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May 25, 1984

84-03 #2

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Region III  
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MIDLAND ENERGY CENTER PROJECT  
DOCKET NOS 50-329 AND 50-330  
CONCRETE EXPANSION ANCHORS INSTALLED IN METAL DECKING  
FILE: 0.4.9.90 SERIAL: 30296

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

- 1) Serial 28058, dated March 29, 1984

On February 28, 1984, Consumers Power Company notified your staff of a potential 10CFR50.55(e) condition involving the installation of concrete expansion anchors in metal decking.

This letter is an interim 10CFR50.55(e) report. The attachment to this letter describes the concern and summarizes the investigation and corrective action taking place.

Another report, either interim or final, will be sent on or before July 27, 1984.

*James W. Cook*

JWC/AHB/lr

Attachment 1: MCAR-82, Interim Report 1, dated May 8, 1984

CC: Document Control Desk, NRC  
Washington, DC

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Bechtel Associates Professional Corporation

150318

SUBJECT: NCAR 82  
Expansion Anchors Installed in Metal Decking

INTERIM REPORT 1

DATE: May 8, 1984

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

Introduction

This report addresses a potential safety concern regarding use of expansion anchors installed in metal decking (reference Quality Action Report H-010 and Safety Concern Reportability Evaluation 95).

Background

In some cases where grouting under a base plate was required (i.e., in the valley portion of metal decking), torquing of expansion anchor bolts may have been performed after the grout had reached its design strength. This raised the concern that where bolt torque is applied after the grout has hardened, the bond between the grout and anchor may prevent proper setting of the anchor's wedges.

During the investigative phase of the condition described above, an additional potential area of concern was identified regarding the shear capacity of expansion anchors installed through metal decking. Design allowables used for these installations were based on manufacturer's recommended design allowables that did not address installations into metal decking. As a result, certain installation configurations may possibly experience a reduction in shear capacity because of the way the load is transferred through the grout or rib of the metal decking.

This report addresses both bonding effects and the possible reduction in shear capacity of expansion anchors installed in metal decking.

Investigative Action

1. Bond

Testing done in accordance with Specification 7220-C-308(Q), required for response to Quality Action Request H-010, did not conclusively indicate that the wedges of the expansion anchors had been properly set during installation if the bond between the anchor and grout develops. The number of anchors installed in the valleys of metal decking, which would exhibit this bonding effect, is estimated to be around 500 anchors.

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## 2. Shear

Testing has been performed to evaluate the shear capacity of expansion anchor bolts installed in metal decking in accordance with Specification 7220-C-309(Q). These tests indicated that for some installation configurations, the anchor exceeded 100% of its ultimate capacity. For other types of installation, the capacity ranged as low as 50% of the anchors' ultimate capacity. Additional shear tests are being planned. The number of anchors installed in metal decking being investigated for a reduction of design shear capacity is around 15,000 anchors.

### Analysis of Safety Implication

#### 1. Bond

If, during the installation process, the bond between the grout and the anchor precluded the anchor's wedges from setting properly, a maximum base plate displacement of up to 1/2 inch (depending on anchor size) may occur before the wedges set. This additional displacement has an indeterminate effect on the support component without additional evaluation of each specific installation type where this situation exists. Considering the small number of anchors installed in the valleys of metal decking, corrective action will be taken to verify that the wedges are set properly.

#### 2. Shear

Results from initial C-309(Q) testing showed that, for some cases, the shear capacity of expansion anchors installed in metal decking was less than the allowable design load times the current factor of safety of 4. However, no cases have indicated that the allowable design load exceeds the capacity of the anchor. The need for using the factor of safety of 4 for use on expansion anchors installed on commodities other than piping is being evaluated. In addition, the effects of displacement at the allowable load using a revised factor of safety is being evaluated. Based on information to date, the reduction in shear capacity does not indicate a safety concern.

### Probable Cause

#### 1. Bond

Regarding the bond between the grout and anchor, the probable cause is that the installation torque may not have been applied

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before the grout had cured, thus allowing a bond to develop between the anchor and the grout. This bonding effect may have prevented the wedges of the anchor from setting properly.

## 2. Shear

Regarding the reduced shear capacity of expansion anchors, the probable cause is the shear capacity reduction associated with the shear load transfer mechanism.

### Corrective Action

#### 1. Bond

For base plates with expansion anchors installed in the valleys of metal decking, the anchors will be properly set. Nonconformance Report A-00154 has been issued to track this activity. A plan and schedule to develop procedures for setting the anchors are to be completed by July 11, 1984.

For future installations, the sequence for installing expansion anchors will be to apply 100% of the installation torque before grouting.

In addition, based on test data obtained from Specification 7220-C-308(Q), base plates installed on slabs and walls using expansion anchors and grout are being evaluated for the effects of the grout bonding to the anchors.

#### 2. Shear

The extent of corrective action required for installations with potentially reduced anchor shear capacity will be based on the results from additional testing being planned and further review of the existing test data from Specification 7220-C-309(Q).

#### 3. Bond and Shear

Based on determination of the root cause, further investigations will be performed, as applicable, to determine if similar or related conditions of these types exist on the Midland project. Results of the investigation will be stated in the next report.

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Reportability

This concern was reported to the Nuclear Regulatory Commission by Consumers Power Company as a potentially reportable condition on February 28, 1984.

Submitted by: EA Lawson  
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Project Engineering Manager

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T.E. Johnson  
Civil Chief Engineer

Approved by: E.H. Smith  
E.H. Smith  
Engineering Manager

Concurrence by: MA Dietrich  
for M.A. Dietrich  
Project Quality Assurance  
Engineer

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