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February 21, 1989

Dr. 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 Supplemental Information in Response to NRC Region III/NRR Inspection of Flued Head Anchor (FHA) Assessment Program"
NRC Docket Nos. 50-237/249 and 50-254/265

Reference: Letter from I.M. Johnson to T.E. Murley dated January 31, 1989.

Dear Dr. Murley:

In the above referenced letter, Commonwealth Edison provided information regarding its ongoing Flued Head Assessment (FHA) program at its Dresden and Quad Cities Stations. Commonwealth Edison wishes to supplement its earlier transmittal to address information regarding how sheer tension interaction is considered for rock anchors and through bolts when sheer lugs are not present.

During the January 24 and 25, 1989 inspections at the Sargent and Lundy Offices, a question was raised by Brookhaven National Labs as to how the sheer and tension loads on rock anchors and through bolts are combined if sheer lugs are ineffective or non-existent. We wish to confirm that the sheer and tension loads are combined by the sheer-friction provisions of ACI-349 Code and its related Appendix B. A copy of the Sargent and Lundy Project Design Control Summary Sheet specifying this is attached for the information of your staff in the review of this issue.

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Please direct any questions you may have regarding this matter to this office.

Very truly yours,

I. M. Johnson
Nuclear Licensing Administrator

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

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Notes:

a. The concrete cone capacity for the individual anchors and/or anchor assemblies shall be calculated as follows:

$$\text{Concrete cone capacity } Pd = 4 \times \emptyset \times \sqrt{f'c} \ (Ap)$$

where:

- Ap = Projected Concrete Cone Area
- $\emptyset$ = 0.85 - All embedments are located in a compression zone or in a tension zone where the tension stress at the surface of the concrete is less than $5\ \emptyset \sqrt{f'c}$.
- f'c = Actual in-place concrete strength based upon concrete cylinder data.
- Effective embedment depth will be determined in accordance with Figure B7-1 of ACI 349 Appendix B.
- The effective projected net area shall be reduced to account for overlapping cones from adjacent anchors and/or assemblies as well as the influence of the penetration sleeve which intersects the cone surface. (See Page 0.22)
- The effect of the near face reinforcing may be utilized to increase the capacity of the concrete cones.
- The shear lugs are considered effective to transfer the applied shear in accordance with the requirements of ACI 349 Appendix B when a state of compression exists in the plane of the concrete element in the vicinity of shear lugs and normal to the face of the shear lug. If the shear lugs are ineffective or non-existent, the anchor bolts shall be assumed to transfer the shear in combination with tension by the shear-friction provisions of ACI-349 Appendix B.

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b. The design strength for an individual anchor, where the cone capacity exceeds the ultimate tensile capacity of the rock anchor, shall be established as: