

U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Reports No. 50-315/86023(DRS); 50-316/86023(DRS)

Dockets No. 50-315; 50-316

Licenses No. DPR-58; DPR-74

Licensee: American Electric Power Service Corporation
Indiana and Michigan Power Company
1 Riverside Plaza
Columbus, OH 43216

Facility Name: D. C. Cook Nuclear Plant, Units 1 and 2

Inspection At: D. C. Cook Site, Bridgman, MI

Inspection Conducted: May 21, 1986

Inspector: J. F. Norton

J. F. Norton

6/4/86
Date

Approved By: D. H. Danielson, Chief
Materials and Processes
Section

D. H. Danielson

6/4/86
Date

Inspection Summary

Inspection on May 21, 1986 (Reports No. 50-315/86023(DRS); 50-316/86023(DRS))

Areas Inspected: Unannounced, routine inspection of licensee action on
IE Bulletin No. 79-02 "Pipe Support Baseplate Design Using Concrete Expansion
Anchor Bolts."

Results: No violations or deviations were identified.

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DETAILS

1. Persons Contacted

Indiana and Michigan Electric Company (I&MEC)

- *W. G. Smith, Jr., Plant Manager
- *A. A. Blind, Assistant Plant Manager
- *G. H. Caple, Administrative Compliance Coordinator
- D. L. Gallagher, Administrative Compliance Coordinator,
Quality Control

American Electric Power Service Corporation (AEPSC)

- *T. R. Satyan-Sharma, Senior Engineer, Safety and Licensing
- *J. E. Petrucelli, Assistant Section Manager, Structural Design
- *F. A. Accetta, Staff Engineer, Civil Engineering
- *R. T. Huerter, Senior Quality Assurance Auditor

US Nuclear Regulatory Commission

- B. L. Jorgensen, Senior Resident Inspector
- *J. K. Heller, Resident Inspector

*Denotes those attending the exit interview.

2. Licensee Action on IE Bulletins

(Closed) IE Bulletin No. 79-02 (315/79-02-BB; 1B; 316/79-02-BB; 1B):
IE Bulletin No. 79-02 "Pipe Support Baseplate Design/Construction Using
Concrete Expansion Anchor Bolts." A review of relevant information
revealed that IE Bulletin No. 79-02 requirements have fully been
implemented at D. C. Cook Units 1 and 2.

a. Background

IE Bulletin No. 79-02 addresses pipe support baseplate design using
concrete expansion anchors. Teledyne Engineering Services (TES) was
authorized by fourteen utilities (including I&MEC) to provide engineer-
ing services which would assist the utilities in responding, in part,
to IE Bulletin No. 79-02, dated March 8, 1979. IE Bulletin No. 79-02
required response to a number of items associated with baseplate
flexibility and its concomitant effect on concrete expansion anchor
bolts. It was determined by the Utility/TES group that a number of
items in the bulletin were generic in nature and could be addressed
more substantially by combining resources and technology.

The specific bulletin items addressed by the Utility/TES group were:

- █ The experimental development of shear-tension interaction curves to properly apply the bulletin safety factors for combined loading.
- █ Experimental determination of the adequacy of concrete anchor bolts that are not preloaded to withstand cyclic loading.
- █ An analytical technique for determining the effect of baseplate flexibility on concrete anchor bolt loading.

The Owner's Group was responsible for directing the efforts of TES and reviewing the specific tasks as they were performed and completed. On April 26, 1979, the Utility/TES group met with the NRC in Bethesda, Maryland to discuss this generic program and its applicability to IE Bulletin No. 79-02. Representatives from I&E and NRR were in attendance and their general conclusion was that "the proposed program would address the concerns for the base plate/anchor bolt installation in a fashion that is acceptable to NRC."

TES submitted Technical Report TR-3501-1, Revision 1, dated August 30, 1979. The report presented the results of a generic program that responded, in part, to the Bulletin. Both experimental and analytical work was performed in this generic program. Shear-tension interaction tests and cyclic test of concrete expansion anchors were performed and a pre and post processor to an existing finite element program was developed to facilitate baseplate analysis. The important general findings of this program are:

- █ Concrete expansion anchor bolts which are preloaded do not deteriorate when subjected to cyclic loading.
- █ A linear assumption for shear-tension interaction loading on concrete expansion anchors is highly conservative.
- █ Baseplate flexibility should be considered in determining the load on concrete expansion anchors.
- █ Testing performed under the program does not indicate a reason for applying different safety factors to different types of expansion anchors.

Subsequently, the NRC staff performed an independent analytical verification of the techniques used to account for baseplate flexibility and its effect on anchor bolt loads. The independent analytical verification consisted of developing an elastic beam-based model of an anchored plate, subjected to static combined axial and moment loading. The concrete base was represented by elastic springs which were capable of sustaining compression only. The anchoring bolts were represented by springs which reproduced the non-linear behavior of the bolts during pull-out. The model also accounted for initial preload in the bolt-plate assembly. The solution to a given

loading condition (i.e., bolt load vs. external load history) was obtained through an in-house developed computer program, which calculated the non-linear behavior in an incremental approach, including equilibrium interaction.

Based on the review and independent verification, the NRC staff concluded that the techniques applied by TES correctly accounted for pipe support baseplate flexibility and was therefore acceptable.

b. Licensee Action

In addition to the generic data developed by TES, the licensee further retained their services to provide a plant specific evaluation of seismic Category I pipe support baseplates and expansion anchors. The engineering analysis is documented in Technical Report TR-3611-2, dated June 27, 1980. Supports were first screened using a conservative procedure to determine anchor bolt forces. Allowable forces were reduced to a low level to account for plate flexibility and prying action as well as shear-tension interaction. Those supports not passing this first level of screening were subjected to a second level of screening which was more precise and less conservative. Supports not passing second level criteria were either analyzed by rigorous computer techniques or the designs were modified to achieve acceptable bolt forces. All rigorous analyses and modifications were checked and verified in accordance with TES Quality Assurance requirements.

Pipe support baseplate modifications were required on 64 supports for Unit 1, and 95 supports for Unit 2. The majority of modifications were designed by TES and used one or more of the following methods:

- Stiffening of the existing baseplate.
- Anchor bolts added to existing baseplates.
- Additional strutting plus baseplate and anchor bolts were added to the existing frame.

c. Conclusion

Baseplate modification have been completed. The modification were accomplished in accordance with licensee engineering and QA/QC requirements. The Region III inspector reviewed paper work and examined several of the modified plates. No discrepancies between design drawings and construction were discerned.

Based on the aforementioned data, it is concluded that IE Bulletin No. 79-02 has been fully implemented at D. C. Cook Units 1 and 2.

3. Exit Meeting

The inspector met with licensee representatives (denoted under Persons Contacted) on May 21, 1986. The inspector summarized the purpose and findings of the inspection. The licensee acknowledged the findings as reported herein. The inspector also discussed the likely informational content of the inspector's report with regard to documents or processes reviewed by the inspector during the inspection. The licensee did not identify any such documents/processes as proprietary.