



Consumers  
Power  
Company

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May 1, 1979  
Howe-131-79

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 NUCLEAR PLANT  
UNIT NO 1, DOCKET NO 50-329  
UNIT NO 2, DOCKET NO 50-330  
REACTOR BUILDING SPRAY PIPING SUPPORTS

Reference: S H Howell letters to J G Keppler; Midland Nuclear Plant;  
Unit No 1, Docket No 50-329; Unit No 2, Docket No 50-330;  
Reactor Building Spray Piping Supports -

- 1) Serial Howe-60-78, dated April 19, 1978
- 2) Serial Howe-92-78, dated June 13, 1978
- 3) Serial Howe-154-78, dated August 30, 1978
- 4) Serial Howe-186-78, dated October 13, 1978
- 5) Serial Howe-231-78, dated November 10, 1978
- 6) Serial Howe-265-78, dated December 15, 1978
- 7) Serial Howe-36-79, dated February 1, 1979
- 8) Serial Howe-93-79, dated March 16, 1979

The referenced letters are interim 50.55(e) reports. This letter is the final 50.55(e) report. Analysis conducted since the initial report has verified the adequacy of the design of the reactor building spray piping supports in that the ASME Section III Code allowable stresses are met.

The enclosed letter provides the final report to Bechtel Management Corrective Action Report (MCAR) 22.

*Stephen H. Howell*

Enclosure: Letter, P A Martinez to G S Keeley, BLC-7507, MCAR-22 Final Report, with attached report, dated April 27, 1979

CC: Director of Office of Inspection  
and Enforcement  
Att: John G Davis, Acting Director,  
USNRC (15)

Director, Office of Management  
Information & Program Control, USNRC (1)

8007291130

## Bechtel Power Corporation

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April 27, 1979

BLC-7507

Mr. G. S. Keeley  
Project Manager  
CONSUMERS POWER COMPANY  
1945 West Parnall Road  
Jackson, Michigan 49201

Midland Units 1 and 2  
Consumers Power Company  
Bechtel Job 7220  
MCAR 22 FINAL REPORT  
Files 2417/2801

Dear Mr. Keeley:

The attached final report for MCAR 22, "Apparent Design Deficiency in the Reactor Building Spray Piping Assemblies," is submitted for your information and use. The basis of the MCAR Final Report submittal is receipt of assurance from ITT Grinnell (primary design responsibility) that the design meets Code requirements.

ITT Grinnell has given Bechtel assurance that the anchors in question are within the Code allowables. Bechtel Engineering has completed the review of the Grinnell report on results of the time history analysis for the six welds that were discussed with Consumers Power on January 22, 1979, and reported to the NRC on February 1, 1979 (Howe-36-79) and March 16, 1979 (Howe-93-79). The review confirms the Grinnell assertion that the six anchors meet Code requirements.

The ITT Grinnell report, which presents the summary of analysis for the remaining anchors, will be reviewed by Bechtel Engineering on or before May 18, 1979. Final verification and closure of the MCAR by Bechtel Quality Assurance will be based upon Engineering's review and acceptance of the Grinnell report. The Grinnell reports reviewed and accepted by Bechtel will

BCC: JLBacon, M-1085A  
WRBird, JSC-216B  
RLCastleberry, Bechtel AA (w/o att)  
TCCooke, Midland  
JLCorley, Midland  
LADreisbach, Bechtel-Midland (w/o att)  
GSKeeley, Pl4-408B  
BWMarguglio, JSC-220A  
PAMartinez, Bechtel AA  
DEMiller, Midland  
JFNewgen, Bechtel-Midland (w/o att)  
MEGibbs, II&B  
File: 0.4.9.17

# Bechtel Associates Professional Corporation

Attachment to BLC-7507

SUBJECT: MCAR 22 (issued 3/21/78)

Reactor Building Spray Anchor Discrepancy

## FINAL REPORT

DATE: April 27, 1979

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

## Introduction

This final report is prepared in response to Midland project Management Corrective Action Report 22, dated March 21, 1978.

## Description of Discrepancy

It was determined that local pipe stresses may potentially exceed ASME Code Section III allowables at the anchor points in the reactor building spray headers located in the reactor building dome. A total of 32 anchor points (16 per unit) were determined to have this potentially overstressed condition.

## Potential Safety Implication

A potential safety problem could exist if the overstressed piping deformed plastically and impeded reactor building spray flow following a LOCA or main steam line break (MSLB).

## Summary of Investigation and Historical Background

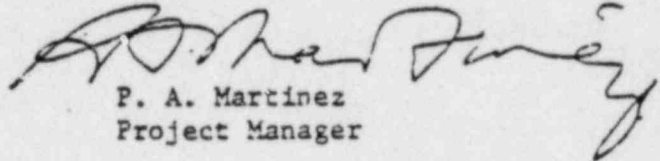
It was determined that the potential condition exists because ITT Grinnell's original anchor design did not use a reinforcing pad, which has been utilized by subsequent ITT Grinnell anchor designs to distribute the loading. The 1976 analysis used by Grinnell in designing these anchors indicated that the original design, without reinforcing pads, was adequate. Only the spray piping anchors have this original design. Subsequent Grinnell anchor designs utilize a reinforcing pad supported by a three-dimensional finite element analysis for all other Grinnell-designed piping anchors in the Midland plant.



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Mr. G. S. Keeley  
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be maintained in the Project Engineering files and will be available for any desired subsequent reviews. Detailed calculations are retained by ITT Grinnell. They are required to be kept for the lifetime of the plant per ANSI N45.2.9-1974.

Very truly yours,



P. A. Martinez  
Project Manager

PAM/AEB/pp

cc: Mr. R. C. Bauman  
Mr. W. R. Bird  
Mr. J. L. Corley  
Mr. B. W. Marguglio

Attachment (4 pages)

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All 16 Unit 2 reactor building spray dome anchors were installed in late 1976 and early 1977 in accordance with Grinnell drawings, except that minor modifications were made to the Level 1 approved Grinnell hanger sketches. The 10 Unit 1 anchors were installed in the prefabricated dome, based on the approved supplier Revision 0 design, in early 1977 prior to the lifting and setting of the Unit 1 dome. For the remaining six anchors in the Unit 1 ring girder area, a revised anchor design was received from the supplier which included reinforcing pads. These anchors have not been installed pending resolution of this MCAR. The Grinnell sketches were revised to show the minor modification required for installation and sent to Grinnell for concurrence.

Simultaneous to the above in April 1977, Grinnell revised their sketches (Units 1 and 2) to incorporate a reinforcing pad. These revised sketches were received by Bechtel Engineering in June 1977.

The Unit 2 drawings were returned to Grinnell by Bechtel Engineering with an approval Level 9 (revision unacceptable) because the Unit 2 anchors were already installed. The Unit 1 drawings were returned to Grinnell by Bechtel Engineering with an approval Level 1 (revision acceptable) based on the erroneous schedule information that they were not yet installed.

During the week ending March 13, 1978, a review of the status of the pad material questioned the need for reinforcing pads, bringing to light the fact that the as-designed/built condition may have exceeded the code allowable stresses. Significant actions and results which developed in the investigation of the anchor design are described in the following paragraphs.

- 1) Bechtel initiated a reanalysis of the reactor building spray system piping to define specific loading for each of the subject anchors. The original design loading provided to Grinnell was based on worst case seismic loading with additional allowance to ensure an adequate design for a water hammer loading combination. It had been anticipated that the water hammer loads would not have exceeded the

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seismic loading. The water hammer loading combination analysis was to be performed later in the project cycle with a review of the adequacy of the initially designed reactor building spray system supports for this loading.

It was determined that the water hammer loading combination significantly exceeded the previously provided seismic loadings. Independent of the investigation for MCAR 22, this planned verification would have caused the recognition of the potentially overstressed conditions, based on the initial calculational method. Therefore, Bechtel proceeded to develop time-history loadings to allow Grinnell to perform a more exact analysis using actual loading conditions.

- 2) Bechtel reviewed the anchor-to-pipe interface stress levels, based on the loading developed in Item 1, and determined that the stress levels were acceptable. Bechtel analysis was based on using the stress intensification factor technique for an unreinforced pipe branch.
- 3) Concurrent with Bechtel activity in Item 2, Grinnell reviewed the anchor stanchion design and structural attachment interface for acceptable stress levels. Grinnell determined that, using the most severe of the time-history data combined with other loads provided by Bechtel as a result of Item 1 activity, all but six anchors per unit were acceptable. These six anchors were calculated to be approximately 6% over code allowables at the Bechtel-supplied structural support and Grinnell anchor interface.

Grinnell subsequently reviewed these anchors based on the actual time-history loading developed by Bechtel as discussed in Item 1. Based on this analysis, the report of which is attached, Grinnell has determined that these anchors are also within code allowables.

- 4) It is concluded that the statement on the MCAR concerning apparent cause is inaccurate, and that no deficiency in the supplier design calculations has been discovered.

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## Corrective Action

As a result of the determination that the reactor building spray piping system can be used as is, no corrective action involving hardware is required.

A review of the methods used to ensure timely response by Grinnell and resolution of comments on changes to hangers were initiated early in the investigation. It is concluded that the existing procedural methods for anchor design review and approval are adequate. Since the time of recognition of the problem in March 1978, these methods have been properly implemented.

## Reportability

Project Engineering's final evaluation is that the originally reported discrepancy of the subject MCAR has been shown through analysis not to exist, and thus there is not now a reportable condition within the requirements of 10 CFR 50.55(e).

Submitted by:

*W. J. Larson*

Approved by:

*W. J. Larson*

Concurrence by:

*Karl Wiedner*

4/17/5



## Bechtel Associates Professional Corporation

SUBJECT: MCAR 24 (issued 9/7/78)

Settlement of the Diesel Generator Foundations and Building  
(Insufficient Compaction in Plant Area Fill Related to  
Seismic Category I Structures and Facilities)

INTERIM REPORT 5

DATE: April 16, 1979

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

Introduction

1. The title has been expanded to include activities related to plant area fill under other Seismic Category I structures in addition to the diesel generator building.
2. Extensive effort has been expended to respond to the NRC letter dated March 21, 1979, concerning the subject 10 CFR 50.54 request regarding plant fill. Portions of activities regarding plant fill and settlement will be covered in response to those questions.
3. This report is submitted to advise of interim status, developments, and project actions related to plant backfill settlement in the following areas since Interim Report 4, dated February 16, 1979. Information provided in Interim Report 5 includes settlement data up to April 13, 1979, wherever possible.
  - a. Settlement of the diesel generator foundations and building as described in MCAR 24 and NCR 1482
  - b. Backfill under Seismic Category I structures other than the diesel generator building.

Description of Deficiency

## 1. Diesel Generator Foundation and Building

It was stated in Interim Report 1 of MCAR 24, dated September 22, 1978, that "the diesel generator building settlements were noticed to exceed anticipated values in July 1978." The "anticipated values" referred to were not the "estimated ultimate settlement" values given in FSAR Figure 2.5-48. (Estimated ultimate settlement is defined as the estimated value predicted for a 40-year plant life.) Instead, these "anticipated values" were merely values of settlement that were greater than the amount of settlement which would have been expected under usual conditions for the elapsed time. The July 1978 settlement readings were within the estimated maximum settlement values given in the FSAR.

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The diesel generator foundation and building settlement data are shown in Figures 1, 13, 14, and 14-1. The maximum/minimum time settlement curves for the diesel generator building and one diesel generator foundation, shown in Figures 15 and 16 of Interim Report 4, have been updated to include settlement for all locations shown in Figure 1. This updated information is shown in Figures 43 and 44.

## 2. Other Seismic Category I Structures

Settlement data for Seismic Category I structures other than the diesel generator building are shown in Figure 2. Additional soil borings are being performed to evaluate fill under Seismic Category I structures other than the diesel generator building. Updated information on fill material not meeting project specification requirements will be provided in the response to the NRC's 10 CFR 50.54 request.

### Corrective Action

#### 1. Diesel Generator Foundations and Building Settlements

Corrective actions for this area have been discussed in Interim Reports 3 and 4. The preloading was completed to 20 feet above the final plant grade on April 7, 1979. The instrumentation shown in Figure 17 of Interim Report 4 has been completely installed.

#### 2. Other Seismic Category I structures

The corrective actions will be discussed in response to the NRC's 10 CFR 50.54 request.

### Activities Related to Plant Fill and Settlement

#### 1. Diesel Generator Building and Foundations

##### a. Activities Completed Since Last Report

##### 1) Soil exploration

Soil exploration in the diesel generator building area was described in Interim Report 4 except for Dutch cone penetrometer soundings. Fourteen Dutch cone penetrometer soundings were performed in the area of the diesel generator building. The locations of these soundings are shown in Figure 8 of Interim Report 4. The soundings were performed according to the "Tentative Method for Deep, Quasi-Static Cone and Friction-Cone Penetration Tests of

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Soil," ASTM Standard Designation D 3441-75T. Test results indicate that the soil under the diesel generator building above an approximate elevation of 605 feet is highly variable in classification. These results are consistent with soil boring results. They indicate that the fill below the building is variable in strength properties and susceptible to nonuniform settlement.

## 2) Liquefaction study

An analysis of liquefaction potential for sand in all quadrants beneath the diesel generator building was performed. The analysis was based on the soil boring information, field quality control data, and the gradation tests performed by Goldberg, Zoino, Dunnicliff, & Associates, Inc. The results of the analysis show that the northwest quadrant of the fill beneath the building is susceptible to liquefaction. However, the liquefiable sand pockets in the northwest quadrant are only locally connected and are surrounded by cohesive soil and dense sand. Corrective actions for this problem will be addressed in response to the NRC's 10 CFR 50.54 request.

## 3) Strengthening of the turbine building wall

This item, as described in Interim Report 4, was completed prior to placing preload above the 10-foot level (elevation 644').

## 4) Preload operation

Preloading of the diesel generator building has been completed. The granular fill material for the preload has been placed to el 654' as shown in Figures 11 and 12. This completes Step VII in Figure 12. Step VI of the preload sequence, which was to hold the preload at 15 feet above final plant grade, was deleted.

## 5) Construction of diesel generator structure

The last section of the building (roof slab) was poured on March 22, 1979. The construction of the main structure has been completed. These additions of weight to the building will assist the consolidation process.

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## 6) Crack mapping

The existing cracks in the diesel generator building which were mapped before preloading are shown in Figure 45. The present level of the preload prevents further visual examination of the cracks.

## 7) Utility monitoring

Pipes passing near and under the diesel generator building have been profiled in accordance with the monitoring program discussed in Interim Report 4. Pipe profiles are shown in Figure 60. Checks on Seismic Category I electrical ducts in the yard area show no obstructions.

## b. Activities in Progress

### 1) Settlement monitoring

#### a) Instrumentation data

Plots of borros anchors, surface plates (settlement platforms), and preload intensity are shown in Figures 46 through 56. Piezometer and cooling pond water level plots are shown in Figures 57 through 59.

Throughout the preload stages, 39 piezometers within the preload area were monitored on a daily basis, while the 28 settlement marker, 32 settlement platforms, and 45 borros anchors were monitored weekly. Instrumentation placed outside the preload area was also monitored for comparison. The results show that the preload program is causing the anticipated building settlement. Indications from piezometer readings are being studied.

#### b) Evaluation of underground pipe for preload pressure

The effect of preload on the circulating water pipes is being monitored as addressed in Interim Report 4. Figure 11 has been updated to show the roundness monitoring requirements for these pipes.



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## c) Crack monitoring

Some of the existing cracks in the diesel generator building walls are being electronically monitored. Since Interim Report 4 there has been essentially no change in the size of the cracks, monitored per Figure 18 of Interim Report 4.

## 2) Structural evaluation/analysis

An analytical model is being developed to analyze the effects of settlement of the diesel generator building and foundations. A seismic analysis, considering a range of possible soil parameters, is in progress.

## 3) Acceptance criteria

### a) Structural analysis

Criteria to evaluate the diesel generator structure and the foundations for the effect of settlement are being developed. These will be addressed in response to the NRC's 10 CFR 50.54 request.

### b) Removal of preload

Evaluation of the settlement readings will provide a basis for deciding when to remove the preload and predicting the maximum residual settlements of the diesel generator building.

## 2. Other Seismic Category I Structures and Facilities

### a. Activities Completed Since Last Report

#### 1) Soil exploration

Additional borings have been taken. The locations of these borings are shown in Figure 42.

#### 2) Crack mapping

The main structural elements of the service water pump structure and auxiliary building penetration rooms have been examined for cracks. The cracks identified in the service water structure have been mapped as shown in Figure 62.

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## 3) Settlement monitoring

- a) Emergency diesel fuel oil tanks have been filled with water and their settlements are being recorded.
- b) Pipes in the general plant fill area which have been profiled are shown in Figure 61.
- c) A borros anchor has been installed in the auxiliary building control tower at the same location as boring AX-6 shown in Figure 42.

## b. Future Activities Planned

Activities include continuation of the monitoring program, evaluation of fill under Seismic Category I structures, evaluation of the structures and facilities, and identification of any needed corrective action.

## Effect on Project Schedule

The current schedule analysis indicates an estimated potential delay in construction completion and system turnover of 2 months for the present corrective action program for the diesel generator foundations and buildings. The impact of this potential delay in system turnover on the preoperational testing schedule is yet to be determined. However, no impact on the fuel load date due to this delay is anticipated.

The potential for schedule impact for any needed corrective action related to other Seismic Category I structures is yet to be determined.

Submitted by: Amilam Gump

Reviewed by: Boh BOH

Approved by: K. Wiedner

Concurrence by: Karl Wiedner

AG/js  
4/4/1

## DRAWING SUMMARY

MCAR 24 Interim Report 5

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Figures Included in MCAR 24

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