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1881 - 1981

SEP 29 1981

Mr. Ronald C. Haynes, Director
United States Nuclear Regulatory Commission
Office of Inspection and Enforcement, Region I
631 Park Avenue
King of Prussia, PA 19406

Subject: Significant Deficiency Report No. 35
Final Report for HVAC Fabrication and Installation Deficiencies
Limerick Generating Station, Units 1 and 2
NRC Construction Permit Nos. CPPR-106, 107

References: a) Telecon of February 24, 1981
H. R. Walters (PECO) to R. Gallo (NRC)
b) Interim Report of March 23, 1981

File: QUAL 2-10-2 (SDR #35)

Dear Mr. Haynes:

Attached is our final report on the above subject deficiency which was reported to the USNRC per the above references in accordance with 10CFR50.55(e).

If there are any questions on the matter we would be pleased to discuss them with you.

Sincerely,

John S. Kemper

JPE/gra
Attachment
Copy to: Director of Inspection and Enforcement
United States Nuclear Regulatory Commission
Washington, D.C. 20555

J. P. Durr, Resident NRC Inspector

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FINAL SIGNIFICANT DEFICIENCY REPORT NO. 35

HVAC RELATED PROBLEMS

LIMERICK GENERATING STATION

UNITS 1 AND 2

PHILADELPHIA ELECTRIC COMPANY

SEPTEMBER 1981

SDR-35-1

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1.0 Introduction

This is the final report on the HVAC related problems at Limerick Generating Station. It has been determined that the HVAC Subcontractor has fabricated and erected ductwork and duct hangers which are not in compliance with the design documents.

The deficiencies are related to the structural and functional aspects of the Seismic Class I and Class II A HVAC ducts and supports.

It has been determined that failure to detect the deficiencies could have affected the safety of the plant.

This problem was initially reported to the NRC by telecon (H. R. Walters, PECO, to R. Gallo, NRC) on 2/24/81. Subsequently an interim report was submitted by letter J. S. Kemper, PECO, to B. Grier, NRC, on 3/23/81.

2.0 Description of Deficiencies

There are two parts to this problem. The first part involves the failure of the quality assurance and quality control organizations of the Subcontractor and Contractor, along with the quality assurance organization of the Licensee, to recognize in a timely manner the overall significance of noncompliances being identified and to initiate corrective action. The second part of the problem is the hardware problem which resulted. Accordingly, this report will address each of these problems separately.

Part 1. The quality problem appears to have had its beginning in the Subcontractor's shop fabrication of ductwork in noncompliance with Project design documents. In addition, the Subcontractor's Quality Control personnel failed to conduct their inspections utilizing project design documents.

The Contractor's shop inspector did not identify this noncompliance since he was not instructed to inspect the construction details of the ductwork.

The field installation of the ductwork was also affected by quality problems. Field work commenced in 1977 although at a relatively low level. The Subcontractor's QC effort involved one or two inspectors and it now appears this was not commensurate with the increasing work load. Also, there was insufficient indoctrination and training of the Subcontractor's QC personnel.

Likewise, the number of Contractor's QC personnel were insufficient to handle this increasing work load.

Both the Contractor and Licensee provided limited QA coverage during this period. There were periodic audits and surveillances of the Subcontractor's shop and field activities, but the noncompliances resulting from these activities were not recognized as being symptomatic of a larger problem in a timely manner. This condition persisted until "stop work" orders were established on both the Subcontractor's shop and field activities during the first quarter of 1981.

Had timely resolution of these noncompliances been made by all the parties concerned, the scope and seriousness of the problem could have been better controlled. This lack of timely resolution coupled with minimum staffing appears to have been the common problem with all the quality related organizations involved in this activity.

Part 2. The impact of the quality problems on the hardware resulted in deficiencies and potential deficiencies described below. The resolution of these items is also included in the description.

2a. Duct Hanger Sketch Discrepancies

It was determined that a majority of the hanger sketches developed by the Subcontractor are, to varying degrees, in noncompliance with the Contractor design documents. All of the hanger sketches for Unit #1 and Common Plant have been individually reviewed with a review in progress on Unit #2. All the discrepancies relative to the generic design details were evaluated and any hangers not meeting the design requirements were dispositioned:
a) to repair hangers already installed or;
b) to revise sketches of hangers not yet installed.
The number of hangers requiring repair or sketch revision is less than 10% of the total.

2b. Corner Bend Radius

Design documents define the bend radius requirements for the HVAC duct corner bends. Contrary to these requirements, the Subcontractor made bend radii as tight as 1/32". Such small radii raised the concern of material fracturing due to the sharp corners.

Based on non-destructive examination of the worst cases (thickest material and tightest bend radius), it was concluded that the actual corner bend radii are not significant from a fracturing point of view.

2c. Companion Angle/Stiffener Corner Welds on Ductwork

Design drawings show the design requirements for the duct companion angle/stiffener corner welds. Contrary to the requirements of full penetration welds, the Subcontractor provided fillet welds.

All combinations of duct sizes and design pressures were evaluated. Any companion angle/stiffener corner welds not meeting the minimum design requirements are to be repaired.

2d. Audit Findings/Exception Reports

Approximately fifty-five Licensee Audit Findings and thirty Contractor exception reports have been issued. The majority of these findings document Subcontractor noncompliance to drawing and specification requirements; some document the need to clarify design document requirements. The majority of the findings and exception reports have not been resolved and the remainder will be resolved in the near future.

3.0 Analysis of Safety Implications

The exact nature of any hypothesized failure mode of the ductwork or hangers affected is indeterminate, therefore all deficiencies have been evaluated and will be dispositioned as required. Consequently, the ductwork and hangers will conform to the criteria included in the Final Safety Analysis Report.

4.0 Corrective Action and Action to Prevent Recurrence

Following the issuance of the "Stop Work" orders, an extensive program of audits and inspection was undertaken by the Subcontractor, Contractor, and Licensee. This was accompanied or followed closely by a major indoctrination and training effort along with the assignment of additional QA and QC manpower.

The following tabulates, in detail, the actions taken:

4.1 Contractor's shop inspection surveillance effort was substantially increased with conditions established for the use of 2 or 3 full time inspectors in residence as required.

4.2 Contractor has developed an on-site Quality Control Inspection Program which includes 100% visual examination for Seismic I and IIA completed Duct Sections, Plenums, and shop fabricated hangers.

4.3 Subcontractor's Shop Activities were modified as follows:

4.3a Revised; 1) QA Manual, and; 2) Shop Procedure Manual which includes quality control inspection activities.

4.3b Audit activity was doubled.

4.3c Welding inspectors were retrained.

4.3d Additional training was provided for welding and craft supervisory personnel based on AWS criteria.

4.4 Subcontractor's Site Activities were modified as follows; Subcontractor site inspection procedure has been upgraded to include prescoping of In-Process, Installation and Final Inspections. Selected "Hold Points" have been added to provide for inspection of ductwork and hangers.

4.5 Subcontractor increased the size of the Site Q.C. Staff to 17 people including 2 additional Supervisors who are employed to direct Field Q.C. Inspection Activities. (Note: 6 people were employed in this effort prior to identification of the problem).

4.6 The Subcontractor increased the level of Indoctrination and Training of assigned Q.C. Inspectors, craft and supervisory personnel. In addition, Contractor QA has initiated monthly Limited Scope Audits of the Subcontractor's site activities with emphasis placed on hardware related activities.

4.7 Subcontractor has implemented an Engineering review of all drawings.

4.8 Contractor's Field Engineering is now conducting 100% review of Subcontractor's Fabrication Drawings of hangers and duct work.

4.9 Additional shop audits of Subcontractor facilities by personnel from Contractor and Licensee Quality Assurance.

5.0 Conclusions

As a result of the plan of action being implemented, the safety and structural and functional integrity of the HVAC ductwork and hangers will not be compromised.

The Quality Assurance and Quality Control changes are now being effectively implemented at a level commensurate with shop fabrication and field installation activities. All of the nonconforming conditions noted herein will be corrected by 6/1/82.