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Power
Company**

DMB

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July 11, 1984

82-12 #7

Mr J G Keppler, Regional Administrator
US Nuclear Regulatory Commission
Region III
799 Roosevelt Road
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MIDLAND ENERGY CENTER PROJECT
DOCKET NOS 50-329 AND 50-330
SHEAR LUG DESIGN FOR EMBEDS
FILE: 0.4.9.68 SERIAL: 30357

Reference: J W Cook letters to J G Keppler, same subject:

- 1) Serial 19106, dated December 3, 1982
- 2) Serial 20721, dated March 1, 1983
- 3) Serial 22207, dated May 20, 1983
- 4) Serial 26603, dated November 22, 1983
- 5) Serial 28015, dated February 24, 1984
- 6) Serial 30301, dated June 1, 1984

The referenced letters were interim 10CFR50.55(e) reports regarding concrete embedment design using shear lugs located outside the compression zone. This is a final report.

Consumers Power Company has reviewed the results of Bechtel Project Engineering investigations and concurs that the use of shear lugs outside the compression zone is an effective and proper design technique. The attachment to this letter describes the investigation process that lead to this conclusion.

James W. Cook

JWC/WRB/cd

Attachment: 1) MCAR 63, Final Report, dated May 14, 1984

CC: Document Control Desk, NRC DSHood, US NRC
Washington, DC Office of NRR

Midland NRC Resident Office INPO Records Center
Midland Nuclear Plant

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Bechtel Associates Professional Corporation

SUBJECT: MCAR 63 (Issued 11/10/82)
Design of Steel Embedments That Use Shear Lugs
Located Outside of the Compression Zone

FINAL REPORT

DATE: May 14, 1984

PROJECT: Consumers Power Company
Midland Plant Units 1 and 2
Bechtel Job 7220

Reference: Rotz, J.V. and Reifschneider, M., Experimental
Evaluation of Steel Embedments in Concrete Subjected
to Combined Axial and Shear Loading, Bechtel Power
Corporation, February 1984

Introduction

This report addresses a concern with the design of steel embedments in concrete that use shear lugs located outside of the compression zone.

Background

The American Concrete Institute (ACI) 349 Code, Appendix B, issued August 1979, specifies that shear lugs in embedment designs shall be considered effective only in the compression zone. Midland embedment designs completed and installed before this date considered shear lugs to accommodate shear loads and tension bars to accommodate tension loads. Other than ACI 349, Appendix B, no known design code or industry standard restricts the design of embedments using shear lugs outside the compression zone.

For embedments within the scope of this MCAR, the Midland Final Safety Analysis Report, Section 3.8, is committed to design reinforced concrete according to ACI 318-63 and 318-71, and structural steel according to the AISC 1969 edition; however, these codes do not specifically address all aspects of embedment design.

Investigative Action

An evaluation to determine which of the embedments identified have shear lugs located outside the compression zone has been completed for the current design loads.

To determine if the embedments installed in the Midland plant are capable of performing their safety function, a testing program was completed at the University of Michigan to determine the effectiveness of shear lugs located outside of the compression zone. Evaluation of the test results shown in the reference was completed February 29, 1984.

Bechtel Associates Professional Corporation

MCAR 63
FINAL REPORT

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Page 2

Analysis of Safety Implications

Analysis of the tests shows that shear lugs located outside the compression zone are fully effective. Analysis of the tests also shows that the common practice of resisting all tension loads by the tension anchors and all shear loads by the shear lugs (including those outside the compression zone) is a conservative procedure. Therefore, this design practice, which was in place before issuance of MCAR 63, is sufficient to ensure a safe and adequate design.

Corrective Action

There is no corrective action required.

Reportability

This concern, considered potentially reportable in accordance with Title 10 of the Code of Federal Regulations, Part 50.55(e), was reported to the NRC by Consumers Power Company on November 5, 1982. Based on evaluation of the test results this concern is considered not reportable.

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