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November 4, 1988

Mr. Thomas E. Murley, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Dresden Station Units 2 and 3
Quad Cities Station Units 1 and 2
"Transmittal of Information Pertaining
to the On-Going Flued Head Assessment
(FHA) Program"
NRC Docket Nos. 50-237/249 and 50-254/265

Dear Mr. Murley:

In an October 13, 1988 conference call with NRR, EG&G and CECO personnel, several questions were raised with regard to the on-going Flued Head Assessment (FHA) Program at Dresden and Quad Cities Stations.

This first issue pertains to the basis for the embed length assumed for the Concrete Expansion Anchors (CEA's) in the FHA program. The second issue pertained to the safety factor used for rock anchors in the assessment, which the last issue pertains to how shear transfer from groute to concrete addressed in the program. Attached, please find a copy of our response to these items.

We wish to stress that the FHA's have been walked-down in the field and the information from these walkdowns is available for the review of your staff and/or their contractors.

Please direct any questions regarding this matter to this office.

Very truly yours

I. M. Johnson
Nuclear Licensing Administrator

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Attachment

cc: T. Ross - NRR, Project Manager
B. Siegel - NRR, Project Manager
A.B. Davis - Regional Administrator, RIII
Senior Resident Inspector - Dresden
Senior Resident Inspector - Quad Cities

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The following is CECO's clarification to the three items which were discussed with the NRR during the October 13, 1988, telephone conversation between NRR, BNL, CECO and S&L.

Item #1:

Expansion Anchors: Provide a basis for the embedment length used in the assessment of concrete expansion anchors (CEA).

Response #1:

- o Flued Head Anchors (FHA) at Dresden do not utilize CEAs.
- o FHAs at Quad Cities utilize CEAs and the embedment length used in the assessment is the most conservative.
 - Shell type anchors: Only one shell length is manufactured for each diameter and the shell must be below the surface of concrete. The embedment length is conservatively assumed to be the length of the shell.
 - Wedge type anchors: Shortest manufactured length corresponds to a minimum 4-1/2 diameter embedment. This conservative 4-1/2 diameter embedment is utilized in the assessment.
- o IEB 79-02 program has been completed with excellent results. Hence, there is a high degree of confidence that the existing anchors are properly installed. (Letters to J. G. Keppler, NRC Region III, dated 9/5/80 from R. F. Janecek and dated 2/19/80 from D. L. Peoples, NRC Docket Nos. 50-237/249/254/265/295/304.)

Item #2:

Rock Anchors: Provide the basis for using a factor of safety less than 4 when the concrete cone pullout governs ultimate tension capacity.

Response #2:

- o All FHAs at Dresden and some FHAs at Quad Cities have rock anchors, which exhibit ductile behavior since their tension capacity is controlled by the anchor bolt steel capacity.
- o Some FHAs at Quad Cities have rock anchors which are controlled by the concrete cone capacity.
 - As presented to the NRC during a meeting on February 11, 1988, factors of safety of 3 and 2 are used for the SSE and pipe break load cases for these rock anchors.
 - Based on this criteria, necessary modifications have been completed at Quad Cities Unit 2, and have been issued for Quad Cities Unit 1.

- The factor of safety of 3 is consistent with ACI 349, Appendix B.

- o These safety factors provide more than adequate safety margin, add significant conservatism to the original design basis, and are conservative since the pipe break loading definition is conservative.
- o Portland General Electric has established an assessment criteria for rock anchors at the Trojan Plant using a factor of safety of 2 for SSE. (Letter dated 8/11/87, from D. W. Cockfield to NRC Document Control Desk, Docket No. 50-344.)

The present Dresden/Quad Cities criteria is conservative compared to the Trojan criteria.

Item #3:

Shear load transfer: Explain the presence of concrete compressive stress at shear lug locations. Explain how the shear transfer from grout to concrete is addressed.

Response #3:

- o As indicated in CECO's 9/7/88 transmittal, a state of biaxial global compression in the plane of the concrete element in the vicinity of shear lugs exists.
- o In addition, the rock anchors are pretensioned during installation. This introduces a state of compression between the plate and concrete.
- o Prior to FHA load application, a state of triaxial compression exists.
- o Assessment approach considers shear lugs effective only when a state of compression in the plane of the concrete element can be shown.
- o This assessment approach meets Dresden and Quad Cities FSAR commitments. It is in fact more conservative than the FSAR committed codes, AISC and ACI 318-63, which permit the design of shear lugs regardless of the state of stress in concrete.
- o Industry practice is to consider shear lugs effective regardless of the state of stress in concrete.
- o The present shear lug assessment criteria considers shear lug spacing requirements of ACI 349-85, Appendix B, Section B.5.1.2.2(d). This check serves as a conservative check on the shear transfer from grout to concrete.