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ComEd

March 20, 2000

United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

LaSalle County Station, Units 1 and 2
Facility Operating License Nos. NPF-11 and NPF-18
NRC Docket Nos. 50-373 and 50-374

Subject: Response to Request for Additional Information
NRC Inspection Report 50-373/99020,
50-374/99020

References: (1) Letter from J.L. Caldwell (U.S. NRC) to O.D. Kingsley (ComEd), "Reply to Non-Cited Violation for NRC Inspection Report 50-373/99020; 50-374/99020," dated February 8, 2000.

(2) Letter from J.A. Benjamin (ComEd) to U.S. NRC, "Reply to Non-Cited Violation for NRC Inspection Report 50-373/99020; 50-374/99020," dated December 21, 1999.

(3) Letter from C.G. Pardee (ComEd) to U.S. NRC, "Response to Request for Additional Information NRC Inspection Report 50-373/99020," dated March 10, 2000.

The Reference 1 letter from the NRC requested information from ComEd based on our Reference 2 response to a Non – Cited Violation issued in November 1999. Reference 3 was submitted to address the specific request attached to the NRC letter. Based on subsequent discussions between Mr. Steve Reynolds of the NRC Region III and ComEd's Mr. Rod Krich on March 14, 2000, ComEd is providing information which responds to requests in the body of the Reference 1 letter.

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The NRC has requested additional information to address the design control issue for anchor bolt stiffness values used in pipe support calculations, and to resolve the fundamental issue related to the appropriateness of modeling the structural attachments to base plates as pinned connections. The concern raised by the NRC in reviewing ComEd's response, dated December 21, 1999, against a single load-displacement static test data curve, previously provided, was that the load seen by the anchor bolt at 0.05 inch displacement would exceed the anchor bolt allowable load by 50%. This appears to have led the NRC to the conclusion that the requisite safety margin of four (4) would not be maintained. The information provided below supports our conclusion that the safety margin of four for the anchor bolt is not compromised.

We have concluded that using a single load verses displacement curve for predicting anchor bolt behavior in the working load range can be misleading. There are many factors that affect anchor bolt behavior; i.e., concrete strength, aggregate angularity, anchor bolt angularity, anchor bolt installation torque, anchor bolt tension relaxation over time, and anchor bolt embedment depth. The true anchor bolt behavior at working loads is indeterminate, unless in-situ tests for specific anchor bolts are performed. This variability has been verified by review of the test data from the Inspection and Enforcement Bulletin (IEB) 79-02, "Pipe Support Base Plate Designs Using Concrete Expansion Anchor Bolts." ComEd's primary use of the load versus displacement static test data curves was to determine, for various anchor bolt types, the ultimate anchor bolt load, ultimate displacement, and stiffness.

As provided in our December 21, 1999, response, the 0.05 inch displacement at the anchor bolt was based on the worst case plate rotation using a conservative rigid plate assumption. If plate flexibility were considered, an even smaller anchor bolt displacement would be calculated. As the plate rotates and the anchor bolts displace, the anchor bolt tension due to the secondary moment is relieved. In addition, the displacements required to relieve the moment is small with respect to the displacement at the ultimate capacity of the expansion anchor bolts, and does not affect the overall load carrying capacity of the expansion anchor bolt. Due to the self-relieving nature of the concrete expansion anchor bolt assembly, no significant forces are developed due to the secondary moment. Therefore, the forces due to the secondary moment do not need to be considered in the design of the anchor bolt assembly.

We have concluded that the use of pinned end connections used in the modeling of certain pipe support structures was appropriate, and that the stiffness values used for anchor bolt design were appropriate. However, we agree with the NRC that the technical basis for the stiffness value was not documented in the calculation reviewed, but we note that this value stems from ComEd's work conducted to closeout IEB 79-02.

ComEd has conducted a review on the use of pinned connections for design of pipe support assemblies and has concluded that the use and application of these pinned boundary conditions were appropriate. Use of pinned connections in design is a recognized structural modeling technique for various bolted or welded connection types. Industry practice and codes recognize that connections that are capable of developing a majority of the theoretical pinned rotation can be treated as pinned connections during the design process. This practice is outlined in textbooks such as, "Steel Structures: Design and Behaviors," by C. G. Salmon and J. E. Johnson and "Design of Steel Structures," by Gaylord and Gaylord.

The secant modulus is the appropriate stiffness to be used for the design of anchor bolts. As discussed in our IEB 79-02 submittal dated July 5, 1979, LaSalle County Station has used a secant modulus for the design of expansion anchors. This value represents the anchor bolt stiffness at ultimate load. All anchor bolts must realize this stiffness before failure. Therefore, the secant modulus correctly computes the anchor bolt forces at the ultimate load, and is the correct value to use when qualifying an anchor bolt against an ultimate load. Our approach considers the ultimate behavior of anchors, and establishes acceptance criteria based on the ultimate behavior (i.e., ultimate load divided by a factor of safety of four). This is in accordance with the requirements of IEB 79-02, which states that expansion anchor bolts shall have a minimum factor of safety of four with respect to the bolt's ultimate capacity determined from static load tests. Consistent with our design basis, it has not been ComEd's practice to predict anchor behavior in the anchor's working load. Maintaining the required factor of safety with respect to the ultimate load has been our approach.

The February 8, 2000, NRC letter recognized the need for a public technical meeting to address possible generic implications of the pipe support modeling issue. We have proposed a tentative meeting for the first week in April. The meeting will cover the following points:

- Modeling of certain anchorage assemblies using pinned end boundary conditions is appropriate and consistent with engineering practice.
- For the supports assumed with pinned end boundary conditions, any moment developed in the plate is due to secondary effects and is self-limiting. An infinitesimal displacement of the anchor bolt is sufficient to relieve the forces associated with the secondary moment.
- The secant stiffness modulus is an appropriate stiffness representation. It is consistent with LaSalle County Station Licensing Basis documented in ComEd's response to Inspection and Enforcement Bulletin (IEB) 79-02, "Pipe Support Base Plate Designs Using Concrete Expansion Anchor Bolts," dated July 5, 1979.

- The design of pipe supports at LaSalle County Station was conducted in accordance with the appropriate codes and regulatory requirements. The anchor bolt design provides the requisite margin of safety specified in IEB 79-02.

Should you have any questions concerning this letter, please contact Mr. Frank A. Spangenberg, III, Regulatory Assurance Manager, at (815) 357-6761, extension 2383.

Respectfully,

Charles G. Pardee
Site Vice President
LaSalle County Station

Attachment

cc: Regional Administrator - NRC Region III
NRC Senior Resident Inspector - LaSalle County Station