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UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION III  
799 ROOSEVELT ROAD  
GLEN ELLYN, ILLINOIS 60137

May 14, 1984

MEMORANDUM FOR: Region III Personnel

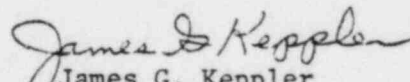
FROM: James G. Keppler, Regional Administrator

SUBJECT: CHANGE OF REGIONAL COUNSEL

On June 19, 1984, Steve Lewis will be leaving Region III to assume the position of Deputy Assistant Chief Hearing Counsel in the Office of the Executive Legal Director (ELD). Steve has served as Regional Counsel since October 1982.

Steve's replacement will be Bruce Berson. Bruce was an attorney in ELD from August 1977 to April 1983. He has a broad background in NRC legal matters, having worked in the Hearing, Operations and Administration, and Regulations Division of ELD. From April 1983 to April 1984 Bruce was the regulatory affairs manager for Roy F. Westin, Inc., the Department of Energy Headquarters' support contractor for the high level waste program. Bruce rejoined ELD in April 1984.

Bruce will report to Region III on June 18, 1984, but has already made one familiarization visit to the Region and plans to make one further visit to the Region before assuming his duties. Steve and Bruce are working to achieve a smooth transition of responsibilities.

  
James G. Keppler  
Regional Administrator



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

Docket Nos: 50-329  
and 50-330

MAY 26 1982

Mr. J. W. Cook  
Vice President  
Consumers Power Company  
1945 West Parnall Road  
Jackson, Michigan 49201

Dear Mr. Cook:

Subject: Issuance of Amendments No. 3 to Construction Permits -  
Midland Plant, Units 1 and 2

The Nuclear Regulatory Commission has issued Amendment No. 3 to Construction Permit No. CPPR-81 and Amendment No. 3 to Construction Permit No. CPPR-82 which were issued to you for construction of the Midland Plant, Units 1 and 2. The amendments have been issued pursuant to a Memorandum and Order (Imposing Certain Interim Conditions Pending Issuance of Partial Initial Decision) by the Atomic Safety and Licensing Board dated April 30, 1982.

We have determined that these amendments do not authorize a change in effluent types or total amounts nor an increase in power level and will not result in any significant environmental impact. Having made this determination, we have further concluded that these amendments involve an action which is insignificant from the standpoint of environmental impact and, pursuant to 10 CFR 51.5(d)(4), that an environmental impact statement or negative declaration and environmental impact appraisal need not be prepared in connection with the issuance of the amendments.

We have concluded, based on the considerations discussed above, that: (1) with respect to these amendments, the proposed facility can be constructed and operated without undue risk to the public health and safety, and (2) the issuance of these amendments will not be inimical to the common defense and security or to the health and safety of the public.

Copies of Amendment No. 3 to CPPR-81, Amendment No. 3 to CPPR-82, and a related notice which has been forwarded to the Office of the Federal Register for publication are enclosed.

Sincerely,

*Elinor G. Adensam*

Elinor G. Adensam, Chief  
Licensing Branch No. 4  
Division of Licensing

Enclosures:

1. Amendment No. 3 to CPPR-81
2. Amendment NO. 3 to CPPR-82
3. Federal Register Notice

cc w/encl: See next page

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MIDLAND

Mr. J. W. Cook  
Vice President  
Consumers Power Company  
1945 West Parnall Road  
Jackson, Michigan 49201

cc: Michael I. Miller, Esq.  
Ronald G. Zamarin, Esq.  
Alan S. Farnell, Esq.  
Isham, Lincoln & Beale  
Suite 4200  
1 First National Plaza  
Chicago, Illinois 60603

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

Ms. Mary Sinclair  
5711 Summerset Drive  
Midland, Michigan 48640

Stewart H. Freeman  
Assistant Attorney General  
State of Michigan Environmental  
Protection Division  
720 Law Building  
Lansing, Michigan 48913

Mr. Wendell Marshall  
Route 10  
Midland, Michigan 48640

Mr. Roger W. Huston  
Suite 220  
7910 Woodmont Avenue  
Bethesda, Maryland 20814

Mr. R. B. Borsum  
Nuclear Power Generation Division  
Babcock & Wilcox  
7910 Woodmont Avenue, Suite 220  
Bethesda, Maryland 20814

Cherry & Flynn  
Suite 3700  
Three First National Plaza  
Chicago, Illinois 60602

Mr. Don van Farrowe, Chief  
Division of Radiological Health  
Department of Public Health  
P.O. Box 33035  
Lansing, Michigan 48909

William J. Scanlon, Esq.  
2034 Pauline Boulevard  
Ann Arbor, Michigan 48103

U.S. Nuclear Regulatory Commission  
Resident Inspectors Office  
Route 7  
Midland, Michigan 48640

Ms. Barbara Stamiris  
5795 N. River  
Freeland, Michigan 48623

Mr. Paul A. Perry, Secretary  
Consumers Power Company  
212 W. Michigan Avenue  
Jackson, Michigan 49201

Mr. Walt Apley  
c/o Mr. Max Clausen  
Battelle Pacific North West Labs (PNWL)  
Battelle Blvd.  
SIGMA IV Building  
Richland, Washington 99352

Mr. I. Charak, Manager  
NRC Assistance Project  
Argonne National Laboratory  
9700 South Cass Avenue  
Argonne, Illinois 60439

James G. Keppler, Regional Administrator  
U.S. Nuclear Regulatory Commission,  
Region III  
799 Roosevelt Road  
Glen Ellyn, Illinois 60137

Mr. Steve Gadler  
2120 Carter Avenue  
St. Paul, Minnesota 55108

Mr. J. W. Cook

- 2 -

cc: Commander, Naval Surface Weapons Center  
ATTN: P. C. Huang  
White Oak  
Silver Spring, Maryland 20910

Mr. L. J. Auge, Manager  
Facility Design Engineering  
Energy Technology Engineering Center  
P.O. Box 1449  
Canoga Park, California 91304

Mr. Neil Gehring  
U.S. Corps of Engineers  
NCEED - T  
7th Floor  
477 Michigan Avenue  
Detroit, Michigan 48226

Charles Bechhoefer, Esq.  
Atomic Safety & Licensing Board  
U.S. Nuclear Regulatory Commission  
Washington, D. C. 20555

Mr. Ralph S. Decker  
Atomic Safety & Licensing Board  
U.S. Nuclear Regulatory Commission  
Washington, D. C. 20555

Dr. Frederick P. Cowan  
Apt. B-125  
6125 N. Verde Trail  
Boca Raton, Florida 33433

Jerry Harbour, Esq.  
Atomic Safety and Licensing Board  
U.S. Nuclear Regulatory Commission  
Washington, D. C. 20555

Geotechnical Engineers, Inc.  
ATTN: Dr. Steve J. Poulos  
1017 Main Street  
Winchester, Massachusetts 01890



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

CONSUMERS POWER COMPANY

MIDLAND PLANT, UNIT 1

DOCKET NO. 50-329

AMENDMENT TO CONSTRUCTION PERMIT

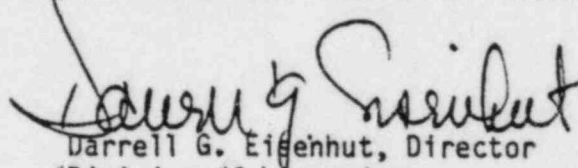
Construction Permit No. CPPR-81  
Amendment No. 3

1. The Nuclear Regulatory Commission has found that:
  - A. With respect to this amendment, the proposed facility can be constructed and operated without undue risk to the public health and safety;
  - B. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
  - C. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.
2. Accordingly, pursuant to a Memorandum and Order by the Atomic Safety and Licensing Board, dated April 30, 1982, Construction Permit No. CPPR-81 is amended by adding paragraph 2.G. to read as follows:
  - G.(1) The applicant shall obtain explicit prior approval from the NRC staff (to the extent such approval has not already been obtained) before proceeding with the following soils-related activities. These activities, with the exception of those already approved by the NRC and those that the NRC staff agrees are not critical, shall be controlled by a NRC staff-approved Quality Assurance Plan:
    - a. any placing, compacting, excavating, or drilling soil materials around safety-related structures and systems;
    - b. physical implementation of remedial action for correction of soil-related problems under and around safety-related structures and systems, including but not limited to:
      - (i) dewatering systems
      - (ii) underpinning of service water building

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- (iii) removal and replacement of fill beneath the feedwater isolation valve pit areas, auxiliary building electrical penetration areas and control tower, and beneath the turbine building
  - (iv) placing of underpinning supports beneath any of the structures listed in (iii) above
  - (v) compaction and loading activities;
- c. construction work in soil materials under or around safety-related structures and systems such as field installation, or rebedding, of conduits and piping.
- (2) Paragraph 2.G.(1) shall not apply to remedial actions approved by the NRC staff prior to April 30, 1982, nor to any exploring, sampling, or testing of soil samples associated with determining actual soil properties on site which has the approval of the Administrator of Region III. These testing activities shall be controlled by a NRC staff-approved Quality Assurance Plan which includes procedures for controlling excavation or drilling activities more than six feet deep in "Q" areas.

FOR THE NUCLEAR REGULATORY COMMISSION



Darrell G. Eighenhut, Director  
Division of Licensing  
Office of Nuclear Reactor Regulation

Date of Issuance: MAY 26 1982



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

CONSUMERS POWER COMPANY

MIDLAND PLANT, UNIT 2

DOCKET NO. 50-330

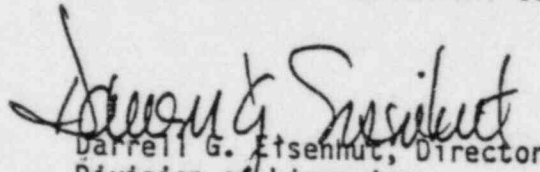
AMENDMENT TO CONSTRUCTION PERMIT

Construction Permit No. CPPR-82  
Amendment No. 3

1. The Nuclear Regulatory Commission has found that:
  - A. With respect to this amendment, the proposed facility can be constructed and operated without undue risk to the public health and safety;
  - B. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
  - C. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.
2. Accordingly, pursuant to a Memorandum and Order by the Atomic Safety and Licensing Board, dated April 30, 1982, Construction Permit No. CPPR-81 is amended by adding paragraph 2.G. to read as follows:
  - G.(1) The applicant shall obtain explicit prior approval from the NRC staff (to the extent such approval has not already been obtained) before proceeding with the following soils-related activities. These activities, with the exception of those already approved by the NRC and those that the NRC staff agrees are not critical, shall be controlled by a NRC staff-approved Quality Assurance Plan:
    - a. any placing, compacting, excavating, or drilling soil materials around safety-related structures and systems;
    - b. physical implementation of remedial action for correction of soil-related problems under and around safety-related structures and systems, including but not limited to:
      - (i) dewatering systems
      - (ii) underpinning of service water building

- (iii) removal and replacement of fill beneath the feedwater isolation valve pit areas, auxiliary building electrical penetration areas and control tower, and beneath the turbine building
  - (iv) placing of underpinning supports beneath any of the structures listed in (iii) above
  - (v) compaction and loading activities;
- c. construction work in soil materials under or around safety-related structures and systems such as field installation, or rebedding, of conduits and piping.
- (2) Paragraph 2.G.(1) shall not apply to remedial actions approved by the NRC staff prior to April 30, 1982, nor to any exploring, sampling, or testing of soil samples associated with determining actual soil properties on site which has the approval of the Administrator of Region III. These testing activities shall be controlled by a NRC staff-approved Quality Assurance Plan which includes procedures for controlling excavation or drilling activities more than six feet deep in "Q" areas.

FOR THE NUCLEAR REGULATORY COMMISSION



Darrell G. Eisenhut, Director  
Division of Licensing  
Office of Nuclear Reactor Regulation

Date of Issuance: MAY 26 1982



UNITED STATES NUCLEAR REGULATORY COMMISSION

DOCKET NOS. 50-329 AND 50-330

CONSUMERS POWER COMPANY

MIDLAND PLANT, UNITS 1 AND 2

NOTICE OF ISSUANCE OF AMENDMENTS TO CONSTRUCTION PERMITS

Notice is hereby given that pursuant to a Memorandum and Order dated April 30, 1982, by the Atomic Safety and Licensing Board, the U. S. Nuclear Regulatory Commission has issued Amendment No. 3 to Construction Permit No. CPPR-81 and Amendment No. 3 to Construction Permit No. CPPR-82, which were issued to Consumers Power Company for construction of Midland Plant, Units 1 and 2, located in Midland County, Michigan.

The Board's Order, which imposes certain interim conditions on the construction permits pending issuance of a Partial Initial Decision, was issued in connection with ongoing proceedings with respect to an Order issued by the NRC modifying the construction permits for the facility. Notice of these proceedings was published in the Federal Register on March 20, 1980 (45 FR 19214). An amended notice was published in the Federal Register on May 28, 1980 (45 FR 35949).

The Commission has found that this action does not constitute an undue risk to the health and safety of the public, and is not inimical to the common defense and security. In addition, the issuance of these amendments will not result in any significant environmental impact; and pursuant to 10 CFR Section 51.5(d)(4) an environmental impact statement or negative declaration and environmental impact appraisal need not be prepared in connection with issuance of the amendments.

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A copy of the Memorandum and Order, dated April 30, 1982, the construction permits, the amendments and other related documents are available for public inspection at the Commission's Public Document Room, 1717 H Street, N.W., Washington, D. C. and at the Grace Dow Memorial Library, 1710 W. St. Andrews Road, Midland, Michigan. Single copies of the amendments may be obtained upon request addressed to the U. S. Nuclear Regulatory Commission, Washington, D. C. 20555, Attention: Director, Division of Licensing.

Dated at Bethesda, Maryland, this 26<sup>th</sup> day of May 1982.

FOR THE NUCLEAR REGULATORY COMMISSION

*Elinor G. Adensam*

Elinor G. Adensam, Chief  
Licensing Branch No. 4  
Division of Licensing

Resident Inspector

1714



CONFIRMATORY ACTION LETTER  
UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION III  
799 ROOSEVELT ROAD  
GLEN ELLYN, ILLINOIS 60137

AUG 12 1982

Docket No. 50-329  
Docket No. 50-330

Consumers Power Company  
ATTN: Mr. James W. Cook  
Vice President  
Midland Project  
1945 West Parnall Road  
Jackson, MI 49201

Gentlemen:

Based on discussions between you and Mr. W. Shafer on August 11, 1982, we understand that you have stopped work in the remedial soils area in accordance with Stop Work Order FSW-24.

Prior to lifting this stop work order in whole or in part you will obtain prior Region III approval. Such approval will be based on a clear understanding and approval by Region III of the work activities to be undertaken.

If your understanding is different than the above, please contact this office immediately.

Sincerely,

for James G. Keppler  
Regional Administrator

- cc: DMB/Document Control Desk (RIDS)
- Resident Inspector, RIII
- The Honorable Charles Bechhoefer, ASLB
- The Honorable Jerry Harbour, ASLB
- The Honorable Frederick P. Cowan, ASLB
- The Honorable Ralph S. Decker, ASLB
- Michael Miller
- Ronald Callen, Michigan  
Public Service Commission
- Myron M. Cherry
- Barbara Stamiris
- Mary Sinclair
- Wendell Marshall
- Colonel Steve J. Gadler (P.E.)

8208160393

CONFIRMATORY ACTION LETTER

Resident - 8

SEP 24 1982

Docket No. 50-329  
Docket No. 50-330

Consumers Power Company  
ATTN: Mr. James W. Cook  
Vice President  
Midland Project  
1945 West Parnall Road  
Jackson, MI 49201

Gentlemen:

This letter confirms the telephone discussion on September 24, 1982, between Messrs. Warnick and Shafer of this office and Mr. D. Miller and others of your staff regarding the problems in the remedial soils QC requalification program identified by Messrs. Gardner and Landsman.

The purpose of this letter is to document our understanding of the actions you have taken or plan to take.

As a result of our discussion, we understand that you have initiated or plan to initiate the following actions:

- (1) All work on remedial soils has been stopped with the exception of those continuous activities such as maintaining the freeze wall and well pumping.
- (2) All examinations related to remedial soils QC requalification have stopped and all QC personnel previously certified have been decertified.
- (3) A retraining program will be established and conducted for all QC personnel who failed and for future failures.
- (4) A written examination will be developed for all QC requalification examinations in the area of remedial soils.

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OFFICE ▶						
SURNAME ▶						
DATE ▶						

CONFIRMATORY ACTION LETTER

CONFIRMATORY ACTION LETTER

Consumers Power Company

- 2 -

SEP 24 1982

We also understand that you will meet with our staff on September 29, 1982, to describe what measures you will establish to accelerate the requalification and certification of the QC personnel involved in the balance of plant quality program.

If our understanding of your actions is not in accordance with the above, please contact this office immediately.

Sincerely,

James G. Keppler  
Regional Administrator

- cc: DME/Document Control Desk (RIDS)
- Resident Inspector, RIII
- The Honorable Charles Bechhoefer, ASLB
- The Honorable Jerry Harbour, ASLB
- The Honorable Frederick P. Cowan, ASLB
- The Honorable Ralph S. Decker, ASLB
- Michael Miller
- Ronald Callen, Michigan  
Public Service Commission
- Myron M. Cherry
- Barbara Stamiris
- Mary Sinclair
- Wendell Marshall
- Colonel Steve J. Gadler (P.E.)
- William Paton, ELD

OFFICE	RIII	RFW	Davis	Keppler		
USERNAME	Shafer	Warnick	Davis	Keppler		
DATE	9/24/82	9/24/82	9/24	9/24		

Resident Inspector

1984



CONFIRMATORY ACTION LETTER  
UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION III  
799 ROOSEVELT ROAD  
GLEN ELLYN, ILLINOIS 60137

AUG 12 1982

Docket No. 50-329  
Docket No. 50-330

Consumers Power Company  
ATTN: Mr. James W. Cook  
Vice President  
Midland Project  
1945 West Parnall Road  
Jackson, MI 49201

Gentlemen:

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Prior to lifting this stop work order in whole or in part you will obtain prior Region III approval. Such approval will be based on a clear understanding and approval by Region III of the work activities to be undertaken.

If your understanding is different than the above, please contact this office immediately.

Sincerely,

for James G. Keppler  
Regional Administrator

- cc: DMB/Document Control Desk (RIDS)
- Resident Inspector, RIII
- The Honorable Charles Bechhoefer, ASLB
- The Honorable Jerry Harbour, ASLB
- The Honorable Frederick P. Cowan, ASLB
- The Honorable Ralph S. Decker, ASLB
- Michael Miller
- Ronald Callen, Michigan
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- Myron M. Cherry
- Barbara Stamiris
- Mary Sinclair
- Wendell Marshall
- Colonel Steve J. Gadler (P.E.)

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MIDLAND REACTOR HOLDDOWN BOLT CHRONOLOGY

2/8/73 heat "000" shipped from Shill Steel.

11/6/73 specification 7220-C-233(Q) issued for client review.

12/27/73 Rev. 1 of specification issued for bids.

1/30/74 heat "00" shipped from Armco Steel.

2/5/74 heat "00" received at Southern Bolt Co.(SB).

3/11/74 heat "0" and "000" shipped from Bethlehem Steel.

3/25/74 heats "0" and "000" received at SB, shipment complete by 3/27/74.

4/74 initial attempts to secure bolt vendor fails.

4/29/74 telecon on adding a jam nut to bolt design.

5/2/74 DCN #1 adds jam nut to bolt design.

5/3/74 Revision 2 of specification issued for procurement.

5/23/74 FMR-C-1104 issued.

5/23/74 attempt to procure bolt material only.

5/30/74 Bechtel bid request inquiry (material only) material is 4145, ASTM A-490.

6/74 attempt to procure bolt material only fails.

6/28/74 bid requests sent out to companies for manufacture of bolts.

7/5/74 TWX MVSS-Bechtel, bid on bolts only.

7/23/74 MVSS sends in bid (Inryco also bids in this time frame).

7/26/74 MVSS proposal (cites ASTM A-490).

7/30/74 J. Dyson Co. sent specs for bolts (changed from 7'2½" to 7'4" long).

8/5/74 decisions made as to applicable NDE requirements during this week.

8/8/74 TWX Bechtel-MVSS sends NDE requirements.

8/8/74 TWX adds NDE requirements to Contract (supplier withdraws?).

8/16/74 TWX MVSS-Bechtel, is 4340 steel acceptable?

8/19/74 letter, Dyson Co.-MVSS, material we have on hand cannot hope to meet specs.

8/19/74 TWX, MVSS-Bechtel (to be repeated 8/23/74). Need correct specification.

8/21/74 TWX, MVSS-Bechtel, ASTM A-490 is not correct specification to use.

8/23/74 TWX, A-490 not right spec., bolts will be brittle if tensiles to A-490.

8/23/74 TWX, MVSS-Bechtel, need spec., trying to find material (availability critical).

8/28/74 response to transmittals. A-490 is right spec., 4140/5 not approved. 25 mil exp.

8/27/74 Bechtel memo. 25 mil exp. for charpy test, other requirements.

8/28/74 MVSS advised ASTM A-490 is not right spec.

8/30/74 SB quotation utilizing ASTM 354.

9/3/74 TWX, MVSS-Bechtel, proposal for bolts: ASTM 354, 4140 steel, 25 mil lat. exp.

9/5/74 Bechtel advised that MVSS contacted ASTM member to discuss spec.

9/7/74 memo, verbal purchase order, "MVSS has started fabrication" (?).

9/8/74 TWX, MVSS-Bechtel

9/10/74 letter, SB-MVSS, heat treat (HT) procedure, 4140 steel, temper at 1000 degrees.

9/10/74 BEBC 527 Ok's use of ASTM A-354-BD for bolt specification.

9/12/74 TWX, Bechtel-MVSS, change spec., can use 4140, need HT and MT procedures.

9/13/74 date of purchase order, not proceed until procedures approved.

9/16/74 letter: MVSS cancels contract with J. Dyson & Sons for bolts.

9/16/74 request for approval to formalize contract, Rev. 0.

9/20/74 *PHONE CALL*  
memo, MVSS changes suppliers, now SB, (notes bolts will be irreplaceable).

9/23/74 *on phone call BOLTS ARE ASME III CLASS I COMPONENT SUPPORTS.*

9/27/74 SCN 4004, total re-evaluation of NDE requirements for spec.

10/1/74 memo gives history of bolts to date, spec. changes, testing changes.

10/3/74 TWX transmits testing requirements per SCN 4004 to MVSS.

10/4/74 phone call, Yettke-Grote, questions on 10/3/74 TWX.

10/7/74 TWX to MVSS answers phone call questions.

10/8/74 Bid. (includes 25 mil lateral expansion charpy criteria) (SB-MVSS).

10/11/74 SCN 4005 issued to alter SCN 4004 (on basis of questions from MVSS).

10/14/74 request for approval to commit (formalize contract) Rev. 1.

10/16/74 MVSS QC manual approved.

10/23/74 TWX, SCN 4004 will be sent to MVSS.

10/25/74 Bechtel receipt of HT procedure.



11/4/74 purchase order revised, new purchase order number.

11/5/74 HT procedure rejected by Bechtel (level 4 )

11/7/74 TWX, MVSS-SB, customer has rejected HT procedures.

11/7/74 Revision 2 of specification 7220-C-233.

11/8/74 FMR-C-1004-3, Rev. 2 of purchase order 7220-C0233.

11/11/74 TWX recieved, do not perform HT until procedures approved.

11/11/74 TWX to SB received, HT procedure to be per SCN-4005.

12/3/74 quotation, Rex-SB, 200 studs, 800 nuts.

12/5/74 Spec. 7220-C-233(Q) Rev. 3, incorporate SCN's 4002-4005.

12/9/74 Transmittal #24, is Rex HT OK?, bolts ready to go to Rex.

12/13/74 FMR C-1004-4, Rev. 3 of purchase order (adds SCN's).

12/16/74 TWX. Bechtel-MVSS approves Rex HT procedure, but STOP WORK (now need 6/1/76).

12/19/74 letter to MVSS on revised HT procedure "SB outline" of HT procedure.

12/20/74 Rex HT procedure #1, Rev. 0 date (transmittal #24, temper 900-1000 degrees).

12/26/74 TWX #25MVSS-Bechtel, "unable to stop fabrication".

12/74-1/75? studs shipped from SB, recieved at Rex.

1/28/75 Rex material test, specimens # 1,2,6,7,8,9,11,12.

2/4/75 letter, SB-MVSS material cannot meet requirements.

2/5/75 phone call for test results for HT (above).

2/6/75 MVSS sends TWX to Bechtel with Rex test results

2/12/75 phone call, Goin to MVSS, want RC 45 for bolts(TWX to Bechtel, same subject).

2/17/75 Rex material test of material salt quenched (experiment).

2/18/75 memo to Castleberry, 6 tests, exceed RC 38 (BCBE 536).

3/14/75 plant design guide, metallurgical design, Rev. 1 (never approved?)

3/20/75 telecon, hardness problems, test results unacceptable.

3/21/75 TWX confirms telecon, results unacceptable, not change hardness spec.

3/24/75 Rex material test for material water quenched (experiment).

4/1/75 phone call, 850 degree temper test run.

4/3/75 SB-MVSS letter on test run, justify 825 degrees? wrong hardness, meeting?

4/7/75 TWX, Bechtel to deal directly with Rex, but only if really necessary.

4/7/75 Rex asks if 850 is OK, also Rev. 3 of Rex HT procedure (verbal OK for use).

4/8/75 telecon, Hutchinson, Goin confirming letter, 850 OK per Bechtel.

4/11/75 Notes. 4140 marginal, 4340 better, excessive hardness, where tested?

4/11/75 confirmation letter received at SB.

4/14/75 memo, Castleberry to Parker, hardness spec, can accept with spec exceeded.

4/16/75 Rev. 4 of specification.

4/18/75 date on record for austenitizing load #4 at Rex.

4/18/75 memo, Parker to Castleberry, hardness, tempering, material is marginal.

4/21/75 letter, MNSS-SB, required documentation (received 4/24/75)

4/75 date on HT records (charts) supplied by Rex for documentation.

4/20-25/75? heat treating of bolts in furnace HA-4

4/22/75 HT material test report by Rex, 1-4 of 19 total.

4/25/75 HT material test report by Rex, 5-11 of 19 total.

4/25/75 date observed on HT record for 5th load (3rd load?).

5/1/75 Bechtel approval of Rex HT procedure, Rev. 3.

5/5/75 Powers (SB) QC visit to Rex.

5/16/75 HT material test report by Rex, 11-19 of 19 total.

5/28/75 19 test reports sent to MVSS with dummy documentation package.

5/28/75 EEB 796 cannot reduce tensile values, Rockwells hard to obtain.

6/3/75 HT material test "machined from 2" of end of bar".

6/9/75 HT material test "machined 7" from end (or bar)".

6/16/75 HT material test "stud #1 from heat "000"".

6/18/75 HT material test "stud #8 from heat "000", 850 degrees".

6/27/75 HT material test "machined from center of bar", heat "0000" marked "scrap".

6/75 date on HT charts supplied by Rex for documentation package.

7/2/75 HT material test report "machined from center of bar" heat "00".

7/3/75 letter to Rex advises of future shop inspection.

7/8/75 HT material report, heat "0000", 850 degree tempering temp.

7/9/75 TWX, no inspector needed at Rex for 7/15/75 shipment inspection.

7/11/75 TWX to Rex. advised by MVSS, no Bechtel insp. required until notice.

7/11/75 Rex surveillance, no contact due to personnel unavailability.

7/14/75 chemical analysis of steel done by lab for Rex.

7/15/75 Rex HT Rev. 4 reduces number of required tensile tests.

7/15/75 jobsite (Midland?) meeting, Bechtel & MVSS, required test reports.

7/16/75 Rex surveillance, studs already HT'd and tested.

7/17/75 memo BCBE 604 physical and mechanical tests are by heat #.

7/18/75 Rex HT procedure, Rev 4 sent to Bechtel, recieved 7/22/75.

7/21/75 date observed on HT chart for heat"00"(thermocouple chart).

7/21/75 TWX dated 7/18 recieved, need charpy's, CMTR's, shipping procedures.

7/22/75 Rex HT procedure Rev. 3 dated 4/7/75 approved (TWX).

7/24/75 Rex HT procedure, Rev. 4, approved by Bechtel.

7/25/75 letter, Bechtel-MVSS, mentions 7/15/75 meeting.

7/29/75 date on test report for documentation from Rex, 194 bars noted.

7/31/75 letter, SB-MVSS copies of CMTR's and nut charpy tests (in error)?

7/31/75 date of QC approvals on shipping documents.

8/4/75 documentation submitted to Bechtel?

8/4/75 test run on 4340 material (Ft. Worth).

8/18/75 Rex surveillance, all studs rejected for MT indications of more than 1".

8/14/75 TWX, delete 25 mil lateral expansion criteria (nut charpy SPS lab report)

8/15/75 SPS lab report on Charpy impact test specimens (lacks later wording).

8/19/75 telegram on charpy impact specimen tests, add wording.

8/20/75 Rex surveillance, 4 studs ground to determine depth of indications.

8/20/75 Powers (SB QC) visit to Rex.

8/22/75 Rex surveillance (reviewed progress on nuts, nuts released for shipping).

8/25/75 BCBG 881 on wording of charpy specimens test.

8/25/75 letter, SB-Rex, send studs back, submit bill (recieved at Rex 8/29/75).

8/26/75 MT report date, 147 studs have linear indications, 13 have cracks (rejected).

8/27/75 TWX reducing diameter by .060 notes Rex mechanical properties test

8/27/75 S. MT procedure, Rev. 0 date.

9/11/75 Rex surveillance, all studs have been shipped back to SB.

9/22/75 Rev. 5 of the specification (?).

9/29/75 letter, SB-Tech Steel & Alloy, new material purchase order.

9/29/75 telecon, Yettke, Hutchinson, Newgen, Grote.

9/29/75 Bechtel TWX on reducing bolt diameter.

9/29/75 MVSS says studs not pass MT after machining, want to try new material notes that studs are on the "critical path" ,"running out of time" .

9/29/75 SB MT procedure, Rev. 1 .

9/29/75 TWX, reduction of bolt diameter by .060 approved.

9/30/75 final Rex surveillance.

9/30/75 TWX, history of studs, start again, material suppliers withdraw (MT required).

10/1/75 phone call, SB has 4340 material, trail runs at Superior HT co.

10/3/75 hand grinding of indications at SB, reconsider use of lathe, .060 deep.

10/3/75 BCBE 625 bar suppliers have withdrawn, machine more than .060??

10/8/75 telecon with Tech Steel and Alloy.

10/10/75 memo on shop inspection, Rex finished, need SB surveillance, grinding, MT.

10/15/75 TWX to MVSS, will studs be delivered 1/76? Superior HT procedure?Disposition?

10/22/75 Phone memo, SB has 85 studs which pass MT examination.

10/29/75 SB surveillance, bolts being evaluated.

10/30/75 letter, Newgen-MVSS, Superior HT procedure, hardness, temper temperature.

11/4-5/75 SB surveillance, machining of studs.

11/11/75 TWX, SB proposes turning bolts to 2.257 diameter.

11/18/75 SB surveillance, machining of bolts.

11/20/75 SB sends SB MT procedure to MVSS ("now have proper equipment").

- 11/20/75 TWX, can reduce stud diameter to 2.257".
- 11/25/75 SB surveillance.
- 12/3/75 SB MT procedure Rev. 1 sent to Bechtel.
- 12/4/75 SB order to Tech Steel & Alloy for Unit II material (?).
- 12/4/75 letter, 77 studs pass shop MT procedure
- 12/15/75 SB MT's bolts during this week, machining of bolts continues (surveillance).
- 1/4/76 97 bolts pass MT during this week, are released for shipment by inspector.
- 1/6/76 date of inspector-witnessed MT tests at SB.
- 1/7/76 visual inspection of studs at SB, QC mgr. signs paperwork.
- 1/7/76 procedure for hand grinding approved by Bechtel.
- 1/13/76 Bechtel inspector and SB QC mgr sign paperwork.
- 1/14/76 96 bolts shipped to construction site at Midland.
- 1/15/76 approved hand grind procedure sent from MVSS to SB.
- 1/22/76 Unit I bolts (96) arrive onsite at Midland.
- 1/21/76 letter, MVSS-SB, error in P.O. 24-hr test is required (done?).
- 1/27-30/76 SB surveillance.
- 1/30/76 visual inspection of bolts onsite at Midland.
- 2/16-20/76 SB surveillance, nuts inspected.
- 2/20/76 Unit II material shipped to SB from Tech Steel & Alloy.
- 3/12/76 SB surveillance, newly acquired material for anchor bolts.
- 3/17/76 withdrawal from stock request for bolts (for construction).
- 3/24/76 SB surveillance, replacement for new material rejected(?).
- 4/20/76 SB surveillance.
- 4/23/76 SB surveillance.
- 4/29/76 SB surveillance, linear indications at 1 inch, 4 equal spaces due to chuck.
- 5/5/76 SB surveillance, grinding of indications.
- 5/11/76 QC mgr. signs CMTR's for Unit II bolts.
- 5/13/76 memo on final shipment of studs (Unit II).

5/12-14/76 final SB surveillance  
 5/17/76 correction instructions, add 2 HT reports & tensile values (Unit II bolts)  
 8/30/76 memo on ASME code usage for component supports.  
 10/22/76 telecon  
 11/8/76 SCN 6007 adds 25 mil lateral expansion as charpy test criteria  
 4/77 Unit I studs embedded in concrete at Midland  
 7/23-30/79 Studs tensioned (Unit I)  
 7/26/79 Stud #35 tensioned (as part of above tensioning)  
 9/14/79 stud #3 found to be broken  
 9/18/79 broken end of stud recovered.  
 10/1/79 teledyne contacted  
 10/19/79 broken stud #3 sent to Teledyne.  
 12/19-20/79 second broken stud observed in outer ring.  
 12/20/79 PN III 79-66 issued on broken studs.  
 12/21/79 second broken stud sent to Teledyne.  
 1/22/80 PN III 79-66A update on broken studs.  
 1/25/80 Teledyne report.  
 2/5/80 third stud found broken.  
 2/14/80 meeting at SB, NRC, Bechtel, Consumers, SB personnel (no Rex personnel).  
 2/27-29/80 NRC investigation onsite at Midland.  
 3/5-6/80 NRC investigation at SB.  
 3/12-13/80 NRC investigation at Rex.  
 3/18-19/80 NRC investigation at Bechtel (Ann Arbor).  
 3/20/80 NRC investigation at MVSS  
 4/2/80 call to Consumers (Wood) ten questions from investigation & review.  
 / /80 investigation report drafted  
 / /80 investigation report issued  
 / /80 close-out meeting with Consumers, Bechtel.



Consumers  
Power  
Company

James W Cook  
Vice President - Projects, Engineering  
and Construction

General Offices: 1946 West Parnall Road, Jackson, MI 49201 • (517) 788-0453

November 23, 1981

Mr J G Keppler, Regional Director  
Office of Inspection and Enforcement  
US Nuclear Regulatory Commission  
Region III  
799 Roosevelt Road  
Glen Ellyn, IL 60137

MIDLAND PROJECT -  
MIDLAND DOCKET NOS 50-329, 50-330  
UNIT NO 1, REACTOR VESSEL BROKEN ANCHOR BOLT -  
FILE 0.4.9.35 SERIAL 15035

REFERENCES 1. CONSUMERS POWER LETTERS TO J G KEPPLER, SAME SUBJECT

- a. HOWE-267-79 DATED OCTOBER 12, 1979
- b. HOWE-311-79 DATED DECEMBER 14, 1979
- c. HOWE-51-80 DATED MARCH 3, 1980
- d. HOWE-80-80 DATED APRIL 30, 1980
- e. SERIAL 8971 DATED MAY 16, 1980
- f. SERIAL 8809 DATED AUGUST 1, 1980
- g. SERIAL 9330 DATED JULY 24, 1980
- h. SERIAL 9787 DATED DECEMBER 10, 1980
- i. SERIAL 11524 DATED MARCH 31, 1981
- j. SERIAL 12051 DATED JULY 17, 1981

2. J G KEPPLER LETTER TO S H HOWELL, DOCKET NOS 59-329  
AND 50-330 DATED AUGUST 18, 1980

3. R L TEDESCO LETTER TO J W COOK, DOCKET NOS 50-329  
AND 50-330 DATED MARCH 6, 1981

4. D S HOOD LETTER TO CONSUMERS POWER DATED JULY 7, 1980

Enclosures 1. Report entitled, "Reactor Pressure Vessel Support Modification  
for Midland Nuclear Power Plant, Midland, Michigan, Report  
No 3", dated November 1981.

2. Letter Report - Teledyne Engineering Services (TES) Project  
5355: Expanded Criteria for Acceptability for Service of  
Midland Unit 1 RV Anchor Stress.

oc1181-0965a141

~~519~~ 8112080292

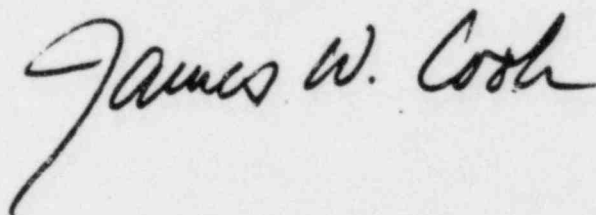
References 1.a through j were Interim 50.55(e) reports, concerning the broken anchor bolts in the Unit No 1 reactor vessel support skirt.

Reference 1.g provided interim technical information concerning the reactor pressure vessel support modification and the schedule for the accomplishment of that modification. Reference 1.h provided the description of the analytical techniques being used that the NRC had requested in Reference 4. Enclosure 1 to this report supersedes References 1.g and 1.h by providing updated and current information as to the design of the modified support system, analytical techniques to be used and the completion schedules.

Enclosure 2 provides a report from Teledyne Engineering Services on expanded acceptance criteria for the anchor stud stress.

The two enclosed reports comprise a complete and current package of documentation describing the design concept, the analytical techniques to be used and the completion schedule for the modification of the reactor vessel support system. The reports are in concurrence with the requirement in Reference 3 to keep the NRC informed of developments and progress made by the Company with regard to this issue. Immediately following NRR's review of the enclosures, it is the Company's intent to meet with NRR staff members on December 3, 1981 to present a summary of these reports and to resolve any concerns they might have and thereby obtain formal recognition that the conditions and understandings specified in References 2 and 3 have still been satisfied.

This letter is intended to be an interim 50.55(e) report transmitting our final technical report on the reactor vessel anchor bolt modification. The final 50.55(e) report will be submitted on or before December 3, 1981. Upon completion of this task, the final designs and analytical results will be reported in the FSAR.



JWC/BFH/cl



CC Director of Office of Inspection & Enforcement (15)  
Director, Office of Management, Information and Program Control (1)  
Atomic Safety and Licensing Appeal Board  
CBechhoefer, ASLB w/o  
MMCherry, Esq  
RJCook, Midland Resident Inspector  
FPCowan, ASLB w/o  
RSDecker, ASLB w/o  
HDenton, NRC (5)  
SHFreeman, Esq, Ass't Attorney General w/o  
JHarbour, ASLB w/o  
DSHood, NRC (2)  
FJKelley, Esq, Attorney General w/o  
WHMarshall  
WDPaton, Esq w/o  
MSinclair w/o  
GTTaylor, Esq, Ass't Attorney General w/o

PRELIMINARY NOTIFICATION

Date: 1/22/80

PRELIMINARY NOTIFICATION OF EVENT OR UNUSUAL OCCURRENCE--PNO-III-79-66A

This preliminary notification constitutes EARLY notice of events of POSSIBLE safety or public interest significance. The information presented is as initially received without verification or evaluation and is basically all that is known by IE staff as of this date.

Facility: Consumers Power Company  
Midland Unit 1 (DN 50-329)  
Midland, Michigan

Subject: BROKEN REACTOR VESSEL ANCHOR BOLTS AT MIDLAND 1 CONSTRUCTION SITE

This PN is an update of PNO-III-66 issued on December 20, 1979.

The following information was received by Consumers Power Company on tests performed on the Midland 1 reactor vessel anchor bolts.

1. Test results indicate that most of the bolts have a hardness value above the ASME material specification limit (indication of brittleness).
2. The cause for the two bolts previously reported broken at Midland 1 was due to stress corrosion cracking in conjunction with the potential sub-standard mechanical properties of the bolts.
3. The 96 bolts received by Midland may have been part of a larger order of bolts heat treated at the same time by the J. W. Rex Company. The disposition of the remaining 90 bolts from that order is not known at this time.

All information to date indicates that the bolt material in Midland Unit 2 is acceptable.

The licensee is planning to meet with consultants and Bechtel next week to review the data further. Region III will follow this problem at the Midland site.

No press release is planned by the licensee until the final evaluation of the material is made. The NRC does not plan a press release at this time.

Distribution: Transmitted H St \_\_\_\_\_

Chairman Ahearne  
Commissioner Gilinsky  
Commissioner Kennedy

Commissioner Hendrie  
Commissioner Bradford  
ACRS

S. J. Chilk, SECY  
C. C. Kammerer, CA  
(For Distribution)

Transmitted: MNBB \_\_\_\_\_  
L. V. Gossick, EDO  
M. L. Ornstein, EDO  
J. J. Fouchard, PA  
N. M. Haller, MPA  
R. G. Ryan, OSP  
H. K. Shapar, ELD

P. Bldg \_\_\_\_\_  
H. R. Denton, NRR  
R. C. DeYoung, NRR  
R. J. Mattson, NRR  
D. Vassallo, NRR  
D. Risenhut, NRR  
SS Bldg \_\_\_\_\_  
W. J. Dircks, NMSS  
S. Levine, RES

IE:XOOS \_\_\_\_\_ (IE: HQ Dist.)

Landow \_\_\_\_\_ (6 min/page)  
J. J. Cummings, OIA

(MAIL)  
R. Minogue, SD  
IE:XOOS

PRELIMINARY NOTIFICATION

8002080074

PRELIMINARY NOTIFICATION

The State of Michigan is being notified.

The information was provided by the licensee at the Jackson, Michigan corporate office at approximately 12:30 p.m. on January 21, 1980.

*RC Knop*  
Contact: R. C. Knop, RIII  
384-2578

*G. Fiorelli*  
G. Fiorelli, RIII  
384-2603

Distribution: Transmitted H St \_\_\_\_\_

Chairman Ahearne  
Commissioner Gilinsky  
Commissioner Kennedy

Commissioner Hendrie  
Commissioner Bradford  
ACRS

S. J. Chilk, SECY  
C. C. Kammerer, CA  
(For Distribution)

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R. G. Ryan, OSP  
H. K. Shapar, ELD

P. Bldg \_\_\_\_\_  
H. R. Denton, NRR  
R. C. DeYoung, NRR  
R. J. Mattson, NRR  
D. Vassallo, NRR  
D. Eisenhut, NRR  
SS Bldg \_\_\_\_\_  
W. J. Dircks, NMSS  
S. Levine, RES

IE:XOOS \_\_\_\_\_ (IE: HQ Dist.)

Landow \_\_\_\_\_ (6 min/page)  
J. J. Cummings, OIA

(MAIL)  
R. Minogue, SD  
IE:XOOS

PRELIMINARY NOTIFICATION

Date: 12/20/79

PRELIMINARY NOTIFICATION OF EVENT OR UNUSUAL OCCURRENCE--PNO-III- 66

This preliminary notification constitutes EARLY notice of events of POSSIBLE safety or public interest significance. The information presented is as initially received without verification or evaluation and is basically all that is known by IE staff as of this date.

Facility: Consumers Power Company  
Midland Unit 1 (DN 50-329)  
Midland, Michigan

Subject: BROKEN REACTOR VESSEL ANCHOR BOLTS AT MIDLAND 1 CONSTRUCTION SITE

Consumers Power reported to RIII (Chicago) that a second reactor vessel anchor bolt on Midland Unit 1 was found broken on December 19, 1979. A previous bolt had been found broken on September 14, 1979 and was reported as a 10 CFR 50.55(e) item at that time. Both bolts were heat number 654N136. They were treated at J. W. Rex Company and supplied by Southern Bolt and Fastener Corporation. The material originated at Bethlehem Steel. Fifty-eight bolts of this heat number were installed in Unit 1 and none in Unit 2. Teledyne Engineering Services is currently performing a series of tests on the first bolt material and results are expected in the near future. It is not known at this time if this heat number was supplied to any other reactor site.

This PN is being issued because of possible generic considerations. Region III is following up on this matter.

No press release is planned by the licensee or the NRC.

The State of Michigan is being notified.

This information was provided by a regional based inspector at Midland site at 1:30 p.m. on December 20, 1979.

*RCK*  
Contact: R. C. Knop, RIII  
384-2578

*CF*  
G. Fiorelli, RIII  
384-2603

Distribution: Transmitted H St \_\_\_\_\_

Chairman Ahearne  
Commissioner Gilinsky  
Commissioner Kennedy

Commissioner Hendrie  
Commissioner Bradford  
ACRS

S. J. Chilk, SECY  
C. C. Kammerer, CA  
(For Distribution)

Transmitted: MNBB \_\_\_\_\_  
L. V. Gossick, EDO  
H. L. Ornstein, EDO  
J. J. Fouchard, PA  
N. M. Haller, MPA  
R. G. Ryan, OSP  
H. K. Shapar, ELD

P. Bldg \_\_\_\_\_  
H. R. Denton, NRR  
R. C. DeYoung, NRR  
R. J. Mattson, NRR  
D. Vassallo, NRR  
D. Eisenhut, NRR  
SS Bldg \_\_\_\_\_  
W. J. Dircks, NMSS  
S. Levine, RES

IE:XOOS \_\_\_\_\_ (IE: HQ Dist.)

Landow \_\_\_\_\_ (6 min/page)  
J. J. Cummings, OIA

(MAIL)  
R. Minogue, SD  
IE:XOOS

PRELIMINARY NOTIFICATION

~~8403070234~~

1p.

NRC ENTRANCE MEETING

2-4-80

R.V. ANCHOR BOLTS

<u>NAME</u>	<u>COMPANY</u>	<u>TITLE</u>
D. R. KEATING	CPC <sup>o</sup>	QA GROUP SUPV.
RAT Wheeler	CPCO	Civil Section
J. L. WOOD	CPC <sup>o</sup>	QA Group Supv.
E. M. Hughes	Bechtel	Asst Project Engineer
LA Dreisbach	Bechtel	PEAF
RE. SEVA	"	DAE
Bruce H. Peck	Cite	CONSTRUCTION SUPV
PAUL GOGUET	BECHTEL	FLD. ENGR.
Harvey W. Stager	CPC <sup>o</sup>	Staff Engineer - Proj Engr Services
T. E. Vandel	NRC R III	Project Inspector
R. J. COOK	NRC	RESIDENT INSPECTOR
<del>_____</del> C M Erb	" R III	Eng Insp



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION III  
799 ROOSEVELT ROAD  
GLEN ELLYN, ILLINOIS 60137

*Foster*  
*Coof*

JUN 27 1980

MEMORANDUM FOR: Dudley Thompson, Executive Officer for Operations Support  
FROM: James G. Keppler, Director, Region III  
SUBJECT: CONSUMERS POWER COMPANY - RECOMMENDED ORDER

We recommend that an Order be issued to Consumers Power Company requiring licensee action to correct unacceptable anchor bolts at the Midland facility. This is a significant technical problem. Recognizing that a hearing is pending on an Order related to inadequate foundation materials at the site, and recognizing the technical significance of this problem, we believe that an Order requiring corrective action is warranted. A draft letter to the licensee and Order is attached for Headquarters use.

Certain items of noncompliance were identified during the course of the investigation and these are included as an attachment to the draft Order. Considering that these items occurred 4-5 years ago, we see no purpose in requiring a response to the items of noncompliance. The Order requires the necessary licensee corrective action.

We have been in contact with NRR personnel who are evaluating the licensee's proposed corrective action. While they indicate that their review is not complete, they believe the proposed actions will be acceptable upon final review.

Please let us know if you have questions on this matter.

*for* *Gen W. Roy*  
James G. Keppler  
Director

Attachments:

1. Draft Letter to licensee  
w/attached Order
2. Draft Investigation Report

cc w/attachments:

H. D. Thornburg, RCI  
J. Lieberman, ELD

cc w/attachment 1:

R. DeYoung, IE

~~8403070345~~

*Stopp*



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION III  
799 ROOSEVELT ROAD  
GLEN ELLYN, ILLINOIS 60137

Docket No. 50-329

Docket No. 50-330

Consumers Power Company

ATTN: Mr. Stephen H. Howell

Vice President

1945 West Parnall Road

Jackson, MI 49201

Gentlemen:

This refers to the investigation conducted by Messrs. J. E. Foster and C. M. Erb of the Region III Office during February 27 - May 2, 1980, regarding the procurement and manufacture of reactor vessel holddown studs utilized for Midland Unit 1. Our findings were discussed during a meeting between J. G. Keppler, Director, Region III and you and members of your respective staffs on May 2, 1980.

Our investigation findings indicate serious deficiencies related to the specification, material selection and heat treatment for these important items, and we are concerned that your system was not sufficient to identify these deficiencies. Based on our concerns relative to bolting materials, we are issuing the attached Order requiring specific corrective actions.

Items of noncompliance identified during this investigation are attached to the Order. We recognize that the reactor vessel holddown studs were manufactured approximately five years ago, and conditions relative to their manufacture cannot be altered at this date. Therefore, no response to the specific items of noncompliance is required.

In accordance with Section 2.790 of the NRC's "Rules of Practice," Part 2, Title 10, Code of Federal Regulations, a copy of this letter and the enclosure, will be placed in the NRC's Public Document Room.

Your response to the enclosed Order and future inspections will determine if further escalated enforcement action is required.

Sincerely,

Victor Stello, Jr.,  
Director  
Office of Inspection and  
Enforcement



Consumers Power Company

- 3 -

Enclosures:

1. Draft letter to licensee  
with enclosed Order
2. Draft IE Investigation Reports  
No. 50-329/80-13 and No.  
50-330/80-14

cc w/encls:

Ronald Callen, Michigan Public

Service Commission

Myron M. Cherry, Chicago

THE UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

IN THE MATTER OF:

Consumers Power Company

Midland Nuclear Power Plant

Units 1 and 2

Docket No. 50-329

Docket No. 50-330

I

The Consumers Power Company (the "licensee") is the holder of Construction Permits No. CPPR-81 and No. CPPR-82 which authorize the construction of two pressurized water reactors in Midland, Michigan. The construction permits expire on October 1, 1981 and October 1, 1982 for Unit 2 and Unit 1 respectively.

II

In February 1980, the licensee reported that three reactor hold down bolts on Unit 1 had failed. An investigation into this problem, which was concluded on April 18, 1980, shows that the hold down bolts on the Unit 1 reactor vessel are unacceptable per ASME III and ASTM specifications. The bolts were made of improper material and not properly heat treated or tested. Improper engineering judgements including specification of material

and quality assurance deficiencies led to the problem. The related violations of NRC regulations are set forth in Attachment 1. Under existing criteria, the bolts are rejectable on Unit 1 and similar bolts on Unit 2 and the steam generators are questionable.

### III

Under the Atomic Energy Act of 1954, as amended, and the Commission's regulations, activities authorized by construction permits or portions thereof may be suspended should the Commission find information which would warrant the Commission to refuse to grant a construction permit on an original application. We conclude that the engineering and quality assurance deficiencies which led to the failure of the reactor hold down bolts are an adequate basis to refuse to grant a construction permit, and therefore, suspension of certain activities under Construction Permits No. CPPR-81 and No. CPPR-82 is warranted if these safety related issues cannot be resolved.

### IV

In view of the foregoing and pursuant to the Atomic Energy Act of 1954, as amended, and the Commission's regulations in 10 CFR Parts 2 and 50, IT IS HEREBY ORDERED THAT THE LICENSEE SHALL:

- a) obtain approval of the Office of Nuclear Reactor Regulation of the method of repair of the reactor vessel anchor bolts for Unit 1;
- b) provide assurance that anchor bolts for the Unit 2 reactor vessel and the steam generators meet existing criteria, and if they do not meet existing criteria, obtain approval from the Office of Nuclear Reactor Regulation of the method of repair of these anchor bolts; and
- c) assure that other safety related bolting and component support materials have been procured according to the proper quality standards and codes and provide a written report within 30 days to the Region III office as to the extent of the materials reviewed.

Until such time as items a), b), and c) above are complete, the licensee shall cease all further safety related construction work regarding the bolts in question or other construction not approved by NRR to provide compensation for the unacceptable bolts.

V

The licensee or any person whose interest is affected by this Order may within twenty (20) days of date of this Order request a hearing with

respect to all or any part of this Order. In the event a hearing is requested, issues to be considered will be:

- 1) whether the facts set forth in Section II of this Order are correct; and
- 2) whether this Order should be sustained.

Any request for a hearing shall not stay the effective date of this Order.

FOR THE NUCLEAR REGULATORY COMMISSION

---

Harold Denton  
Director  
Office of Nuclear Reactor  
Regulation

---

Victor Stello, Jr.  
Director  
Office of Inspection and  
Enforcement

Dated at Bethesda, Maryland  
this      day of      , 1980

Attachment: Notice of  
Violation

Attachment 1

NOTICE OF VIOLATION

Consumers Power Company

Docket No. 50-329

Docket No. 50-330

This refers to the investigation conducted by representatives of the Region III office at the Midland site on February 27-29, 1980; with subsequent visits March 5-6 at Southern Bolt Company; March 11-12 at J. W. Rex Company; March 18-19 at Bechtel; March 20 at Mississippi Valley Structural Steel, April 18 at Bechtel, discussed during the May 2, 1980 meeting at the Region III Offices.

It appears that certain of your activities were in noncompliance with NRC requirements as noted below. Each item is an infraction.

1. 10 CFR 50, Appendix B, Criterion IV, requires, in part, that . . .  
"Measures shall be established to assure that applicable regulatory requirements, design bases, and other requirements, which are necessary to assure adequate quality are suitably included or referenced in the documents for procurement of material, equipment, . . . whether purchased by the applicant or by its contractors and subcontractors."

Governing procurement specification No. 7220-C-233(Q), Revision 3, states that reactor vessel anchor bolts and nuts will be utilized as ASME (American Society of Mechanical Engineers), Section III, Division 1, Class 1 component supports. Complete requirements for Section III, Class 1 component supports were incorporated in the Winter 1973 amendment to Section III, and were identified as Component Supports, Subsection NF.

The purchase order for reactor vessel anchor bolts was dated September 16, 1974, making the applicable ASME Code Edition Winter of 1973 or Summer, 1974.

Contrary to the above requirement, Subsection NF was not made the requirement for reactor vessel anchor bolts with the following results:

- a. ASTM A354 Grade BD was specified as the stud material, which did not have an ASME code allowable stress at the time of order, September 16, 1974.
- b. While fracture toughness tests were made, no attention was given to the brittle fracture indicated by lateral deformation tests.

~~c. THERE WAS NO INVOLVEMENT OF THE AUTHORIZED  
NUCLEAR INSPECTOR IN THIS ORDER OF STUDS.~~

PAGE 3 IS MISSING FROM THIS PACKAGE.

3. 10 CFR 50, Appendix B, Criterion IX, requires, in part, that "Measures shall be established to assure that . . . heat treating, and nondestructive testing, are controlled and accomplished by qualified personnel using qualified procedures in accordance with codes, specifications, criteria, and other special requirements."

Contrary to the above, measures did not assure that heat treating and nondestructive tests were controlled in accordance with applicable codes and specifications. Examples are:

- a. The Southern Bolt Quality Assurance manual in Paragraph 2M, Section 10.0, requires that purchase orders state "where the heat treater is to Brinell (hardness test) pieces."

Contrary to this requirement, no location (e.g. surface of bolt) for this test was specified in the heat treatment purchase order.

- b. ASTM Code requirements (A-354, A-370) provide for hardness testing of bolting materials. These requirements call for surface hardness tests, with subsurface tests being allowed under specific and limited conditions.



Contrary to these requirements, greater than specified hardness results on the surface of the studs led to performing hardness tests at the mid-radius, on the end of tensile test specimens. Conditions to allow such testing under ASTM Codes were not present, and such tests defeat the purpose of the hardness test as a nondestructive test.

- c. The heat treat procedure utilized for treating the reactor studs, J. W. Rex #1, Section 2, states that a "furnace load shall consist of approximately 10 pieces plus test bars."

Contrary to the above, furnace temperature charts submitted for documentation (dated April, 1975) indicate that tempering furnace loads exceeded 10 pieces (38-39 studs were tempered per furnace load). (It is also noted that, in one case, two test pieces did not accompany production bars during heat treatment. Therefore, the test results for this test piece may not represent those for the production pieces).

- d. Purchase Order #24844, from Mississippi Valley Structural Steel to Southern Bolt and Fastener Corp., in section 5, indicated that "total material traceability is required."

J. W. Rex Heat Treat Procedure, J. W. Rex #1, Rev. 4, in section 2, required testing and documentation to be on the basis of material heats.

Contrary to the above, material traceability was not maintained in that J. W. Rex was not notified that the studs to be heat treated consisted of two types of steel and four material heats until initial heat treating had been accomplished.

U.S. NUCLEAR REGULATORY COMMISSION  
OFFICE OF INSPECTION AND ENFORCEMENT

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REGION III

Report No. 50-329/80-13; 50-330/80-14

Docket No. 50-329; 50-330

License No. CPPR-81; CPPR-82

Licensee: Consumers Power Company  
1945 West Parnall Road  
Jackson, MI 49201

Facility Name: Midland, Units 1 and 2

Investigation At: Midland Site, Midland  
Southern Bolt Company, Shreveport, LA

J. W. Rex Company  
Lansdale, PA

Mississippi Valley Structural Steel Co.  
St. Louis, MO

Investigation Conducted: February 27-29, March 5-6, 12-13, 20,  
April 18, and May 2, 1980

Investigator: \_\_\_\_\_ Date \_\_\_\_\_  
J. E. Foster

Inspector: \_\_\_\_\_ Date \_\_\_\_\_  
C. M. Erb

Reviewed by: \_\_\_\_\_ Date \_\_\_\_\_  
C. E. Norelius  
Assistant to the Director

\_\_\_\_\_ Date \_\_\_\_\_  
R. C. Knop, Chief  
Projects Section 1

Investigation Summary

Investigation on February 27-29, March 5-6, 12-13, 20, April 18, May 2, 1980  
(Report Nos. 50-329/80-13; 50-330/80-14)

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Areas Investigated: Special, announced investigation concerning manufacture and installation of reactor pressure vessel holddown studs utilized in Midland Unit 1. The investigation required 150 inspector hours by two NRC personnel.

Results: Of the areas investigated, 3 items of noncompliance were identified: (Infraction - Inadequate Procurement Document Control - Details section, Paragraph 6b; Infraction - Inadequate Control of Special Processes - Details Section, Paragraphs 6d, 6e, 6f; Infraction - Inadequate Control of Purchased Material, Equipment and Services - Details section, Paragraph 6f).

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## REASON FOR INVESTIGATION

On September 14, 1979, Consumers Power Company (CPCo) personnel notified NRC Region III, by telephone, of the discovery of a broken reactor vessel holddown stud on the Midland Unit 1 reactor vessel. This condition was subsequently reported under the requirements of 10 CFR 50.55(e) on October 12, 1979, with interim status reports on December 14, 1979 and March 3, 1980. Two other studs were subsequently found to be broken. As this condition reflected a significant deficiency, an NRC investigation was initiated to review the materials, manufacture, and installation of the studs.

## SUMMARY OF FACTS

Region III (RIII) inspectors visited the Midland site on February 4-5, 1980, and also attended a meeting at the supplier's facility on February 14, 1980. The results of this inspection and meeting are reported in I.E. Inspection Report No. 50-329/80-05, 50-330/80-05.

The investigation into the causes of the stud failures was initiated by a site visit during February 27-29, 1980. Subsequently, visits were made to the principal contractor (Mississippi Valley Structural Steel), the supplier (Southern Bolt and Fastener Corporation), the heat treating facility (J.W. Rex Co.), and the Architect-Engineer (Bechtel Power Corporation). During these visits, pertinent files were reviewed, and personnel were interviewed. Materials gathered during these visits were intensively reviewed.

The investigation findings indicate that the root cause of the anchor stud failures was the failure to characterize the studs as American Society of Mechanical Engineers (ASME) Section III, Class 1, Component Supports (Division NF). This failure allowed use of an American Society of Testing and Materials (ASTM) standard specification which would not be allowed under Division NF. Among contributing factors were:

1. The ASTM specification utilized (ASTM A-354) allowed use of American Iron and Steel Institute (AISI) 4140 and 4145 steel in stud manufacture. This material is very difficult to properly heat treat in the diameter required for these studs. Difficulties in through-hardening of the steel in the larger diameters may produce a hard surface and softer center.
2. The heat treater had extreme difficulty treating the material and obtaining acceptable hardness and tensile test results. Finally, hardness tests taken from halfway between the surface and center locations provided acceptable hardness results, but did not indicate the unacceptably hard surface (44-48 Rockwell C). Two reported tests were from test pieces which did not receive the same treatment as the production run of studs.

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3. Charpy impact tests were obtained for the studs, and test results provided indications of questionable properties. However, these impact tests had been performed "for information only" and the results were not reviewed. Previously reported manufacturing problems had not triggered any concern which would cause a review of the Charpy tests.

Several Quality Assurance deficiencies were noted; (1) lack of licensee involvement; (2) failure to advise the heat treater of different heats of material; (3) inadequate document review; (4) failure to respond to indications that the studs were deficient; (5) failure to review materials previously purchased, when the purchase specification was revised; and (6) miscalculation of the stud stress area resulting in a slight over-specification stressing of the studs (this item was licensee identified).

The stud failure mechanism has been identified as stress-assisted corrosion cracking, resulting from properties of the stud material. The licensee is in the process of de-tensioning the Unit 1 studs and evaluating their use.

Tests indicate that some studs utilized in Unit 2, although of different material and heat treatment, have above-specification surface hardness readings. Some steam generator bolts are also questionable and are under review.

An unresolved item was identified during file reviews. A Bechtel memorandum indicated that it had been project practice not to include reference to ASME III in design documents. It is not known if other items were procured without reference to ASME III. An unresolved item is one where more information is needed to determine if noncompliance exists.

DETAILS1. Personnel ContactedConsumers Power

W. Bird, Manager, Midland QA  
J. Cook, Vice President, Midland  
T. Cooke, Project Superintendent  
J. Corley, Section Head, IE&TV  
S. Howell, Senior Vice President  
H. Hudson, Procurement  
D. Keating, QA Group Supervisor  
B. Peck, Construction Supervisor  
H. Slager, Materials Section, Design  
R. Wheeler, PND-Civil Section  
J. Wood, Quality Assurance Group Supervisor

Bechtel Power Corporation

J. Barbee, Supervisor, Codes and Standards  
W. Barclay, PFQCE  
A. Boos, Project Field Engineer  
C. Boyak, Project Engineer  
R. Brown, Attorney  
P. Corcoran, Resident Assistant Project Engineer  
L. Davis, Construction  
L. Dreisbach, PQA Engineer  
M. Elgaaly, Project Engineer  
P. Goguen, Field Engineer  
H. Hudson, Procurement  
J. Russell, QC  
J. Rutgers, Project Manager  
R. Sevo, QA Engineer  
E. Smith, QA  
T. Suplee, Project Engineer  
D. Yuan, Project Engineer

Mississippi Valley Structural Steel

M. Cohn, Engineer  
J. Pantukhoff, Vice President

Southern Bolt and Fastener Corporation

R. Alexander, Vice President  
K. Day, QC Administrator  
T. Goin, Field Sales Representative  
E. Nelson, President  
D. Sibley, Quality Assurance  
J. Williams, Shipping  
J. Wood, Purchasing

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J. W. Rex Company

G. Derstine, Director, Quality Control  
K. Krewson, Division Superintendent  
F. Vasso, Sales Manager

2. Introduction

The Midland Nuclear Power Plant, Unit 1 and 2, licensed to Consumers Power Company, is under construction on a site approximately one mile south of Midland, Michigan. Bechtel Power Corporation is the Architect-Engineer and Constructor for the plant, designed to utilize a Babcock and Wilcox Nuclear Steam Supply System. Unit 1 is designed to supply process steam to nearby Dow Chemical Corporation in addition to producing electric power.

The reactor pressure vessels for these units are supported by a reactor vessel skirt, which rests on a sole plate in the reactor pedestal. Two rows of reactor holddown studs (48 inner, 48 outer) secure the reactor skirt to the sole plate. These studs are 2 1/2 inches in diameter, 7 feet 4 inches in length, weigh approximately 124 pounds each, and are secured to an embedded anchor plate. By design, the studs were to be pretensioned to 75 KSI (See Exhibit I). These studs are designed to accommodate postulated accident loadings (vessel tip and uplift) and perform no critical function during normal reactor operation.

While the reactor holddown studs are studs by definition (no bolt head is present) the terms stud and bolt have both been used to describe this equipment.

3. Scope

This investigation was conducted to review the history of the reactor pressure vessel studs at the Midland Plant as to their specification, materials, fabrication, heat treatment, testing and installation. The investigation focused on the studs utilized for Unit 1.

The chronology of the NRC investigation is attached as Exhibit II, and a chronology of bolt manufacture is attached as Exhibit VI.

4. Technical Background

The hardenability of an alloy is defined as its ability to transform to a fully hardened structure (martensite) throughout a cross section from the austenitizing temperature in the quench medium used. Statements from the bolting section of the 1978 Metals Handbook indicate that (1) "As strength increases and section size increases, hardenability becomes the most important factor in choosing a bolting material," and (2) following an oil quench, the center section of a bolt should be 90% martensite.

The choice of AISI 4140/41<sup>4</sup>65 steel for studs 2 1/2 inches in diameter by 7 feet 4 inches in length, weighing approximately 124 lbs. each, makes meeting this important metallurgical requirement extremely difficult. Test results indicate that the studs have varying pro-



properties, indicating that the heat treatment did not produce uniform results. However, due to the properties of the steel itself, it is questionable whether AISI 4140/4145 steel could have been adequately heat treated in this size range without high rejection rates.

AISI 4140-4145 steel is a commonly utilized bolting material, found in many applications. It is recognized by the ASTM Code as an acceptable material in smaller diameter bolting, in a range from 1/2 - 1 3/4 inches. In this size range, the material can be heat treated with relative ease. In larger sizes the material is very difficult to through harden, with the center of the material being several points Rc (Rockwell Hardness) softer than the surface.

As a consequence of the material properties and heat treatment, the surface of the studs is extremely hard, while the mid radius properties barely meet or are below the hardness and mechanical requirements of the stud specification.

Certain anomolous indications raised questions about the stud material. In addition to hardness gradients across the studs, test records indicate some locations along the length of the studs are harder than other locations.

The bar stock utilized for reactor holddown studs did not receive any of the special treatments commonly utilized for critical nuclear grade bolts. Such bolts are typically purchased as vacuum-degassed steel, and purchased oversize. The material is then machined to the needed size, eliminating surface defects which could be a cause for rejection when magnetic testing is done.

The application of the studs is as important as the material in judging suitability. The studs are considerably stressed, and embedded in concrete, conditions conducive to stress assisted corrosion cracking. The threaded areas provide a notch area where this failure mechanism is most likely to occur.

##### 5. Review of FSAR

The Midland Final Safety Analysis Report refers to the reactor vessel anchor bolts specifically in several sections, and by inference in other sections.

Section 3.8.1.6.4, "Containment Liner Plate," in Paragraph 3.8.1.6.4.1, "Materials," notes that the bolts are to be to ASTM 354, grade BD (modified).

Paragraph 3.8.3.1.1 describes the bolts, but does not discuss their design.

Paragraph 3.8.3.4.1 addresses Reactor Coolant Equipment Supports, and on Page 3.8-49, refers to design standards for bolts utilized in Seismic Category I structural supports. This section was added as part of

Revision 17, dated January, 1979, and was in response to NRC questions on FSAR statements. This section appears to commit the licensee to ASME Section III.

NRC question 110.51(3.9.3) resulted in the revision of Section 3.8.3.4.1, noted above. The question dealt with anchor bolts, and support designs. NRC question 110.57(3.9.3) requested further clarifying information after the initial response to question 110.51, and also applies to bolting.

The licensee stated that this response had been mislocated in the FSAR, and was not meant to pertain to reactor vessel support bolting.

Table 3.8-32 appears to apply to the bolts, again describing their material as ASTM A-354, Grade BD.

Figure 3.8-30 is the drawing in the FSAR reflecting stud location and arrangement.

None of the FSAR sections appear to specifically commit to ASME Section III for reactor support holddown bolts.

## 6. Manufacture of Holddown Studs

- a. Material purchase. AISI 4140 and 4145 (low alloy) hot rolled steel rods, 2 1/2 inches in diameter, were utilized for stud manufacture. The steel was purchased from Shill Steel (heat "0000," and not utilized), Armco Steel (heat "00") and Bethlehem Steel (heats "0" and "000") during February 1973 to March 1974. No special requirements were imposed on the material, such as vacuum degassing or machining to reduce surface defects. Chemical analyses supplied by the suppliers showed typical values for these steels. As the rods were purchased well prior to issue of the stud specification or purchase order, Southern Bolt and Fastener (Southern Bolt) did not know how this material would be utilized, and was simply stocking steel rod. Southern Bolt personnel advised that this material was utilized due to unavailability of other grades of steel or larger diameter material.

Discussions indicated that, at this time, Southern Bolt and Fastener was a relatively small firm which manufactured bolts and studs by cutting and threading steel rods and forging heads for bolts. This was their first significant nuclear order.

- b. Specification. Requirements for reactor vessel anchor studs were included in Bechtel Specification No. 7220-C-233(Q), "Technical Specifications for Purchase of Miscellaneous Metal for Consumers Power Company."

The specification, in Revision No. 3, dated December 5, 1974, and later revisions, included in Section 5.10 the notation that "These anchor bolts and nuts will be utilized as ASME Section III,

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Division 1, Class 1, Component Supports." File information, (See Exhibit III) indicates that this notation is not an error, and ASME Section III was intended to govern the procurement of reactor vessel anchor bolts.

While component Supports were described in ASME Section III, 1968, a separate Subsection, NF-Component Supports, was added to the 1973 Winter Addenda of the ASME Code, and was required for materials purchased to ASME III specifications six months later. As the purchase order for the reactor vessel holddown bolts was issued on September 16, 1974, the studs should have been characterized as ASME Section III, Class 1, Subsection-NF materials (the reactor pressure vessel code dated 1968 is not applicable to these bolts as they were not a part of the reactor vessel contract). File documents indicate that attempts were made to specify the studs to the equivalent of NF requirements. However, the specification does not meet NF requirements in several significant areas, including ASTM specifications, materials, and testing requirements.

Failure to properly characterize the studs is contrary to 10 CFR 50, Appendix B, Criterion IV, and the Procurement Specification No. 7220-C-233(Q). (50-329/80-13-01, 50-330/80-14-01).

Included in file documentation was a memo (See Exhibit IV) indicating that it was a project practice to refrain from citing ASME Section III in purchase specifications. It is not known if other items were procured without reference to ASME Section III. This is an unresolved item (50-329/80-13-01U, 50-330/80-14-01U).

As originally issued for procurement on May 3, 1974, Bechtel Specification No. 7220-C-233(Q), Revision 2, required anchor studs to ASTM A-490-1971 requirements.

ASTM A-490(1970) "Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints" included a range of 1/2 inch to 4 inch diameter bolts in its scope. This was changed in 1971 to allow a range of only 1/2 - 1 1/2 inch diameter bolts under the specification. The vendor, Mississippi Valley Structural Steel (MVSS) advised Bechtel that ASTM A-490 (1971) did not apply to bolts 2 1/2 inches in diameter, and following discussion, the specification was revised to require ASTM A-354-1966 (Quenched and Tempered Alloy Steel Bolts, Studs, and other Externally Threaded Fasteners). ASTM A-354 is not acceptable under ASME Section III.

When ASTM designations were changed from ASTM A-490 to ASTM A-354, a requirement for Charpy impact test (a measure of ductility) to show a minimum lateral expansion of 25 mils was deleted. The revised specification required Charpy impact test results "for information only." Bechtel personnel advised that this requirement was deleted on the basis of an engineering decision.

ASTM A-354-1966 Grade BD allowed the use of a number of steels, as long as they met the chemical, tensile, and hardness require-

ments specified. When the vendor proffered AISI 4140-4145 material, Bechtel advised them that it would be acceptable if it met the specification requirements. However, Bechtel file memos indicate a recognition that AISI 4140-4145 material was "marginal" for the application, and suggestions were made by Bechtel personnel to purchase additional bolts because of expected test failures. No action was taken in response to these comments.

As originally issued, the stud specification did not contain testing requirements. Specification Change Notices (SCNs) added these requirements (SCN 4004 dated September 27, 1974, SCN 4005 dated October 11, 1974). Following these changes, the purchase order was modified to include the testing requirements. The specification provided values for minimum yield, and minimum but not maximum, tensile strength, (See Exhibit V, two pages of the Specification).

- c. Fabrication. The AISI 4140-4145 rods were cut to size and threaded at each end. This was apparently completed in early December, 1974.
- d. Heat treatment. The studs were shipped to the J. W. Rex Company (REX), Lansdale, PA, sometime during December 1974-January 1975. Southern Bolt personnel indicated that REX was selected due to availability and size of rod they could accommodate.

J. W. Rex personnel indicated that they were not initially notified that there were four heats contained in the stud order, and for several months treated the studs indiscriminately as though all material was one heat. This is contrary to 10 CFR 50 Appendix B, Criterion IX, and material traceability requirements contained in Mississippi Valley Structural Steel, Purchase Order 24844 and J. W. Rex Heat Treat Procedure #1. (50-329/80-13-02, 50-330/80-14-02).

REX documents indicate the first full heat treatment (austenitizing and then tempering) was performed during late January 1975. The REX Laboratory Mechanical Property Test Report for this treatment (tests performed on reduced size mechanical specimens), dated January 28, 1975, indicates tensile strength values of 144,500-158,000 PSI, yield strengths of 116,200-130,800 PSI, and Rockwell hardness of Rc 37-42. Twelve of the values reported do not meet requirements, including those pertaining to hardness. These results were reported to Southern Bolt, Mississippi Valley Structural Steel, and Bechtel.

Mississippi Valley inquired if the specification could be changed to ASTM A-354-74, Grade BC, or if hardness requirements could be relaxed. When questioned by Bechtel as to the amount of relaxation on hardness specifications necessary, they requested an allowable Rockwell hardness of Rc 45. Bechtel advised that the test results were unacceptable and hardness requirements could not be relaxed. Southern Bolt was advised of this via telecon on March 21, 1975. This information was passed on to REX.

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Several tests were made at the REX facility in attempts to ascertain a heat treatment procedure which would yield acceptable studs. A request to lower the tempering temperature was made, partially as a result of these tests. A letter from Southern Bolt to MVSS, dated April 13, 1975, was used as partial basis for the request to lower tempering temperature. It reflects a resultant hardness of Rc 37 from a tempering run at 850° F. However, the REX file test for this run indicates a hardness value of Rc 41 (all other reported values were correct). As the tempering temperature requested was within the allowable range per ASTM A-354, the change from a tempering temperature of 900°-1000° F to a tempering temperature of 850° F was approved by Bechtel.

Further heat treating was performed at REX, and 21 mechanical property tests were run between April 22-May 16, 1975. These results were given to Southern Bolt and transmitted to MVSS by letter of May 28, 1975. Five of the reported values did not meet minimum yield value requirements. These results apparently were not reported to Bechtel.

Further heat treatments were run at REX, utilizing 850° F as a tempering temperature. Results from tests run on June 27, 1975 and July 2, 1975 (heat "00" at 925° F) were reported for formal documentation. Test reports were to be on pieces accompanying production runs. However, records indicate that two tests run on July 2, 1975 were for test pieces which did not accompany the production pieces, and one hardness value appears to have been reduced from Rc 39 to Rc 38 on the REX file report. This is contrary to 10 CFR 50, Appendix B, Criterion IX and the J. W. Rex Heat Treat Procedure #1. (50-329/80-13-02, 50-330/80-14-02).

Steel from Heat "0000" could not meet specification requirements, and it was apparently scrapped. No information concerning the disposition of this material could be developed.

There are some indications that the heat treatment was improper as to temperature actually induced in the studs during tempering. Furnace heat charts for most furnace runs were from wall thermocouple readings, and for heat "00" the thermocouple placed on the studs was utilized. A comparison of the furnace charts indicates that the studs did not heat as rapidly as the furnace wall, and may not have reached tempering temperatures for the desired length of time.

There are also indications that the presence of a suspending nut as part of the heat treatment fixture may have caused that portion of the stud covered by the nut to heat more slowly than other sections, and hence be tempered to a lesser degree.

Consumers Power personnel have obtained flow rates for the oil bath quench, and have indicated their belief that flow rates are low for a sufficiently rapid quench following stud austenitizing. This would affect the hardening of the studs.

From a review of test records, the dates on the furnace heat charts (date of heat treatment) supplied for the formal documentation package are in error (only month and year were noted on these records). Actual dates were determined from dates on test records and penciled dates on furnace chart margins. In some cases the date is nearly one month in error.

Furnace charts submitted for documentation indicated that 38-39 studs were tempered per furnace load. This is contrary to 10 CFR 50, Appendix B, Criterion IX and J. W. Rex Heat Treat Procedure #1, which required a maximum furnace load of 10 pieces plus test bars. (50-329/80-13-02, 50-330/80-14-02).

REX personnel stated that the heat treatment of the Midland studs was possibly the most frustrating order that they had taken. They noted that the studs were in their facility over six months, when a routine order is processed in approximately two weeks.

- e. Testing. Tensile, yield, and hardness testing was performed at J. W. Rex Company following heat treatments.      allowed, tensile and yield tests were performed on reduced specimens. No test pieces were preserved.

REX personnel stated that hardness tests were performed on the stud surface for the initial hardness tests. The tests performed subsequent to June 1975, were subsurface tests done on the tensile specimens themselves at the mid radius of the bolt.

Correspondence indicated that there was discussion of ASTM A-354, Paragraph 4.3, which states "Acceptance on the basis of the tensile requirements shall take precedence where minimum requirements are subject to controversy." It was indicated that a part of ASTM A-370, which gives hardness testing guidance, was also discussed. This part provides for an "arbitration point" in the threaded area of a bolt, and mid radius hardness testing in the thread areas. This portion of the specification is intended for use when the readings are in dispute.

Hardness tests are non-destructive examinations, often done on each piece of critical equipment. Many standards (such as ASTM A-490, ASTM A-540) specify such surface hardness tests be performed. The sections of ASTM discussing subsurface tests, mentioned above, were apparently intended to be utilized in case of controversy over requirements, not in case of unacceptable results from surface hardness tests. Therefore, the subsurface tests do not meet the requirements of the stud specification. This is in noncompliance 10 CFR 50, Appendix B, Criterion IX, and ASTM Code requirements (ASTM A-354, A-370). (50-329/80-13-02, 50-330/80-14-02).

Charpy impact testing was performed on the studs and nuts following heat treatment, by a laboratory at Standard Pressed Steel (SPS). Charpy acceptance criteria of 25 mils lateral expansion had not been removed from the purchase order to Southern Bolt, and the SPS lab noted this requirement on their nut Charpy Impact Test

Report. When reviewed by Bechtel, they were advised to delete this statement from the test form. SPS did not place it on the stud Charpy Impact Test Report. Values reported for lateral expansion on studs range from 1.5-9 mils and would not have met the lateral expansion requirement for the studs had it been imposed.

It was noted that the notarized Charpy Impact Test Report in the site documentation file contained the statement "Charpy test specimens on studs were taken longitudinally, more than one inch below the surface and from the mid ten inches of the seven foot four inch stud. Tests were run after heat treatment." This statement is not contained on the SPS file copy of the report and was apparently added following notarization of the document.

Magnetic particle inspection was performed on the studs by Peabody Testing. On August 8, 1975, the Bechtel shop inspector witnessed this testing, and observed unacceptable linear indications (exceeding one inch in length). It was found that Peabody was using a less strict standard than specified, and all of the tested studs were rejected by the Bechtel shop inspector.

The studs were then returned to Southern Bolt, and actions were taken to remove the indications. The studs were variously hand ground and some 20 were machined to 2.257 inches in diameter. During the period September 30, through October 3, 1975, actions were taken by Southern Bolt to procure alternate bar material (AISI 4340) and to begin stud manufacture again. File memos indicated that this action was apparently begun on the belief that the studs could not be acceptable due to difficulty in meeting magnetic particle test criteria. Due to withdrawal of material suppliers, this course of action was abandoned.

Records indicate that on January 6, 1976, the Bechtel shop inspector witnessed magnetic particle testing at Southern Bolt and approved 97 studs for shipment to Midland. These studs were utilized in Unit 1. Unit 2 bolts were subsequently manufactured of AISI 4340 steel and heat treated at a different facility.

- f. Quality assurance review. During this investigation, aspects of quality assurance related to studs were reviewed. File reviews indicated that Consumers Power personnel had no active involvement, beyond approval for financial expenditures, in stud procurement or document review.

No Bechtel shop inspection was performed until after the material had been procured, the studs manufactured, heat treated, and magnetic particle examined. Shop inspection points are at the discretion of the purchaser and inspection prior to final shipment was chosen.

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By memo dated July 17, 1975, (BCBE 604) Bechtel personnel accepted testing on the basis of heat numbers, but required the number of Charpy impact tests to be as specified in Section 5.10.4(c) of Bechtel Specification No. 7220-C-233(Q). This required at least two Charpy tests for heat "0" (approximately 6,325 pounds), and one test for heats "00" and "000." However, only one test was supplied for each heat, and this was not identified during document reviews. This is contrary to 10 CFR 50, Appendix B, Criterion VII and Procurement Specification No. 7220-C-233(Q). (50-329/80-13-03, 50-330/80-14-03).

As the Charpy impact test had been required "for information only" no technically knowledgeable personnel reviewed the test results. Bechtel personnel indicated that tests "for information" are not reviewed unless manufacturing problems are identified.

The following indications of manufacturing problems, did not result in further review:

- (1) Questionability of material.
- (2) Early failing tests.
- (3) Request for relaxation of hardness requirements.
- (4) Magnetic particle examination failures.
- (5) Length of time to successfully heat treat the material.
- (6) Total length of time for stud manufacture.

Review of the Southern Bolt Quality Assurance Manual indicated that it contained requirements for the content of the heat treatment purchase order (Document sent to Heat Treating Company describing treatment). Section 10.0 of Revision 4 (February 27, 1972) in Paragraph 2.M., requires that the purchase orders state "where the heat treater is to Brinell (hardness test) pieces."

Southern Bolt personnel indicated that they could not locate a copy of the heat treatment purchase order for the Unit 1 studs, but provided a copy of the heat treatment purchase order for the Unit 2 studs. The required information on hardness tests location was not provided on this purchase order, and there is no blank provided for recording this information on the standard heat treat form. This is contrary to 10 CFR 50, Appendix B, Criterion IV and the Southern Bolt Quality Assurance Manual. (50-330/80-14-02).

Bechtel Specification No. 7220-233(Q) was revised by Specification Change Notice 6007 on November 8, 1976. This change added Charpy impact acceptance criteria to the section of the specification pertaining to reactor vessel anchor bolts. However, no review of materials procured prior to this change was made to ascertain whether the change affected their status.

Bechtel personnel stated that their review of the specification, done when bolt failures were identified, determined that this revision had been intended for another part of the specification.



A review of pertinent codes indicates that, in the diameters and strength ranges specified, Charpy impact tests have no acceptance criteria.

## 7. Installation

There were no indications of shipping deficiencies or receipt inspection problems other than the failure of the document review to note that a sufficient number of Charpy impact tests were not provided, and identify that furnace loads had exceeded those set by the Heat Treatment Procedure.

The studs for Unit 1 were embedded in concrete during April 1977, and tensioned during the period July 23-30, 1979.

The licensee advised RIII that the studs were over-tensioned due to miscalculation of the effective stress area. The studs were preloaded to an initial stress of 75 KSI in the shank area, but should have been preloaded to this figure in the thread area. The effect of this miscalculation was to prestress the bolts to approximately 92 KSI versus the specified 75 KSI in the thread area.

A review of Region III records of inspections pertaining to reactor vessel anchor bolts revealed that during an inspection on November 16-19, 1976, a citation was issued to the licensee for failure to protect some of the threads in embedded bolts for Unit 2. There were no other inspection reports relevant to reactor vessel holddown bolts.

## 8. Identification of Problems

On September 14, 1979, workmen placing jam nuts on the tensioned studs found that a stud (with a nut attached) had failed, and could not be located. This stud was subsequently retrieved from a scrap pile.

Consumers Power advised RIII by telephone of this discovery on September 14, 1979, and followed with a formal letter under the requirements of 10 CFR 50.55(e). Status reports dated October 12, 1979, December 14, 1979, and March 3, 1980 advised of the status of their review. Two additional studs were subsequently found to have failed.

## 9. Consultant Review

Consumers Power contracted with Teledyne Engineering Services to perform a failure analysis of the Unit 1 studs, and a review of Unit 2 studs.

Their initial report "Investigation of Preservice Failure of Midland RPV Anchor Studs," (TR-3887-1), dated January 25, 1980, indicates that the studs have a severe hardness gradient, and indicates the failure mechanism as stress corrosion cracking.

## 10. Management Meeting

A management meeting with representatives of Consumers Power Co., and Bechtel Power Corporation was held at the RIII office on May 2, 1980.

During this meeting, the findings of the investigation were discussed, including matters which were being considered as items of noncompliance (no delineation of noncompliance items was made at that time).

Consumers personnel indicated that they disagreed with the RIII position regarding ASME Section III applicability.

Consumers and Bechtel personnel discussed possible modifications being considered to compensate for the identified stud deficiencies. Any engineering changes formally proposed will be referred to the Office of Nuclear Reactor Regulation for review and acceptance.

The licensee advised that Unit 1 studs were in the process of being detensioned, and detensioning of Unit 2 studs was planned for the near future.

## 11. Unresolved Items

Unresolved items are matters about which more information is required in order to ascertain whether they are acceptable items, items of noncompliance, or deviations. Unresolved items disclosed during the inspection are discussed in Paragraph 6.B.

### Attachments:

- Exhibit I. Reactor Vessel Support Diagram (Bolts)
- Exhibit II. Investigation Chronology
- Exhibit III. File Information Related to ASME III
- Exhibit IV. Memorandum on ASME III Usage
- Exhibit V. Stud Specification (2 pages)
- Exhibit VI. Stud Manufacture Chronology



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NRC INVESTIGATION CHRONOLOGY

- 9/14/79 Licensee reports stud failure.
- 10/12/79 50.55(e) report from licensee.
- 12/14/79 interim report on 50.55(e).
- 2/4-5/80 Inspection of studs on site.
- 2/5/80 Third stud found broken.
- 2/14/80 Meeting at Southern Bolt, NRC, CP, SB personnel.
- 2/27-29/80 NRC Investigation initiated, Midland site.
- 3/3/80 second interim report from licensee.
- 3/5-6/80 NRC investigation at Southern Bolt and Fastener.
- 3/20/80 Inspection Report 80-05 transmitted (2/4-5/80 inspection report).
- 3/12-13/80 NRC Investigation at J. W. Rex Company.
- 3/18-19/80 NRC Investigation at Bechtel office, Ann Arbor, Michigan.
- 3/20/80 NRC Investigation at Mississippi Valley Structural Steel.
- 4/2/80 Call to Consumers passes on issues for resolution.
- 4/15/80 Phone call to clarify issues for resolution.
- 4/18/80 NRC Investigation at Bechtel, Ann Arbor (answers to questions).
- 5/2/80 Meeting with Consumers Power.

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FILE INFORMATION RELATED TO ASME III APPLICATION TO HOLDDOWN STUDS

(excerpts)

9/23/74, telephone call memo by R. Grote to R. Ryden/D. Koski: "project engineering added to the magnetic particle inspection of the nuts so to be in accordance with ASME Section III - NF," "the subject bolts are classified as ASME Section III Class I component supports."

9/27/74, Specification Change Notice (SCN) C-223-4004: "(Note: these anchor bolts will be utilized as ASME Section III Division I Class I component supports)."

10/1/74, memo BCBE 436, by R. E. Felton to R. L. Castleberry (pg. 2): "Project engineering has affirmed the magnetic particle examination requirement on nuts, the reason being that ASME Section III governs the procurement of reactor anchor bolts."

4/11/75, unsigned notes identified as having been made by Mr. John Hink: "the RVAB (reactor vessel anchor bolts) are classified as component supports in Section NF, Section NF is not mandatory," "design appears to be fairly close to the design requirements of NF."

Exhibit III

# DRAFT

Bechtel Memorandum

To: R. L. Castleberry

From: G. Tuveson

Subject: Midland Units 1 & 2  
application of ASME  
B&PV Code Section III  
Division I Subsection  
NF Requirements to  
Component Support  
Structure

Location: - A2-6A

Date: 8/30/76

Job No. 7220

File: C-2135

The above mentioned subject was discussed between M. Rothwell and M. Elgaaly, A. Desai and B. Dhar of civil group on August 19, 1976.

It was agreed that to be consistent with Midland project position, the ASME code would not be directly referred to in the design documents. But the design, fabrication and construction would meet, to the extent possible, the ASME code requirements within the applicable boundaries.

Accordingly, to meet the intent of the code, civil group will add a section to the specifications C-38 and C-233. When required, the design drawings will call out the applicability of this section for a particular structure.

typed copy of handwritten  
memorandum

Exhibit IV

- 5.9 Shear Stud shall be in accordance with AWS D1.1 Section 4.1.1 and shall meet the following. The material shall conform to either ASTM A 307 or ASTM A 108 as applicable, and shall meet the tensile requirements contained in AWS D1.1.

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5.10 Reactor Vessel Anchor Bolts and Nuts

(NOTE: These anchor bolts and nuts will be utilized as ASME Section III Division 1 Class 1 component supports.)

- 5.10.1 Bolts shall be ASTM A 354 Grade BD, with the following additional requirements:

- a. ASTM A 614 as specified in Section 5.10.3 below.
- b. ASTM A 354 Section 4.4 and Table 3 - Mechanical tests on machined specimens from the Grade BD 2-1/2 inch diameter bolts shall have a minimum yield strength of 130,000 psi, minimum elongation of 14 percent and minimum reduction of area of 35%.
- c. ASTM A 354 Table 2 - The Grade BD 2 1/2 inch diameter bolts shall have a minimum tensile strength of 150,000 psi, a minimum proof load of 120,000 psi and a minimum yield strength of 130,000 psi.
- d. The bolt material shall be subjected to impact testing as specified in Section 5.10.4 below.

- 5.10.2 Nuts shall be in accordance with ASTM A 194 Grade 2 or 2H, with the following additional requirements:

- a. ASTM A 614 as specified in Section 5.10.3 below.
- b. ASTM A 194 Section 5.1 - Certified Material Test Reports shall be in accordance with ASTM A 614 Section 8. If ladle analysis is not available a check analysis may be substituted.
- c. ASTM A-194 Section 9 - The Cone stripping test is not required.
- d. ASTM A 194 Section 14.1 applies.
- e. ASTM A 194 Section 14.3 - Certification shall be in accordance with ASTM A 614 Section 8.
- f. The nut material shall be subjected to impact testing as specified by Section 5.10.4 below.

- 5.10.3 The materials, testing and documentation of the subject nuts and bolts shall be in accordance with ASTM A 614 with the following additional requirements:

- a. ASTM A 614 Section 9.1.2 - The written procedure shall be submitted to the Buyer.

- b. ASTM A 614 Section 9.1.4 - The written procedure shall be submitted to the Buyer.
- c. ASTM A 614 Section 10 is required.
- d. ASTM A 614 Section 11 is required.
- e. ASTM A 614 Section 12 is required.
- f. ASTM A 614 Section 13 is a Seller's option to ASTM A 614 Section 12.

5.10.4 The Charpy V-notch test ( $C_V$ ) shall be required for the bolts and nuts in accordance with the following:

- a. Testing Procedure - Test procedures shall be in accordance with ASTM A 370-72a.
- b. Location and Orientation of Test Specimens - The  $C_V$  impact test specimens shall be prepared with the longitudinal axis of the specimen located at least 1/2 radius or 1 inch below the surface plus the machining allowance per side, whichever is the lesser. The fracture plane of the specimen shall be at least 1 diameter or thickness from the heat treated end.
- c. Sampling Frequency - One test shall be made for each lot of material where a lot is defined as one heat of material heat treated in one charge or as one continuous operation, not to exceed 3,000 lbs by weight.
- d. Condition of Material - The test specimens shall be taken after heat treatment.
- e. Test Temperature - The impact specimens shall be tested at 40°F.
- f. Certified Material Test Report - The test temperature, lateral expansion, absorbed energy and percent shear fracture as well as the orientation and location of all tests shall be reported for information in accordance with ASTM A 614 Section 8.

5.10.5 Handling, shipping and storage shall be in a manner that shall avoid damage to the material. The Seller shall submit written procedures for handling and shipping for approval by the Buyer prior to shipment.



11/6/73 Specification 7220-C-233(Q) issued for client review.  
3/25/74 steel heats "0" and "000" received, "00" and "0000" received previously.

6/28/74 bid requests sent.  
8/5/74 Decisions made as to applicable nondestructive testing requirements.  
8/8/74 TWX adds nondestructive testing requirements, original supplier withdraws.

8/21/74 TWX, MVSS-Bechtel, ASTM A-490 is not right specification.  
8/23/74 TWX, MVSS-Bechtel, need specification, trying to find material.  
8/23/74 Bechtel response TWX, A-490 is correct, 4140/5 steel not approved.  
8/27/74 Memo, test requirements, tensile values, 25 mils expansion for Charpy test.

9/3/74 TWX, MVSS-Bechtel, proposal, ASTM-354, 4140 steel, 25 mils expansion.  
9/10/74 Memo BEBC 527, approves use of ASTM A-354 as specification.  
9/16/74 Contract date.  
10/1/74 Memo, history of studs to date.  
12/20/74 Rex heat treatment procedure #1, revision 0.  
12/74-1/75 Studs shipped from SB to Rex.  
1/28/75 Rex material test report, specimens #1, 2, 6, 8, 9, 11, 12.  
2/4/75 letter, SB-MVSS, material cannot meet requirements.  
2/6/75 TWX, MVSS-Bechtel, provides Rex test result.  
2/12/75 Phone call memo, SB requests relaxation of hardness to Rc 45.  
2/18/75 Memo, discusses six tests, hardness relaxation request.  
3/21/75 TWX, test results unacceptable, not relax hardness requirements.  
4/3/75 letter, SB-MVSS, justifying 850 degree temper (reported hardness is wrong).

4/11/75 Notes, 4140 marginal, excessive hardness, where was hardness tested?  
4/18/75 Memo, hardness, tempering, material is marginal.  
4/22/75 Rex material test, test 1-4 of 19 finally made.  
4/25/75 Rex material test, tests 5-11.  
5/1/75 Bechtel approval of Rex heat treatment procedure, revision #3.  
5/5/75 SB Quality Control manager visits Rex.  
5/16/75 Rex material test, tests 11-19.  
5/28/75 19 test reports sent with "dummy" documentation package for review.  
6/3/75 Rex test, "machined from 2' of end of bar."  
6/9/75 Rex test, "machined from 7' from end of bar."  
6/16/75 Rex test, stud #1 from heat "000".  
6/18/75 Rex test, stud #8 from heat "000", 850 degree temper.  
7/2/75 Rex test, "machined from center of bar," heat "00".  
7/15/75 Midland meeting, Bechtel and MVSS determine allowable number of tests.  
7/17/75 Memo, BCBE 604, physical and mechanical tests to be by heat number.  
7/21/75 date on thermocouple furnace chart for heat "00".  
7/24/75 Revision #4 of Rex heat treatment procedure approved.  
7/29/75 date of material properties report supplied for documentation.  
8/18/75 Rex surveillance report, all studs rejected for linear indications.  
8/20/75 SB Quality Control manager visits Rex.  
8/27/75 TWX on reducing diameter of shank of stud by .060 inches.  
9/30/75 TWX, history of studs, start again, new material suppliers withdraw.  
11/11/75 TWX, SB proposes turning some studs to 2.257 inches in diameter.  
11/20/75 TWX approves turning to 2.257 inches in diameter.  
1/4/76 97 studs pass examination, are released for shipment, 96 shipped.  
1/22/76 studs received at Midland site.  
11/8/76 SCN 6007 adds 25 mil expansion criteria to stud section, possibly in error.

4/77 Unit I studs embedded in concrete at Midland.  
7/23-30/79 Unit I studs tensioned.  
9/14/79 first stud found to have failed.  
1/25/79 Teledyne Engineering report on stud failure mechanisms.