



Consumers
Power
Company

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February 22, 1983

80-09 #9

Mr J G Keppler, Regional Administrator
US Nuclear Regulatory Commission
Region III
799 Roosevelt Road
Glen Ellyn, IL 60137

MIDLAND NUCLEAR COGENERATION PLANT -
DOCKET NOS 50-329 AND 50-330
LOW ALLOY QUENCHED AND TEMPERED BOLTING 1½ INCHES
AND GREATER IN SUPPORT OF SAFETY RELATED SYSTEMS
FILE: 0.4.9.46 SERIAL: 20711

REFERENCES: J W Cook letters to J G Keppler, Same Subject:

- (1) Serial 10996, dated January 9, 1981
- (2) Serial 11526, dated March 31, 1981
- (3) Serial 13690, dated September 29, 1981
- (4) Serial 14666, dated January 15, 1982
- (5) Serial 16149, dated April 2, 1982
- (6) Serial 17354, dated May 17, 1982
- (7) Serial 17542, dated July 9, 1982
- (8) Serial 19085, dated October 29, 1982

This letter, as were the referenced letters, is an interim 50.55(e) report concerning the subject bolting. Attachment 1 to this letter provides a summary of the actions being taken with regard to this item.

Another report, either interim or final, will be sent on or before August 19, 1983.

WRB/cd

Attachment 1: MCAR 45A and 45B, Interim Report 8, dated February 2, 1983.

CC RJCook, NRC Resident Inspector
Midland Nuclear Plant

HRDenton, NRC
Office of NRR

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SUBJECT: MCARs 45A and 45B (issued 12/18/80)

INTERIM REPORT 8

DATE: February 2, 1983

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

Introduction

The discrepancies discussed in this report concern the hardness values of the anchor and connecting studs for the reactor coolant pump (RCP) snubbers.

Background

MCAR 45A

The RCP snubber anchor studs are 2-1/4, 2-1/2, 3, and 3-1/2 inches in diameter and vary in length from 3 feet, 5 inches to 7 feet, 1 inch. They are embedded in the secondary shield wall and the refueling canal wall. Also included are 2-inch and 2-1/4-inch-diameter connecting studs approximately 1 foot, 10 inches long that connect the snubbers to a structural steel transition piece. The anchor studs are partially embedded in the concrete and the connecting studs are in place. The snubbers restrain the RCPs during seismic and/or loss-of-coolant accident (LOCA) events. The studs were purchased from various vendors during 1977 and 1978 by Bechtel construction in accordance with either ASTM A 354, Grade BD, or ASTM A 540, Grade B23, Class 3. They were intended to be tensioned to a preload up to 96 ksi to maintain the specified snubber spring rates under all loading conditions. Prior to tensioning, to ascertain that the studs could withstand long-term loads of this magnitude without becoming susceptible to stress corrosion cracking, Consumers Power Company requested Teledyne Engineering Services (TES) to conduct hardness tests on the exposed end of the embedded and connecting studs. TES conducted these hardness tests from November 21 through November 23, 1980. The test results showed that 207 studs of 384 tested are outside the range of hardness specified by the ASTM specifications.

MCAR 45B

On November 26, 1980, Consumers Power Company expanded the 10 CFR 50.55(e) report to include, as potentially reportable, all low-alloy quenched and tempered bolting materials 1-1/2 inches in diameter and larger used in support of safety-related systems.

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Investigative Action

MCAR 45A

Aptech Engineering Services of Palo Alto, California, was retained by Consumers Power Company to review the hardness data taken by TES, and to evaluate the effect of the measured hardnesses on the ability of the studs to withstand preload, operating, and accident loadings. Based on preliminary Aptech evaluations, it was decided to lower the required stud preload (to a maximum of 12 ksi) to preclude failure because of stress corrosion cracking. Subsequently, Aptech has provided Report AES-81-08-79 (which was transmitted to the NRC via Consumers Power Company letter, Serial 17354, 5/17/82). In the development of a generic evaluation methodology (in support of MCAR 45B), it was found that AES-81-08-79 was unconservative (by about 6%) in that development of fracture toughness limited allowable stresses; therefore, the allowable stresses of AES-81-08-79 have been reevaluated. The smallest maximum allowable preload for any of the RCP snubber anchor bolts is 42.9 ksi based on the reevaluation of the AES-81-08-79 allowable preloads. Therefore, the required 12 ksi preload is less than the allowables in the Aptech report and is acceptable. Instructions were issued to construction to preload the studs to 9 ksi, a value lower than the maximum permissible. A tolerance of ± 3 ksi is allowed.

This preload value, when reduced by temperature and relaxation losses, exceeds 3 ksi, a value in excess of the minimum preload of 1.5 ksi required by Babcock & Wilcox (B&W) during operation. New spring rates have been submitted by Bechtel to B&W. B&W is proceeding with the new seismic and LOCA analysis of the reactor coolant system. ITT Grinnell, supplier of the snubbers, has also been informed of the change in the preload. Grinnell stated that there is no effect on the snubbers or on the spring rate of the snubbers themselves.

The Aptech report noted above also contains an assessment of the allowable accident stresses of the RCP snubber anchor bolts. Based on this report and on the reevaluated allowable accident stresses, the allowable stress limits for operation and short duration loading are available. Preliminary calculations have been prepared and the results indicate that the bolt stresses, based upon the capacity of the snubbers, are acceptable when compared to the Aptech allowables. Upon completion of the calculation, a final MCAR 45A report will be issued.

Procurement documentation packages for these studs have been reviewed. All necessary corrective action was completed and a report issued. No additional action is required.

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MCAR 45B

Consumers Power Company is leading the investigation required by this MCAR. Commonwealth Associates, Incorporated (CAI) of Jackson, Michigan, which is under contract to Consumers Power Company, has reviewed safety-related purchase orders and identified those purchase orders for low-alloy quenched and tempered steel (LAQTS) bolting and/or component support material. CAI has also gathered data that will be used in evaluating the LAQTS materials.

Most of the review being conducted on the LAQTS bolting and component support materials consists of field hardness testing. This testing is being performed by Consumers Power Company and CAI.

Based on preliminary hardness test results, approximately 30 bolting material purchases were identified that appeared to contain material considerably softer than allowed by ASTM specifications. Further evaluation and testing on a portion of these materials by the Consumers Power Company laboratory indicated that the bolting materials were actually within the acceptable hardness limits of the ASTM specifications. The differences were determined to be due to the existence of a decarburized layer that had not been completely removed during field testing. The retesting of the remaining portions of these bolting materials with the decarburized layer removed has been completed. Two bolting material purchases contained material that remained considerably softer than allowed by the ASTM specifications following retest.

To date, hardness testing has identified one bolting purchase that contained material harder than allowed by the design criteria and ASTM specifications.

Science Applications Incorporated (SAI) of Palo Alto, California, has been retained and has developed a sampling plan to determine the quantity of items to be tested. SAI is revising the sampling plan as a result of the additional materials identified by CAI. SAI is investigating a retesting method to identify test data that are in error because of the decarburization and to provide a method for correcting the data. In addition, SAI is providing statistical services in preparing the hardness data for evaluation.

Aptech Engineering Services has been retained to assist in evaluating the LAQTS materials purchased by identifying which materials are LAQTS and require testing. Aptech is also assisting in the analysis of the hardness test results.

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Engineering has completed a case-by-case evaluation of existing Bechtel civil-designed bolting as bearing connections with a 12 ksi maximum preload. These bolts occur in restraints, nozzle collars, and other miscellaneous items. Preliminary results indicate that these connections are acceptable as bearing connections.

Corrective Action

MCAR 45A

Construction has been instructed to preload the snubber studs to $9 + 3$ ksi. A procedure was developed by B&W construction to ensure that the studs are tensioned as required. This work has been completed for Unit 2, and is presently in progress for Unit 1. Engineering has made a preliminary comparison of the calculated anchor bolt stresses with the Aptech allowable stresses. These stresses, based on the capacity of the snubber which limits the loading on the studs, are within the Aptech allowable limits. Upon completion of the calculation, a final MCAR 45A report will be issued.

MCAR 45B

The recommended corrective action for the three purchase orders described under Investigative Action is to locate and replace the suspect bolting or verify by evaluation the acceptability of the material for each specific installation.

Quality control receipt inspection includes hardness testing of LAQTS bolting/component support materials to preclude utilization of defective materials.

Safety Implications

MCAR 45A

If the subject studs were tensioned according to the original design requirements, there may have been a safety deficiency in that some of the studs could have failed because of stress corrosion cracking. If uncorrected, this deficiency could adversely affect the safety of Midland plant operations during the expected life of the plant.

MCAR 45B

Three bolting purchases have been identified to date that contain material that hardness tested outside the ranges allowed by the ASTM specification and that was also unacceptable based on preliminary

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evaluation by engineering. Therefore, it must be assumed that these bolting materials could fail during operating or accident conditions. The disposition of the suspect materials will preclude any adverse safety implications.

Reportability

This condition relative to the RCP snubber studs was identified as "potentially reportable" by Consumers Power Company to the NRC under 10 CFR 50.55(e) on November 25, 1980.

MCAR 45A

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MCAR 45B

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