

Commonwealth Edison Company  
LaSalle Generating Station  
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December 21, 1999

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 No. 50-373 and 50-374

Subject: Inspection Report 50-373/374-99020  
Reply to Non-Cited Violation

- References:
1. Letter from J. A. Grobe to O. D. Kingsley, transmitting NRC Inspection Report 50-373/374-99020, dated, November 2, 1999.
  2. Letter from R. M. Krich to U.S. NRC Document Control Desk, Extension of Due Date to Response to Inspection Report 50-373/374-99020, dated, December 2, 1999.

The purpose of this letter is to reply to a Non-Cited Violation transmitted by Reference 1. Reference 1 required Commonwealth Edison (ComEd) Company to respond by December 2, 1999. As documented in Reference 2, the NRC granted ComEd an extension until December 21, 1999, to provide a response to Reference 1. Non-Cited Violation 50-373/374-99020-02 identified a failure to verify the adequacy of design as regards the stiffness value used for concrete expansion anchors. Based on reviews we have conducted, we have concluded that we have not violated regulations in this matter. The basis for our conclusions are delineated in the attachment to this letter.

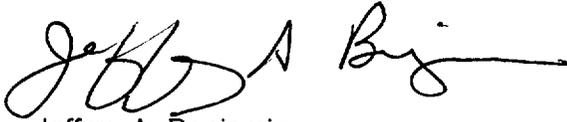
In the referenced letter, the NRC requested a meeting to discuss the possible generic nature of the subject design assumption. The NRC requested that we submit information describing the basis for the anchor bolt stiffness values used in our design, our resolution of the modeling concern, and the impact of our assumptions on pipe support design margins. We consider that the attachment to this letter summarizes this information. We will provide additional information as necessary to support this meeting.

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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,

A handwritten signature in black ink, appearing to read "Jeffrey A. Benjamin". The signature is fluid and cursive, with a long horizontal stroke at the end.

Jeffrey A. Benjamin  
Site Vice President  
LaSalle County Station

Attachment

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

**ATTACHMENT  
RESPONSE TO NOTICE OF VIOLATION  
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**NOTICE OF VIOLATION (50-373/374-99020-02)**

The violation pertains to the assumption used in finite element analyses of LaSalle County Station pipe supports for attachment of structural members to baseplates. In certain cases design engineers assumed that structural attachment points were free to rotate. For LaSalle County Station applications, the connections in question were constructed as fixed connections by full-welding the structural steel to the baseplate connection. The needed flexibility was to be derived from the limited flexibility of the frame, the baseplate and the baseplate anchor bolts. This apparent disparity between the design assumption and construction detail could potentially result in underestimating the loads included in the baseplate anchor bolts.

The failure to verify the adequacy of design is a violation of 10 CFR 50, Appendix B, Criterion III, "Design Control." This is a severity Level IV.

**REASON FOR THE VIOLATION**

We do not consider that we have violated regulations in this matter. The bases for our conclusions are as follows.

An issue was raised related to the structural end-condition modeling in pipe hanger support analysis at the LaSalle County Station. The issue questioned the acceptability of using pinned boundary conditions in pipe support design analysis versus assuming the pipe support joints were fixed. A pinned joint restraint boundary condition assumes that there is some inherent rotation in the connection and that a bending moment in the base plate will not develop, resulting in only reaction forces transferred through the base plate to the concrete expansion anchor bolts. The fixed boundary condition assumes that a bending moment is developed in the base plate and that the concrete expansion anchor bolts will carry both the load created by the bending moment and the reaction forces.

A study was conducted, documenting the justification for using pinned assumptions in the modeling of pipe supports, which is based on accepted industry engineering and code practices. To provide further assurance a sample consisting of a population of the pipe supports that assumed pinned joints restraints in the design analysis was developed, and the pipe support joint restraints were re-evaluated. This re-evaluation consisted of modeling the previously pinned joints as either fixed, or in a few cases, as semi-rigid spring connections. The expansion anchor assemblies were then qualified with these revised boundary conditions using the original expansion anchor acceptance criteria. The conclusion of this analysis technique showed that the LaSalle County Station pipe supports meet the original design allowable even when the stresses due to the secondary moment were included. In addition, it was shown that the joints in question acted more as pinned connections than fixed connections, allowing Commonwealth Edison (ComEd) Company to state that the original design assumption was appropriate.

During the NRC review of the semi-rigid analysis the inspector questioned the stiffness value assumed for the concrete expansion anchors. In Inspection Report 50-373/374-99020 the NRC inspector contended that underestimating the anchor bolt stiffness would result in underestimating the anchor bolt load, potentially affecting the design adequacy of the support. The inspection report cited failure to verify the adequacy of design as a violation of 10 CFR 50, Appendix B, Criterion III, "Design Control." This was documented as Violation 50-372/374-99020-02.

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ComEd contests this violation based on the following.

- The NRC has issued Regulatory Guide (RG) 1.64, "Quality Assurance Requirements for the Design of Nuclear Power Plants" (February 1975), to describe methods acceptable to the NRC to satisfy the requirements of 10 CFR 50, Appendix B, Criterion III. RG 1.64 endorses American National Standard Institute (ANSI) Standard N45.2.11 – 1974, "Quality Assurance Requirements for the Design of Nuclear Power Plants." Section 6.2 of this standard states "The extent of the design verification required is a function of the importance to safety of the item under consideration, the complexity of the design, the degree of standardization, the state-of-the-art, and the similarity with previously proven designs."
- The calculational study reviewed by the NRC does not represent the design bases for pipe support analysis at LaSalle County Station. The original boundary assumptions employed by ComEd are appropriate and are accepted engineering practices (i.e., "state-of-the-art"). Since the original design assumptions are appropriate, the original design bases and licensing bases remain intact without modification, and the design margins remain unchanged.
- A simple check to determine the appropriateness of the joint restraint assumption is to determine the equivalent anchor displacement conservatively assuming a rigid base plate to simplify the analysis. For the worst case hanger configuration provided in the calculational study the concrete anchor displacement required to develop a fully pinned condition was less than 0.05 inch. This value was calculated based on plate geometry, independent of anchor stiffness. Test results show that for deep embedment concrete expansion anchors (i.e., greater than 8 diameters embedment) the concrete expansion anchors can accommodate displacements up to 3/4 anchor diameters prior to any loss in load capacity. The calculated displacement values are much less than the anchor displacement at anchor bolt ultimate capacity. It was recognized during the review efforts associated with Inspection and Enforcement Bulletin (IEB) 79-02, "Pipe Support Base Plate Designs Using Concrete Expansion Anchor Bolts," dated, March 8, 1979, that small displacements occurred in the plate assembly behavior that effectively relieved secondary effects. As long as these displacements were small, the stiffness at the limit state of the anchor was appropriate for the design basis. Therefore, it was appropriate to model these connections as pinned connections because the anchors can easily accommodate the displacement required to relieve the fixed end moment, and thus achieving a pinned condition with no loss in load capacity.
- ComEd does not use semi-rigid analysis techniques for design of pipe supports using concrete expansion anchors. It is not an industry practice to use semi-rigid connections in design, primarily because of the secondary nature of the support moment, and the difficulty in determining the actual degree of restraint expressed as stiffness boundary condition. Anchor stiffness has only been used in the design basis of pipe supports for the local analysis of the base plate anchorage assemblies. The stiffness value and the methodology used to analyze the base plate assembly are identical to the stiffness, methodology and calculations reviewed and accepted by the NRC in response to IEB 79-02. Consistent with good engineering practice, anchor stiffness has not been used

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in the design basis modeling of pipe support frames at LaSalle County Station. The engineer took into consideration the member configuration, member stiffness and joint assembly stiffness to determine the joint restraint boundary condition to be used in the design of pipe support frames. The entire hanger assembly was then designed consistent with the joint restraint boundary condition assumptions made.

- If semi-rigid modeling were to be employed in the design of pipe supports using concrete expansion anchors, specifying a single stiffness value would not be a prudent engineering practice due to the uncertainties in deriving the stiffness value based on the number of variables that impact this parameter. Anchor stiffness is dependent on many factors and anchor displacement prior to ultimate load varies widely based on many factors including anchor pretension, aggregate type, load condition (static, dynamic, and cyclic) and anchor angularity. Analysis would require more than one stiffness value to verify that the design is bounded.

ComEd has reasonable assurance based on industry and engineering practices that the original pinned modeling assumptions were appropriate. The original design bases remains unchanged based on the results of the study.

**CORRECTIVE ACTIONS THAT HAVE BEEN TAKEN AND THE RESULTS ACHIEVED**

As discussed above, a study was conducted documenting the justification for using pinned assumptions in the modeling of pipe supports. No further corrective actions have been taken.

**CORRECTIVE ACTIONS THAT WILL BE TAKEN TO AVOID FURTHER VIOLATION**

No further corrective actions than those described above will be taken to avoid further violations.

**DATE WHEN FULL COMPLIANCE WAS ACHIEVED**

Based on conformance with RG 1.64 and ANSI N45.2.11 full compliance was always maintained.