



Consumers
Power
Company

James W. Cook
Vice President - Projects, Engineering
and Construction

General Offices: 1945 West Parnall Road, Jackson, MI 49201 • (517) 788-0453

March 16, 1984

80-09 #13

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

MIDLAND NUCLEAR ENERGY CENTER
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: 28042

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
- (9) Serial 20711, dated February 22, 1983
- (10) Serial 20747, dated April 5, 1983
- (11) Serial 23774, dated August 19, 1983
- (12) Serial 26594, dated December 2, 1983

This letter, as were the referenced letters, is an interim 10CFR50.55(e) report concerning the subject bolting. Attachment 1 provides a current status and the details of the LAQTS material evaluation that is currently taking place.

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

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S PDR

JWC/HSG/lr

James W. Cook

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Attachment: (1) MCAR 45A, Final Report; MCAR 45B, Interim Report 11, dated
February 27, 1984

CC RJCook, NRC Resident Inspector
Midland Nuclear Plant

HRDenton, NRC
Office of NRR

Document Control Desk, NRC
Washington, DC

INPO Records Center

OM/OL SERVICE LIST

Mr Frank J Kelley
Attorney General of the
State of Michigan
Ms Carole Steinberg, Esq
Assistant Attorney General
Environmental Protection Division
720 Law Building
Lansing, MI 48913

Mr Myron M Cherry, Esq
Suite 3700
Three First National Plaza
Chicago, IL 60602

Mr Wendell H Marshall
RFD 10
Midland, MI 48640

Mr Charles Bechhoefer, Esq
Atomic Safety & Licensing
Board Panel
U S Nuclear Regulatory Commission
Washington, DC 20555

Dr Frederick P Cowan
6152 N Verde Trail
Apt B-125
Boca Raton, FL 33433

Mr Fred C Williams
Isham, Lincoln & Beale
1120 Connecticut Ave, NW, Suite 325
Washington, DC 20036

Mr James E Brunner, Esq
Consumers Power Company
212 West Michigan Avenue
Jackson, MI 49201

Mr D F Judd
Tabcock & Wilcox
PO Box 1260
Lynchburg, VA 24505

Mr Steve Gadler, Esq
2120 Carter Avenue
St Paul, MN 55108

Atomic Safety & Licensing
Appeal Board
U S Nuclear Regulatory Commission
Washington, DC 20555

Mr C R Stephens (3)
Chief, Docketing & Services
U S Nuclear Regulatory Commission
Office of the Secretary
Washington, DC 20555

Ms Mary Sinclair
5711 Summerset Street
Midland, MI 48640

Mr William D Paton, Esq
Counsel for the NRC Staff
U S Nuclear Regulatory Commission
Washington, DC 20555

Atomic Safety & Licensing
Board Panel
U S Nuclear Regulatory Commission
Washington, DC 20555

Ms Barbara Stamiris
5795 North River Road
Rt 3
Freeland, MI 48623

Dr Jerry Harbour
Atomic Safety & Licensing
Board Panel
U S Nuclear Regulatory Commission
Washington, DC 20555

Mr M I Miller, Esq
Isham, Lincoln & Beale
Three First National Plaza
52nd Floor
Chicago, IL 60602

Mr John DeMeester, Esq
Dow Chemical Building
Michigan Division
Midland, MI 48640

Ms Lynne Bernabei
Government Accountability Project
1901 Q Street, NW
Washington, DC 20009

Bechtel Associates Professional Corporation

Attachment 1
Serial 28042
80-09 #13

143744

143748

SUBJECT: MCAR 45A, Final Report
MCAR 45B, Interim Report 11

DATE: February 27, 1984

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

Introduction

The concerns discussed in this report address the hardness values of the anchor and connecting studs for the reactor coolant pump (RCP) snubbers. 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 steel (LAQTS) bolting materials 1-1/2 inches in diameter and larger used in support of safety-related systems. In MCAR 45B, dated December 17, 1980, this scope was expanded to include review of 7/8-inch and larger safety-related LAQTS bolting material. MCAR 45A was issued as a Final Report on August 5, 1982. The MCAR 45A report has been reissued as an attachment to this report and will be carried as an attachment until this MCAR is complete.

Investigative Action

MCAR 45A: Final Report (see attachment)

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 LAQTS bolting and/or component support material. CAI has also gathered data that are being 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.

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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 has revised the sampling plan as a result of the additional materials identified by CAI.

Aptech Engineering Services has been retained to assist in evaluating the LAQTS materials purchased by identifying which materials are LAQTS and require testing. Aptech has developed a generic evaluation methodology (Report AES-8010220, dated July 1983 transmitted to the NRC on December 2, 1983, via Consumers Power Company letter, Serial 26594, J.W. Cook to J.G. Keppler) that establishes hardness limits for LAQTS materials. For bolting materials that exceed the established hardness limits, the methodology provides allowable stresses for preventing stress corrosion crack growth and brittle fracture. Guidelines are also given for evaluation of soft material for tensile-ductile failure.

Based on preliminary hardness test results, approximately 30 bolting material purchases were identified that appeared to contain material considerably softer than the hardness limits established by Aptech. 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. The differences were determined to be due to the existence of a decarburized layer that had not been completely removed during field testing. The hardness test procedure has been modified to prevent future difficulties due to erroneous data. The retesting of the remaining portions of these 30 bolting material purchases with the decarburized layer removed has been completed.

The discovery of the erroneous hardness data resulting from decarburization raised the following two concerns for previously collected hardness data.

- a. Bolting materials that had been tested and appeared to be below established hardness limits may actually be within the limits.
- b. Bolting materials that had been tested and appeared to be above or within established hardness limits may actually be harder than the first hardness tests indicated.

As a result of these concerns, a retest sampling program was developed with SAI to identify previously collected hardness data that are suspect; this program is complete. As a result of this program, bolting material

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purchases that require additional retesting to correct data errors due to decarburization have been identified. This additional testing is currently being accomplished; a March 15, 1984, completion date is anticipated.

Preliminary review of hardness test data indicates that, of approximately 500 unique material deliveries that have been hardness tested to date, approximately 250 deliveries contain material of hardness outside the ranges established by Aptech (transmitted to the NRC on April 5, 1983, via Consumers Power Company letter, Serial 20747, J.W. Cook to J.G. Keppler). These material deliveries have been identified on a nonconformance report and are being placed on hold pending final evaluation of test data and implementation of corrective action.

The majority of the hardness testing has been completed. However, some purchases of bolting material have not been located for hardness testing. To ensure location and testing of these items, a program has been developed to inventory all relevant applications that use bolting materials 7/8 inch in diameter or larger. The completed inventory lists will be used to identify safety-related locations of bolting requiring hardness testing. The inventory lists will also be used to locate remaining portions of safety-related materials tested that do not meet the established hardness limits.

Corrective Action

MCAR 45A: Final Report (see attachment)

MCAR 45B

The recommended corrective action for the bolting deliveries described under Investigative Action is to locate and verify by evaluation the acceptability of the material for each specific installation or replace the suspect bolting. This effort is being tracked under CPCo NCR M01-9-3-289. A case-by-case evaluation of bolting located by this NCR [bolting is located using a field tagging review (FTR) form] is currently being performed by Bechtel engineering. To date, based on 20% evaluation of anticipated FTRs, results indicate that these bolting installations are acceptable for use. A generic solution to use grouted anchor bolts that use LAQTS material as installed has also been developed.

Quality control receipt inspection was revised to include a sample hardness testing of LAQTS bolting/component support materials.

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Safety Implications

MCAR 45A: Final Report (see attachment)

MCAR 45B

Bolting purchases have been identified that contain material that hardness tested outside the ranges established by Aptech. 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 45B

Submitted by:

E.B. Poser

E.B. Poser
Project Engineering Manager

Approved by:

T.E. Johnson

T.E. Johnson
Chief Civil Engineer

Approved by:

E.H. Smith

E.H. Smith
Engineering Manager

Concurrence by:

M.A. Dietrich

for M.A. Dietrich
Project Quality Assurance
Engineer

PVR
PVR/AVD/brb*(C)

Attachment: MCAR 45A Final Report

143744 Bechtel Associates Professional Corporation

777 East Eisenhower Parkway
Ann Arbor, Michigan

143748



Mail Address: P.O. Box 1000, Ann Arbor, Michigan 48106

SUBJECT: NCAR 45A Final Report

DATE: August 5, 1983
(Reformatted and resigned November 18, 1983)

PROJECT: Consumers Power Company
Midland Plant Units 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

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 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.

Investigative Action

Aptech Engineering Services of Palto 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, 5/17/83). In the development of a generic evaluation methodology (in support of NCAR 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 preload

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and accident stresses of AFS-81-08-79 have been reevaluated. Based on this reevaluation of allowable stresses, the lowest maximum allowable preload for any of the RCB snubber anchor bolts is 42.9 ksi. 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. 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.

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

Corrective Action

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 Units 1 and 2. Engineering has made a 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. All corrective actions under MCAR 45A are considered to be complete.

Safety Implications

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 have adversely affected the safety of Midland plant operations during the expected life of the plant.

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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.

Submitted by: *P.V. Regupathy*
for P.V. Regupathy
Civil Group Supervisor

Approved by: *E.B. Poser*
for E.B. Poser
Project Engineering Manager

Concurrence by: *T.E. Johnson*
T.E. Johnson
Chief Civil Engineer

Concurrence by: *E.H. Smith*
E.H. Smith
Engineering Manager

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

PVR/AVD/brb*(C)