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May 27, 1982

Mr. R. C. Haynes
Regional Administrator
Region I
U. S. Nuclear Regulatory Commission
631 Park Avenue
King of Prussia, Pennsylvania 19406

SUSQUEHANNA STEAM ELECTRIC STATION
FINAL REPORT OF A DEFICIENCY INVOLVING
SUPPORTS WELDED TO THE CONTAINMENT LINER PLATE
ERs 100450/100508 FILE 840-4/900-10/821-10
PLA-1054

Reference: (1) PLA-489 dated 5/29/80
(2) PLA-653 dated 3/6/81

Dear Mr. Haynes:

This letter serves to provide the Commission with a final report of a deficiency relating to the welding of supports to the containment liner plate. The deficiency was originally reported to Mr. R. McGaughy of NRC Region I by Mr. A. R. Sabol of PP&L on April 16, 1980. The information contained in this report is submitted pursuant to the provisions of 10 CFR 50.55(e).

The attachment to this letter contains a description of the problem, its cause, safety implications, and the corrective action.

Since the details of this report provide information relevant to the reporting requirements of 10 CFR 21, this correspondence is considered to also discharge any responsibility PP&L may have in compliance thereto.

We trust the Commission will find the information forwarded by this letter to be satisfactory.

Very truly yours,

N. W. Curtis
Vice President-Engineering & Construction-Nuclear

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Attachment

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PLA-1054

ERs 100450/100508

File 840-4/900-10

Mr. R. C. Haynes

cc: Mr. Richard C. DeYoung (15)
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Mr. G. McDonald, Director (1)
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FINAL REPORT1.0 SUBJECT

Attachment of piping and other supports to the containment liner plate.

2.0 INTRODUCTION

The containment structure of Susquehanna Steam Electric Station (Units 1 and 2) is provided with a carbon steel liner plate which serves the purpose of a leak-tight barrier between the containment and its exterior environment. This liner plate is generally 1/4 inch thick with some local areas surrounding penetrations being 1/2 inch or more in thickness. The containment wall liner plate is anchored to the concrete using embedded WT6 x 8.25 structural tees at 24 inch maximum horizontal spacing. Horizontal stiffener plates (typically 3/8" x 6") are provided at an approximate 5 foot vertical spacing. The diaphragm slab liner plate is anchored to the concrete using embedded S3 x 7.5 structural beams at 8 foot x 28 foot maximum spacing. The original design did not provide for use of the liner as a structural element for supporting piping systems or other items. However, as the project design progressed, it became apparent to Bechtel project personnel that supporting items from the liner plate was in fact a practical necessity. This conclusion was reached due to the large number of systems present and the magnitude of supports required in the relatively small volume provided within the containment. It was also recognized that the liner plate does have some structural capacity.

3.0 DESCRIPTION OF DEFICIENCY

Two interrelated deficiencies have been identified in association with supports attached to the containment liner plate.

Deficiency #1

Section 3.8.1 of the project FSAR describes the functions, design bases and acceptance criteria for the containment structure. This section describes loads applied to the liner plate and the manner in which these loads are transferred to the concrete structure and further indicates that the design, analysis and acceptance criteria are based on Bechtel Topical Report BC-TOP-1, Revision 1. Neither the FSAR nor BC-TOP-1 provided for structural attachment loads applied directly to the liner utilizing the liner as a structural member. However, contrary to FSAR Section 3.8.1, items were attached directly to the containment liner plate:

Deficiency #2

Criterion III of 10 CFR 50, Appendix B requires that measures be established for identification and control of design interfaces between design organizations. Design revisions including field changes, are required to be similarly controlled.

Attachment of small pipe supports (where pipe is 2 inches and smaller in diameter) to the containment liner plates was initially accomplished without proper coordination between Bechtel project design disciplines. This situation developed because it was felt that the resulting additional loadings were insignificant. Although the loading from small pipe supports may be considered insignificant when attached to major structural elements, this assumption is not necessarily valid for attachments to the containment liner plate. In addition, field modifications as permitted for large and small pipe by project Specification 8856-M-213 were not reviewed for liner plate adequacy.

Since Bechtel's design interface and coordination between civil and plant design disciplines had not been established for control with regard to pipe attachments to the containment liner plate, Susquehanna Quality Assurance Program requirements were not completely fulfilled.

4.0 ANALYSIS OF SAFETY IMPLICATIONS

The leak-tight integrity of the containment liner plate must be maintained at all times during the operational life of the nuclear power plant to prevent the loss of the pressure retaining boundary. A breach of containment integrity could result in site boundary radiological dose rates exceeding the limits specified in 10 CFR 100.

PP&L has concluded that, if left uncorrected, the two deficiencies detailed in Section 3.0 (i.e. (1) the failure to adhere to FSAR requirements and (2) the lack of design coordination between Bechtel Engineering disciplines) could have resulted in a breach of the containment liner plate leak-tight integrity. These deficiencies are, therefore, considered to be reportable under the provisions of 10 CFR 50.55(e).

5.0 CORRECTIVE ACTION

(A) Evaluation:

In July 1981 Bechtel Engineering noted that the design of some systems attached to the liner plate considered liner plate membrane stresses and anchorage pullout loads but assumed the liner plate to be rigid. This assumption proved incorrect as support flexibility based on the 1/4 inch thick liner plate causes shifts in the support's natural frequency. The impact of the frequency shift on liner plate attachments under seismic and hydrodynamic loads have been evaluated. The results are as follows:

- (1) For large and small pipe systems designed by detailed analysis, a minimum required liner plate stiffness value has been established for each support.
- (2) A detailed evaluation of the techniques used in small pipe simplified analysis has lead to the conclusion that the liner plate stiffness does not need to be considered. This is due to the fact that there is enough conservatism in the simplified method to compensate for stress and load increases due to support flexibility.
- (3) Loads for HVAC duct supports on the liner plate have been revised in order to account for the actual liner plate stiffness. These revised loads have been used for checking the liner plate stress and the liner plate pullout force.
- (4) Electrical conduit, cable tray and junction box supports are not affected by liner plate flexibility since the loads for these supports are based on the peak accelerations from the floor spectra. Therefore, any shift in natural frequency due to liner plate flexibility will not increase the support loads.

(B) Implementation:

Deficiency #1

FSAR Section 3.8.1 has been revised to include a description of liner plate attachments and the associated method of analysis and acceptance criteria. This revision reflects the as-built condition of the liner plate and its associated attachments.

Deficiency #2

Appendix B (Plant Design Group Procedures), of Bechtel's Engineering Procedures Manual (EPM) has been revised to reflect the coordination specified in drawing 8856-C-297.

Deficiencies #1 and #2

On April 14, 1980, Bechtel project quality assurance issued MCAR-1-50 to provide a formal basis for requiring a detailed analysis of the deficiencies and identification of appropriate corrective action.

Bechtel MCAR-1-50 was dispositioned to require that:

- Information be gathered to document the identity and location of all existing liner plate attachments.
- All existing liner plate attachments be evaluated, and corrected as necessary, to assure compliance to the technical criteria specified in drawing 8856-C-297.

Susquehanna Project Drawing 8856-C-297 was issued on August 21, 1980 to provide adequate technical and procedural controls for the evaluation and further processing of all attachments to the containment liner plate. Drawing 8856-C-297 was revised (Rev. 6) on September 2, 1981 to include the liner plate technical criteria for stiffness as well as the previously identified attachment loads.

A program has been established which requires Bechtel Field Engineering to provide Bechtel Project Engineering-Civil with, (1) "As-Built" drawings of all supports attached to the containment liner plate and, (2) updated FCI-drawings which show the location of these attachments on the liner. Bechtel Project Engineering-Civil then reviews the "As-Built" hanger drawings and the FCI-drawings to ensure that the requirements of drawing 8856-C-297 (Rev. 10 issued 4/9/82) have been satisfied.

As of April 20, 1982, approximately 2,700 supports have been identified as being attached to the Unit I containment liner plate. Evaluation of these supports has resulted in 56 fixes.

Completion of the final hanger review and correction of any deficiencies noted for Unit I will be accomplished prior to fuel load.

All supports attached to the Unit II liner plate will also be reviewed under a similar program to assure that they conform to the criteria established in 8856-C-297.

6.0 CONCLUSION

On completion of the corrective actions described in the previous section, the final installation of the attachments to the containment liner plate, as controlled by Project Drawing 8856-C-297, will be adequate to assure that the liner and its attached systems will perform their design function.