Mr. Muffett) The welding discrepancies included lack of fusion, undersize, craters, undercut, porosity, and small cracks (less than ¼" long).

Q38. How was the structural adequacy of the cable trays and fittings demonstrated?

A38. (Mr. Muffett) The question of the structural adequacy of cable tray stiffeners is addressed by S&L calculation "Effect of Missing Stiffener on Cable Tray Design." The questions regarding the structural adequacy of cable tray fittings are addressed in S&L calculation "Cable Tray Fittings."

Q39. Are any conclusions drawn by these reports?

A39. (Mr. Muffett) Yes, the first conclusion is that the cable pan stiffeners are not required to carry the design loads. The second is that, with one qualification, fitting welds are not required to carry the design loads. The qualification pertains to 90° fittings. On the outside of those fittings only two load paths exist; the fitting weld and the fitting stiffener weld. Therefore, if either weld is missing or otherwise incapable of carrying the requisite load (i.e., cracked) the other weld must be capable of doing so. To provide assurance that there is no 90° fitting with two inoperative

load paths, all 90° fittings are being inspected for missing or racked fitting welds.

Q40. Do you agree with these conclusions?

A40. (Mr. Muffett) In general yes. However, I have one reservation.

Q41. What is your reservation?

A41. (Mr. Muffett) In the calculation "Effect of Missing Stiffener on Cable Tray Design" the methodology of combining seismic response does not adhere to the methodology to which the Byron plant is committed pursuant to its FSAR. S&L has been notified of this concern and at the present time is performing a re-analysis using the combination methodology to which the Byron plant is committed. I anticipate that the reanalysis will be reviewed by the Staff by August 20, 1984.

Q42. What steps has the Staff taken to determine the acceptability of the cable pan hangers?

A42. (Mr. Muffett) I reviewed S&L calculation (19.1.6) "Hatfield and SCC Weld Discrepancies."

Q43 Were any discrepancies discovered in inspections of cable pan hangers subsequent to SCC QC inspections?

A43. (Mr. Muffett) Yes.

Q44. What were the nature of these discrepancies?

A44. (Mr. Muffett) The discrepancies included underlength, undersize, overlap, undercut, craters, and two connections with missing portions of welds. No cracks were present in the sample of welds inspected.

Q45. How was the structural adequacy of the cable pan hangers demonstrated?

A45. (Mr. Muffett) A random sample of 80 hangers was inspected and found to have 107 discrepant welds. Each of these discrepant welds was subjected to a detailed engineering evaluation. None of these connections exceeded code allowables. Nevertheless some large strength reductions were apparent. Based on the largest strength reduction (53%) observed in this sample an additional inspection was required. This inspection inspected 100% of the connections which could not withstand this strength reduction.

Q46. What are the results of this inspection and the Applicant's evaluation of the results?

A46 (Mr. Muffett) The additional inspection identified two connections having missing welds. Based on those findings, the Applicant is initiating a program to inspect all accessible cable pan hanger connections to determine if welds required by design are present. The results of those inspections will be evaluated to determine the need to inspect inaccessible welds. The inspection efforts are expected to take 2 to 6 weeks to complete. The documented program

is expected to be received by the Staff by August 14, 1984. The Staff agrees with the concept of the program as it has been described verbally by the Applicant and believes the program will provide adequate confidence in the acceptability of the installed cable pan hangers. However, final Staff acceptance of the program will await Staff's review of the documented program. The Staff anticipates it will have reviewed the documented program by August 20, 1984.

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January 26, 1981

Mr. James G. Keppler, Director
Directorate of Inspection and
Enforcement - Region III
U.S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, IL 60137

Subject: Byron Station Units 1 and 2
Response to IE Inspection Reports
No. 50-454/80-04 and 50-455/80-05

Reference (a): December 30, 1980 letter from J. G. Keppler to B. Lee

Dear Mr. Keppler:

Reference (a) contained the report of an investigation conducted by Messrs. J. B. McCarten and J. E. Konklin of your office and Mr. L. E. Ellershaw of Region IV regarding activities at Systems Control Corporation and at Byron Station. During that investigation it was determined that certain activities were in noncompliance with NRC requirements. Attachment A to this letter contains Commonwealth Edison Company's response to the Notice of Violation which was appended to Reference (a). The corrective action discussed in Attachment A also addresses your request for discussion of contributing management factors relative to the violation.

Attachment B to this letter contains the requested additional information regarding resolution of the item from Commonwealth Edison Audit No. 6-80-238.

Attachment C to this letter contains the results of the requested inspection of instrument lines.

Please address further questions regarding matters to this office.

Very truly yours,

C. Reed

C. Reed
Vice President

Attachment
cc-6B

NRC Docket Nos. 50-454/455

ATTACHMENT A
Response to Notice of Violation

INFRACTION

Criterion XVI of 10 CFR 50, Appendix B, states, in part, that "Measures shall be established to assure that conditions adverse to quality are promptly identified and corrected...and corrective action taken to preclude repetition."

The Commonwealth Edison Company Quality Assurance Manual in Quality Requirement QR No. 16.0, Section 16.1, states, in part, that "A corrective action system will be used to assure that such items as ...defective material and equipment...are promptly identified and corrected...this system will provide follow up to assure that corrective measures are effectively implemented."

Contrary to the above, during the period from May 1977 to February 1980, the licensee failed to take effective and timely actions to assure that deficiencies in the System Control Corporation (SCC) Quality Assurance Program and equipment fabrication activities were corrected, as evidenced by continued receipt and acceptance on site of defective safety-related equipment from SCC.

CORRECTIVE ACTION TAKEN AND RESULTS ACHIEVED

During the period in question, May 1977 to February 1980, Systems Control Corporation supplied various components under the scope of the following procurement specifications:

Main Control Boards	- Specification F/L-2788
Local Instrument Panels	- Specification F/L-2809
Cable Pans and Hanger Assemblies	- Specification F/L-2815

Systems Control Corporation in the course of fabricating components assemblies under the scope of each specification has deviated from certain specified technical requirements. In each case of deviation, the items of nonconformance have been identified and documented on a Nonconformance Report (NCR).

Corrective action has been completed for the Local Instrument Panels. Nonconformance Reports F-474 and F-484 covering this were closed on 10/21/80.

For the Main Control Boards, engineering analysis to determine disposition has been initiated under NCR F-544 dated 8/8/80.

For cable pan stiffener problems, NRC F-529 was issued on 7/9/80 and Sargent & Lundy has determined the stiffeners satisfied specification requirements. However, final disposition of this NCR is dependent on a re-survey of equipment in the field which is currently under way.

The waiver of inspection points without QA concurrence resulted from failure to recognize that QA approval of waivers was mandatory. Also, the site receipt inspection performed by the Project Construction Department was primarily an inspection for shipping damage. Subsequently, as identified in the NRC inspection report, detailed inspections were performed by Commonwealth Edison which identified deviations on components supplied by Systems Control. The deficiencies identified have been controlled via NCR's. In addition, the Commonwealth Edison Site Quality Assurance Department has established requirements for performing significantly more detailed inspections for all equipment received on site generally using the independent testing contractor. These inspections are in addition to those performed by Project Construction.

MANAGEMENT FACTORS WHICH LED TO CONTINUED RECEIPT OF NONCONFORMING MATERIAL AND ACTION TAKEN TO PREVENT RECURRENCE

With regard to the management factors contributing to the continued receipt and acceptance of defective equipment shipped by Systems Control, the previously established method of handling notification of inspection points was not sufficiently controlled to assure that all established mandatory inspection points were properly executed or properly waived. As a result, processing the notification of inspection points has been revised to ensure that all notifications are processed through a designated Project Construction coordinator who is responsible for: (1) assigning a Project Construction engineer to conduct the inspection point or, (2) obtaining documented waiver from Quality Assurance for all mandatory inspection points which are not to be conducted. Project Construction and Quality Assurance personnel who are involved in the processing of vendor inspection points have been retrained. In addition, all project specifications for the Byron Site have been reviewed to assure that mandatory inspection points are established.

As described in the preceding corrective actions, receiving inspections will be upgraded to provide significantly more detailed inspections for all safety related equipment.

For Systems Control Corporation, source inspection has been conducted for all safety-related equipment shipped since February 1980 and source inspection will be conducted on all future shipments involving Systems Control. These inspections have been conducted by

the Pittsburgh Testing Laboratory under the direction of the Byron Quality Assurance Department. The inspections cover welding, equipment identification, sealing of instrumentation lines and other specification requirements.

Furthermore, since January 1978 Commonwealth Edison has not made any purchases from Systems Control. As a result of the NRC verification of allegations against Systems Control, as reported to Commonwealth Edison on December 30, 1980, Systems Control has been barred from procurement activity involving safety-related purchases for an indefinite period.

DATE WHEN FULL COMPLIANCE WILL BE ACHIEVED

We are in full compliance at this time.

0048B