Enclosure 1

Consumers Power Company

James W Cook
Vice President - Projects, Engineering and Construction

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

April 20, 1984

84-04 #1

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

MIDLAND ENERGY CENTER PROJECT
FINAL REPORT ON POTENTIALLY REPORTABLE CONDITIONS
SEISMIC AND STRUCTURAL DESIGN CONCERNS
FILE: 0.4.9.91 SERIAL: 28026

Because of discrepancies in the original seismic calculations, the following Safety Concerns and Reportability Evaluations (SCREs) were issued: SCRE 9 -Category I structures were analyzed with a nominal soil modulus without considering the variation of ±50% as required by the FSAR; SCRE 15 - for the seismic analysis of the diesel generator building, the material stiffness for soil under the building was assumed to be the same as undisturbed till material instead of fill material; and SCRE 42 - Use of Bechtel Computer Program CE-931 which overestimated the composite modal damping, which resulted in an underestimation of the building responses for the reactor and auxiliary buildings. In addition, SCRE 19 lists both seismic and structural concerns identified as a result of a CPCo review of the civil structural design calculations. The items on SCRE 19 were discussed with Messrs Landsman and Gardner of NRC Region III Inspection and Evaluation during a March 22, 1984 meeting with Bechtel and Consumers Power Company.

Attachment 1 provides a more detailed description and the circumstances under which the items were discovered. In each case, the original evaluation was that the discrepancies and concerns, respectively, were not reportable under 10CFR50.55(e), but that further evaluation would be necessary for confirmation.

In actuality, the engineering analysis supporting overall plant design and resolution of the SCREs has resulted in two basic categories in terms of making a final safety evaluation of the SCRE concerns.

1. Concerns identified in the SCREs, which in fact, have been analyzed to their original design basis and configuration and have been demonstrated to <u>not</u> be safety concerns, or

2. Equipment/system or structural modifications have occurred, (for various reasons) and the engineering analyses have not been performed to the original design basis and configuration. Thus the project has

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not made an absolute confirmation as to nonreportability of subject SCRE concerns. This is specifically true of SCREs 9, 15, 42 and some of the items associated with SCRE 19.

Consumers Power has decided to classify these SCREs as potentially reportable. This is because conditions of the original plant design for category 2 above will remain indeterminate as to actual reportability.

These concerns are classified potentially reportable as no actual case has been identified where the original structure or components would not perform their intended function as required by the original design criteria. Changes in other loads, such as the dead loads, live loads, thermal loads, pipe break loads, etc, which are combined with the seismic loads, could have caused the increased stresses which required plant modification or equipment replacement. The effect of the specific discrepant conditions identified in SCREs 9, 15, and 42, in contributing to the need for equipment replacement or plant modification is not identifiable from the current plant design analysis. None of the SCRE 19 items have been classified as a nonconforming condition. Some of the analysis in current plant design which addresses items listed on SCRE 19 may have contributed to plant design changes. Of the 50 items originally identified in SCRE 19, only six are currently open. These will be resolved through ongoing analyses using current design criteria and thus, like the other SCRE concerns, initial evaluation of the nonreportability of the original conditions will not be verified.

To ensure all changes in seismic criteria and additional stresses are incorporated into the final plant configuration, the floor accelerations have been recalculated, and the structures have been reevaluated. Reevaluation of all piping systems, preparation of Seismic Qualification Review Team (SQRT) documentation involving review of all equipment seismic qualification, and a pump and valve operability review are tasks now in progress.

In conclusion, Consumers Power has decided to classify the subject SCREs as potentially reportable because systems have been changed and equipment has been replaced for reasons which a subject SCRE <u>may</u> have contributed to, and the concerns will not be analyzed to the original design. Since all required changes as documented in the SCREs have been incorporated into the latest calculations, the final plant design is assured to meet current design criteria and commitment to safety.

As can be seen from Attachment 1, each of the items was discovered through a design review process. The specific discrepancies identified are random and isolated. The review processes have provided a comprehensive look at the civil/structural design area. The review results have caused an increased awareness of design packaging and individual design detail necessary to produce acceptable design. It is felt that the past intensive overall reviews, in combination with our current Project Engineering design practices required by Engineering Department Procedures, MPQAD monitors and audits, and CPCo Engineering design overview provide an appropriate overall design review system. No additional specific corrective action is required. This is the

final report on this potentially reportable situation. If significant discrepancies are detected during the review programs, appropriate notification in accordance with 10CFR50.55(e) will be made.

James W. Cook

JWC/PWJ/lr

CC: Document Control Desk, USNRC
Washington, DC

RJCook, NRC Resident Inspector
Midland Nuclear Plant

DHood, USNRC Office of NRR
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3/14/84

ATTACHMENT 1

SUMMARY OF SCRE CONCERNS AS ORIGINALLY ISSUED

SCRE 9 During the FSAR rereview, it was determined that there were some inconsistencies in the FSAR with regard to variations of soil modulus and effects on structural frequencies. With regard to structural adequacy, a check of seismic response forces within the major seismic Category 1 structures for a variation of soil modulus of ± 50% from the nominal value (22×10^6 lb/ft^2) as indicated by FSAR 2.5.4.7, is in process. Our opinion at this time is that the structures, in the configurations currently depicted in the FSAR, will be capable of carrying out their intended safety functions.

With regard to safety-related equipment within these structures, we have applied the option allowed in Section C.2 of Regulatory Guide 1.122, ie, to broaden the peaks associated with structural frequencies by ±15%. In so doing, we have utilized the nominal value of soil modulus (ie, 22×10^6 lb/ft^2) for both the SSE and OBE. On this basis, for the structural configurations currently depicted in the FSAR, it is believed that the systems would be able to carry out their intended safety functions.

SCRE 15 During the course of preparing for the structural and seismic design audit, it was discovered that in the original seismic analysis of the diesel generator building, the material stiffness of the site fill had been inadvertently chosen to be the same as the undisturbed till material.

SCRE 19 During preparation for the NRC structural audit, it was established that various engineering activities related to plant design require additional attention to document full compliance with Project licensing and/or design criteria. The Bechtel prepared list does not include items covered by previous SCREs or existing MCARs. In addition, certain issues raised by Consumers Power Company during the audit preparation need to be integrated (as appropriate) into the listing.

None of the presently identified items are deemed reportable at this time due to the lack of any indicated safety impact. In all cases, appropriate anlayses will be conducted by Bechtel to determine the actual situation relative to potential impact on plant safety.

SCRE 42 During the January 29, 1982 seismic design status review meeting in Ann Arbor, Bechtel presented a floor response spectrum curve for the reactor building comparing the original spectra with the current spectra. The comparison indicates a degree of nonconservatism in the original spectra at certain frequencies. The nonconservatism in the original spectra appears to be the result of the original use of CE-931, which resulted in a composite modal damping which was too high. BLC-11329, dated August 14, 1981, stated that the use of

CE-931 was not a safety problem due to other offsetting factors; however, the spectra comparison presented on January 29 indicates that CE-931 did, in fact, result in a spectra which was too low.

The new seismic analysis which is underway will determine the adequacy of the reactor building design. Bechtel advised during the January 29 meeting that the original design had sufficient margin relative to the nonconservative spectra; however, final determination regarding reportability cannot be made until the new analysis is complete.

Enclosure 2

Consumers Power Company
QA69-0

SAFETY CONCERN AN. REPORTABILITY EVALUATION

PROJECTS, ENGINEERING AND CONSTRUCTION - QUALITY ASSURANCE DEPARTMENT

PAGE 1 RJC

4. HOW WAS CONCERN IDENTIFIED, WHEN, WHERE?

During the FSAR rereview, it was determined that there were some inconsistencies in the FSAR with regard to variations of soil modulus and effects on structural frequencies. Refer to FSAR sections 2.5.4.7, 3.7.2.4, 3.7.2.5, 3.7.2.9, and Appendix 3A (Response to Reg Guide 1.122).

(CONTINUE ON NEXT PAGE)

TO MANAGER-MPQA

1. FROM:
ORGANIZATION: Design Prod

SCRE NO: 9
FILE NO: 15.1
DATE RECEIVED: 2/4/81

2. IS CONCERN A PART 21?
☐ YES ☒ NO
WHEN?
BY WHOM?

3. IS NRC AWARE OF THIS?
☐ YES ☒ NO
WHEN?
BY WHOM?

5. BRIEF DESCRIPTION OF CONCERN - SYSTEM, COMPONENT, ACTIVITY, POSSIBLE SAFETY IMPACT - (ATTACH SUPPORTING DOCUMENTS).

The FSAR sections are now in the process of review and revision to resolve inconsistencies between sections and within sections. This will be completed in the near future.

With regard to structural adequacy, a check of seismic response forces within the major seismic Category 1 structures for a variation of soil modulus of ± 50% from the nominal value (22×10^6 lb/ft^2) as indicated by FSAR 2.5.4.7, is in process. Our opinion at this time is that the structures, in the configurations

(Cont'd)

(CONTINUE ON NEXT PAGE)

6. IMMEDIATE REPORTABILITY EVALUATION:
☐ REPORTABLE - GO TO 13
☐ POTENTIALLY REPORTABLE - GO TO 13
☒ NOT REPORTABLE, FURTHER EVALUATION
☐ NOT REPORTABLE

7. ORGANIZATION REPONSIBLE FOR FURTHER EVALUATION:
Bechtel Project Engineering

8. FINAL REPORTABILITY EVALUATION (IF 6.c. CHECKED):
a. ☒ POTENTIALLY REPORTABLE b. ☐ NOT REPORTABLE

9. QA APPROVAL OF EVALUATION (BLOCKS 1 TO 7): W R Bird MANAGER - MPQA DATE 2/4/81

10. JUSTIFICATION OF EVALUATION - (ATTACH SUPPORTING DOCUMENTS)

a. Based on information in Block 5, there is confidence that the first reportability criterion is not met (ie, no adverse impact on safety).

The completion of ongoing structural (seismic) analysis is required to confirm this.

b. The second reportability criterion that could be applicable is "a significant departure from the final design as approved and released for construction such that the design does not conform to the criteria and bases stated in the Safety Analysis Report."

(CONTINUE ON NEXT PAGE)

11. EVALUATOR'S SIGNATURE/DATE: 2/4/81

12. FINAL QA APPROVAL - MANAGER MPQA/DATE: 3/22/84

NRC NOTIFICATION: HOW? Telecon DATE: 3/15/84 TIME: 5:00 p.m.
INDIVIDUAL NOTIFIED: Ron Gardner
REFERENCE: O.C.R. Chron File No: 28053

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4. CONTINUED

5. CONTINUED

currently depicted in the FSAR, will be capable of carrying out their intended safety functions.

With regard to safety-related equipment within these structures, we have applied the option allowed in Section C.2 of Regulatory Guide 1.122, ie, to broaden the peaks associated with structural frequencies by ± 15%. In so doing, we have utilized the nominal value of soil modulus (ie, 22×10^6 lb/ft^2) for both the SSE and OBE. On this basis, for the structural configurations currently depicted in the FSAR, it is believed that the systems would be able to carry out their intended safety functions.

10. CONTINUED

The SAR will be revised to reflect the actual design approach being used for structures and equipment.

Final Evaluation

See oral communication record of 3/15/84 for basis to declare this item potentially reportable.
3/22/84

14. MINIMUM DISTRIBUTION:

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VICE PRESIDENT - MIDLAND PROJECT
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SLSobkowski, Bechtel AA
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Enclosure 3

Consumers Power Company
QA69-0

SAFETY CONCERN AND REPORTABILITY EVALUATION

PROJECTS, ENGINEERING AND CONSTRUCTION - QUALITY ASSURANCE DEPARTMENT

4. HOW WAS CONCERN IDENTIFIED, WHEN, WHERE?

During the course of preparing for the NRC's Structural and Seismic Design Audit, this concern was brought to Consumers attention in a meeting in the Bechtel Ann Arbor offices on April 3, 1981.

(CONTINUE ON NEXT PAGE)

TO MANAGER-MPQA

1. FROM: B F Henley
ORGANIZATION: Design Prod.

SCRE NO: 15
FILE NO: 15.1. 15.1
DATE RECEIVED: 4/7/81

2. IS CONCERN A PART 21?
☐ YES ☒ NO
WHEN?
BY WHOM?

3. IS NRC AWARE OF THIS?
☐ YES ☒ NO
WHEN?
BY WHOM?

5. BRIEF DESCRIPTION OF CONCERN - SYSTEM, COMPONENT, ACTIVITY, POSSIBLE SAFETY IMPACT - (ATTACH SUPPORTING DOCUMENTS).

In Bechtel's original seismic analysis of the Diesel Generator Building, it has been determined that the material stiffness of the site fill had been inadvertently chosen to be the same as the undisturbed till material. Bechtel should proceed at once to perform a safety impact evaluation for any possible effects on the Diesel Generator structure and internal equipment.

(CONTINUE ON NEXT PAGE)

6. IMMEDIATE REPORTABILITY EVALUATION:
a. ☐ REPORTABLE - GO TO 13
b. ☐ POTENTIALLY REPORTABLE - GO TO 13
c. ☒ NOT REPORTABLE, FURTHER EVALUATION
d. ☐ NOT REPORTABLE

7. ORGANIZATION REPONSIBLE FOR FURTHER EVALUATION:
Bechtel Engineering

8. FINAL REPORTABILITY EVALUATION (IF 6.c. CHECKED):
a. ☒ REPORTABLE (Potentially) b. ☐ NOT REPORTABLE

9. QA APPROVAL OF EVALUATION OF BLOCKS 1 TO 7: [signature] MANAGER - MPQA [signature] DATE

10. JUSTIFICATION OF EVALUATION - (ATTACH SUPPORTING DOCUMENTS)

Final Evaluation

See oral communication record of 3/15/84 for basis to declare this item potentially reportable.
3/22/84

(CONTINUE ON NEXT PAGE)

11. EVALUATOR'S SIGNATURE/DATE:

12. FINAL QA APPROVAL - MANAGER MPQA/DATE:
[signature] 3/22/84

13. NRC NOTIFICATION: HOW? Telecon DATE: 3/15/84 TIME: 5:00 pm
INDIVIDUAL NOTIFIED: Ron Gardner
REFERENCE: O.C.R Chron File No: 28053

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Consumers Power Company
QA70-0

SAFETY CONCERN AND REPORTABILITY EVALUATION

PROJECTS, ENGINEERING AND CONSTRUCTION - QUALITY ASSURANCE DEPARTMENT
SCRE NO: 15

4. CONTINUED

CONTINUED

CONTINUED

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96561966

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Enclosure 4

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Consumers Power Company
QA69-0

SAFETY CONCERN AND REPORTABILITY EVALUATION

PROJECTS, ENGINEERING AND CONSTRUCTION - QUALITY ASSURANCE DEPARTMENT

 RJC

4. HOW WAS CONCERN IDENTIFIED, WHEN, WHERE?

During the January 29, 1982 seismic design status review meeting in Ann Arbor, Bechtel presented a floor response spectrum curve for the reactor building comparing the original spectra with the current spectra. The comparison (attached) indicates a degree of non-conservatism in the original spectra at certain frequencies.

(CONTINUE ON NEXT PAGE)

TO MANAGER-MPQA

1. FROM: RCBauman, P14-312B RCB
ORGANIZATION: Design Prod.

SCRE NO: 42
FILE NO: 15.1
DATE RECEIVED: 2/2/82

2. IS CONCERN A PART 21?
☐ YES ☒ NO
WHEN?
BY WHOM?

3. IS NRC AWARE OF THIS?
☐ YES ☒ NO
WHEN?
BY WHOM?

5. BRIEF DESCRIPTION OF CONCERN - SYSTEM, COMPONENT, ACTIVITY, POSSIBLE SAFETY IMPACT - (ATTACH SUPPORTING DOCUMENTS).

The non-conservatism in the original spectra as shown on the comparison dated 1/27/82 appears to be a result of the original use of CE-931 which resulted in a composite model damping which was too high. BLC-11329 (attached), dated August 14, 1981, stated that the use of CE-931 was not a safety problem due to other off-setting factors, however the spectra comparison presented on January 29 indicates that CE-931 did in fact result in a spectra which was too low.

The new seismic analysis which is underway will determine the adequacy of the reactor building design.

(CONTINUE ON NEXT PAGE)

6. IMMEDIATE REPORTABILITY EVALUATION:
a. ☐ REPORTABLE - GO TO 13
b. ☐ POTENTIALLY REPORTABLE - GO TO 13
c. ☒ NOT REPORTABLE, FURTHER EVALUATION
d. ☐ NOT REPORTABLE

7. ORGANIZATION REPONSIBLE FOR FURTHER EVALUATION:
Bechtel Engineering

8. FINAL REPORTABILITY EVALUATION (IF 6.c. CHECKED):
a. ☑ REPORTABLE b. ☐ NOT REPORTABLE

9. QA APPROVAL OF EVALUATION OF BLOCKS 1 TO 7:
MANAGER - MPQA — DATE: 3/3/82

10. JUSTIFICATION OF EVALUATION - (ATTACH SUPPORTING DOCUMENTS)

Bechtel advised during the January 29 meeting that the original design had sufficient margin relative to the non-conservative spectra, however final determination regarding reportability cannot be made until the new analysis is complete.

Final Evaluation

See oral communication record of 3/15/84 for basis to declare this item potentially reportable.
3/22/84

(CONTINUE ON NEXT PAGE)

11. EVALUATOR'S SIGNATURE/DATE: 2-3-82

12. FINAL QA APPROVAL - MANAGER MPQA/DATE: 3/22/84

13. NRC NOTIFICATION: HOW? Telecon DATE: 3/15/84 TIME: 5:00 PM.
INDIVIDUAL NOTIFIED: Ron Gardner
REFERENCE: Oral Communication Record - Chron File No. 28053

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4. CONTINUED

5. CONTINUED

10. CONTINUED

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MIDLAND FILE NO 15.1

15. ADDITIONAL DISTRIBUTION:

RCBauman
LHCurtis
TRThiruvengadam
RAWells
MADietrich
GSKeeley
JAMooney

(IR1

Bechtel Associates Professional Corporation

039377

777 East Eisenhower Parkway
Ann Arbor, Michigan

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

August 14, 1981

BLC-11329

Consumers Power Company
1945 West Parnall Road
Jackson, Michigan 49201

Attention: Mr. R.C. Bauman
Design Production Manager

Subject: Midland Plant Units 1 and 2
Consumers Power Company
Bechtel Job 7220
Safety Implications -
CE931 Program

This addresses the safety implications for the Midland Project of a concern regarding the application of the CE931 program used in the seismic analysis of Seismic Category I structures. This concern is that the CE931 program may calculate composite modal damping that is too high in some cases. The CE931 program has been used in seismic analysis to calculate composite modal damping for all Seismic Category I structures on the Midland Project. However, investigations have shown that this concern is applicable only to the reactor buildings.

The concern for the reactor building is in damping for the rocking mode for both the east-west and north-south directions. The composite modal damping for this mode has been calculated in 1976 as approximately 12%. This value has been calculated in 1981 as approximately 5% for a slightly revised seismic model for the east-west direction. Using various verification techniques, we have concluded that approximately 5% is the correct damping for this application. Since the 1976 model yields lower responses than the 1981 model, the question of a potential safety concern arises for seismic qualifications performed using the 1976 seismic model.

Based upon our investigations, we believe that there is no identified safety deficiency for the following reasons;

1. The structure is partially embedded in soil. This effect will decrease response and was not considered in the 1976 analysis.

2. Credit was not taken for soil material damping and SSE concrete material damping in the 1976 analysis.

3. CE931 calculated a compositive modal damping of 12%, however, a conservative limitation of 10% was used in the 1976 analysis to develop seismic response spectra and structural responses. This limitation is specified in BC-TOP-4-A and is referenced in the FSAR.

039377

The schedule impact of the resolution of this concern is shown in Schedule EPS-0119, Rev B. This impact is due to the abandonment of the CE-931 program and the substitution of the verified BSAP program in th application.

Very truly yours,

N Swanberg /for L.H. Curtis

L.H. Curtis
Project Engineer

SLS/kje(C)
7/23/7

cc: D.B. Miller
T.J. Sullivan
R.A. Wells
W. Bird
[redacted]

Written Response Requested: No

Consumers Power Company
QA69-0

SAFETY CONCERN / REPORTABILITY EVALUATION

Enclosure 5

PROJECTS, ENGINEERING AND CONSTRUCTION - QUALITY ASSURANCE DEPARTMENT

4. HOW WAS CONCERN IDENTIFIED, WHEN, WHERE?

The issues covered by this SCRE were identified by Bechtel and Consumers Power during preparation for the April 20 NRC structural audit. Additional items may be identified during the audit.

(CONTINUE ON NEXT PAGE)

TO MANAGER-MPQA

1. FROM: RCBauman
ORGANIZATION: Design Prod

SCRE NO: 19
FILE NO: 15.1
DATE RECEIVED: 4/20/81

2. IS CONCERN A PART 21?
☐ YES ☒ NO
WHEN?
BY WHOM?

3. IS NRC AWARE OF THIS?
☐ YES ☒ NO
WHEN?
BY WHOM?

5. BRIEF DESCRIPTION OF CONCERN - SYSTEM, COMPONENT, ACTIVITY, POSSIBLE SAFETY IMPACT - (ATTACH SUPPORTING DOCUMENTS).

During preparation for the NRC structural audit, it was established that various engineering activities related to plant design require additional attention to document full compliance with Project licensing and/or design criteria. These items were discussed with Bechtel on April 13 and are summarized on the attached Bechtel prepared list which does not include items covered by previous SCRE's or existing MCAR's. In addition, certain issues raised by Consumers Power Company during the audit preparation need to be integrated (as appropriate) into the listing.

(CONTINUE ON NEXT PAGE)

6. IMMEDIATE REPORTABILITY EVALUATION:
a. ☐ REPORTABLE - GO TO 13
b. ☐ POTENTIALLY REPORTABLE - GO TO 13
c. ☒ NOT REPORTABLE, FURTHER EVALUATION
d. ☐ NOT REPORTABLE

7. ORGANIZATION RESPONSIBLE FOR FURTHER EVALUATION:
Bechtel Project Engineering

8. FINAL REPORTABILITY EVALUATION (IF 6.c. CHECKED):
a. ☒ POTENTIALLY REPORTABLE b. ☐ NOT REPORTABLE

9. QA APPROVAL OF EVALUATION OF BLOCKS 1 TO 7:
W M Bird MANAGER - MPQA 4/21/81 DATE

10. JUSTIFICATION OF EVALUATION - (ATTACH SUPPORTING DOCUMENTS)

None of the presently identified items are deemed reportable at this time due to the lack of any indicated safety impact. In all cases, appropriate analyses will be conducted by Bechtel to determine the actual situation relative to potential impact on plant safety.

Final Evaluation

See oral communication record of 3/15/84 for basis to declare this item potentially reportable.
3/22/84

(CONTINUE ON NEXT PAGE)

11. EVALUATOR'S SIGNATURE/DATE:
RC Bauman 4/21/81

12. FINAL QA APPROVAL - MANAGER MPQA/DATE:
W M Bird 3/22/84

13. NRC NOTIFICATION: HOW? Telecon DATE: 3/15/84 TIME 5:00 pm
INDIVIDUAL NOTIFIED: Ron Gardner
REFERENCE: OCR Chron File No 28053

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Consumers Power Company
QA70-0

SAFETY CONCERN AI
REPORTABILITY EVALUATION

PROJECTS, ENGINEERING AND CONSTRUCTION - QUALITY ASSURANCE DEPARTMENT
SCRE NO: 19

4. CONTINUED

5. CONTINUED

10. CONTINUED

14. MINIMUM DISTRIBUTION:

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VICE PRESIDENT - MIDLAND PROJECT
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SITE QA SUPERINTENDENT
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MIDLAND FILE NO 15.1

15. ADDITIONAL DISTRIBUTION:

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MADietrich
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DMBudzik
TRThiruvengadam

CONSUMERS
POWER
COMPANY

Projects, Engineering
and Construction
Midland Project Quality
Assurance Department

ORAL COMMUNICATIONS RECORD

Chron File No: 28053

Date of Communication: 3/15/84
Time of Communication: 5:00 PM
Prepared By: W R Bird

MPQA Personnel Participating: W R Bird
Other Party(s): Ron Gardner, NRC Region III

Projects and/or Subjects Discussed: POTENTIAL REPORTABLE ITEM CONCERNING STRUCTURAL DESIGN

Summary of Conversation: SCREs 9, 15, 19 and 42 represent conditions identified in the original seismic and structural design. Specifically:

9 - Structures were analyzed with a nominal versus the FSAR Required ± 50% soils modulus.

15 - Soil stiffness under the diesel generator building was assumed to be from undisturbed till versus fill in the seismic calculation.

19 - Seismic and structural concerns from the Bechtel/CPCo review of civil structural design in 1981.

42 - For the reactor building there was too high of a modal damping in computer code CE-931.

The original conclusion as to reportability was that the conditions were not reportable but that further analysis was required to confirm. Our current deisgn is not representative of the original design conditions. Thus, at the point in time our design analysis is supporting final hardware. Thus we are not in a position to make a clear determination that all of the items represented by the SCREs were in fact not reportable. The basis for our immediate evaluation remain valid to suppo.t the belief that the items in fact do not represent a significant safety condition. However, criteria has changed and hardware has been modified . We are taking the position to declare these items potentially reportable in order to close them. A formal written report will be submitted by April 13, 1984. Closure will be through demonstrating that our final design meets the final design criteria.

WRB/lr

CC: JWCook, P26-336B
JEBrunner, M-1079
DMBudzik, P24-517A
MADietrich, Midland
GREagle, TASK AA
RJErhardt, P14-113A
LSGibson, P24-618A
RCHollar, Bechtel
PWJacobsen, P14-414
DTPerry, Midland
EBPoser, Bechtel
DLQuamme, Midland
GLRichardson, Bechtel
JARutgers, Bechtel
RAWells, Midland
NRC Resident Inspector, Midland
RNGardner, NRC Region III

Consumers Power Company

James W Cook
Vice President - Projects, Engineering and Construction

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

April 20, 1984

84-04 #1

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

MIDLAND ENERGY CENTER PROJECT
FINAL REPORT ON POTENTIALLY REPORTABLE CONDITIONS
SEISMIC AND STRUCTURAL DESIGN CONCERNS
FILE: 0.4.9.91 SERIAL: 28026

Because of discrepancies in the original seismic calculations, the following Safety Concerns and Reportability Evaluations (SCREs) were issued: SCRE 9 -Category I structures were analyzed with a nominal soil modulus without considering the variation of ±50% as required by the FSAR; SCRE 15 - for the seismic analysis of the diesel generator building, the material stiffness for soil under the building was assumed to be the same as undisturbed till material instead of fill material; and SCRE 42 - Use of Bechtel Computer Program CE-931 which overestimated the composite modal damping, which resulted in an underestimation of the building responses for the reactor and auxiliary buildings. In addition, SCRE 19 lists both seismic and structural concerns identified as a result of a CPCo review of the civil structural design calculations. The items on SCRE 19 were discussed with Messrs Landsman and Gardner of NRC Region III Inspection and Evaluation during a March 22, 1984 meeting with Bechtel and Consumers Power Company.

Attachment 1 provides a more detailed description and the circumstances under which the items were discovered. In each case, the original evaluation was that the discrepancies and concerns, respectively, were not reportable under 10CFR50.55(e), but that further evaluation would be necessary for confirmation.

In actuality, the engineering analysis supporting overall plant design and resolution of the SCREs has resulted in two basic categories in terms of making a final safety evaluation of the SCRE concerns.

1. Concerns identified in the SCREs, which in fact, have been analyzed to their original design basis and configuration and have been demonstrated to <u>not</u> be safety concerns, or

2. Equipment/system or structural modifications have occurred, (for various reasons) and the engineering analyses have not been performed to the original design basis and configuration. Thus the project has

not made an absolute confirmation as to nonreportability of subject SCRE concerns. This is specifically true of SCREs 9, 15, 42 and some of the items associated with SCRE 19.

Consumers Power has decided to classify these SCREs as potentially reportable. This is because conditions of the original plant design for category 2 above will remain indeterminate as to actual reportability.

These concerns are classified potentially reportable as no actual case has been identified where the original structure or components would not perform their intended function as required by the original design criteria. Changes in other loads, such as the dead loads, live loads, thermal loads, pipe break loads, etc, which are combined with the seismic loads, could have caused the increased stresses which required plant modification or equipment replacement. The effect of the specific discrepant conditions identified in SCREs 9, 15, and 42, in contributing to the need for equipment replacement or plant modification is not identifiable from the current plant design analysis. None of the SCRE 19 items have been classified as a nonconforming condition. Some of the analysis in current plant design which addresses items listed on SCRE 19 may have contributed to plant design changes. Of the 50 items originally identified in SCRE 19, only six are currently open. These will be resolved through ongoing analyses using current design criteria and thus, like the other SCRE concerns, initial evaluation of the nonreportability of the original conditions will not be verified.

To ensure all changes in seismic criteria and additional stresses are incorporated into the final plant configuration, the floor accelerations have been recalculated, and the structures have been reevaluated. Reevaluation of all piping systems, preparation of Seismic Qualification Review Team (SQRT) documentation involving review of all equipment seismic qualification, and a pump and valve operability review are tasks now in progress.

In conclusion, Consumers Power has decided to classify the subject SCREs as potentially reportable because systems have been changed and equipment has been replaced for reasons which a subject SCRE may have contributed to, and the concerns will not be analyzed to the original design. Since all required changes as documented in the SCREs have been incorporated into the latest calculations, the final plant design is assured to meet current design criteria and commitment to safety.

As can be seen from Attachment 1, each of the items was discovered through a design review process. The specific discrepancies identified are random and isolated. The review processes have provided a comprehensive look at the civil/structural design area. The review results have caused an increased awareness of design packaging and individual design detail necessary to produce acceptable design. It is felt that the past intensive overall reviews, in combination with our current Project Engineering design practices required by Engineering Department Procedures, MPQAD monitors and audits, and CPCo Engineering design overview provide an appropriate overall design review system. No additional specific corrective action is required. This is the

final report on this potentially reportable situation. If significant discrepancies are detected during the review programs, appropriate notification in accordance with 10CFR50.55(e) will be made.

James W. Cook

JWC/PWJ/lr

CC: Document Control Desk, USNRC
Washington, DC

RJCook, NRC Resident Inspector
Midland Nuclear Plant

DHood, USNRC Office of NRR
Bethesda, MD

INPO Records Center

( )

Attachment 6

Consumers Power Company
QA69-0

SAFETY CONCERN AND REPORTABILITY EVALUATION

02816

PROJECTS, ENGINEERING AND CONSTRUCTION - QUALITY ASSURANCE DEPARTMENT

4. HOW WAS CONCERN IDENTIFIED, WHEN, WHERE?

The issues covered by this SCRE were identified by Bechtel and Consumers Power during preparation for the April 20 NRC structural audit. Additional items may be identified during the audit.

(CONTINUE ON NEXT PAGE)

TO MANAGER-MPQA

1. FROM: RCBauman
ORGANIZATION: Design Prod

SCRE NO: 19
FILE NO: 15.1
DATE RECEIVED: 4/20/81

2. IS CONCERN A PART 21?
☐ YES ☒ NO
WHEN?
BY WHOM?

3. IS NRC AWARE OF THIS?
☐ YES ☒ NO
WHEN?
BY WHOM?

5. BRIEF DESCRIPTION OF CONCERN - SYSTEM, COMPONENT, ACTIVITY, POSSIBLE SAFETY IMPACT - (ATTACH SUPPORTING DOCUMENTS).

During preparation for the NRC structural audit, it was established that various engineering activities related to plant design require additional attention to document full compliance with Project licensing and/or design criteria. These items were discussed with Bechtel on April 13 and are summarized on the attached Bechtel prepared list which does not include items covered by previous SCRE's or existing MCAR's. In addition, certain issues raised by Consumers Power Company during the audit preparation need to be integrated (as appropriate) into the listing.

(CONTINUE ON NEXT PAGE)

6. IMMEDIATE REPORTABILITY EVALUATION:
a. ☐ REPORTABLE - GO TO 13
b. ☐ POTENTIALLY REPORTABLE - GO TO 13
c. ☒ NOT REPORTABLE, FURTHER EVALUATION
d. ☐ NOT REPORTABLE

7. ORGANIZATION REPONSIBLE FOR FURTHER EVALUATION:
Bechtel Project Engineering

8. FINAL REPORTABILITY EVALUATION (IF 6.c. CHECKED):
a. ☐ REPORTABLE b. ☐ NOT REPORTABLE

9. QA APPROVAL OF EVALUATION OF BLOCKS 1 TO 7:
W R Bird MANAGER - MPQA 4/21/81 DATE

10. JUSTIFICATION OF EVALUATION - (ATTACH SUPPORTING DOCUMENTS)

None of the presently identified items are deemed reportable at this time due to the lack of any indicated safety impact. In all cases, appropriate analyses will be conducted by Bechtel to determine the actual situation relative to potential impact on plant safety.

(CONTINUE ON NEXT PAGE)

11. EVALUATOR'S SIGNATURE/DATE:
R C Bauman 4/21/81

12. FINAL QA APPROVAL - MANAGER MPQA/DATE:

13. NRC NOTIFICATION: HOW? DATE: TIME:
INDIVIDUAL NOTIFIED:
REFERENCE:

Consumers Power Company

QA70-0 02816

SAFETY CONCERN AND REPORTABILITY EVALUATION

PROJECTS, ENGINEERING AND CONSTRUCTION - QUALITY ASSURANCE DEPARTMENT

SCRE NO: 19

4. CONTINUED

5. CONTINUED

10. CONTINUED

14. MINIMUM DISTRIBUTION:

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VICE PRESIDENT - MIDLAND PROJECT
DIRECTOR - ENVIRONMENTAL SERVICES & QA
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SITE QA SUPERINTENDENT
MANAGER - SAFETY & LICENSING
MIDLAND FILE NO 15.1

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NOTES:

1) THIS MARKED COPY IS AN ATTACHMENT TO SCRE NO. 19.

2) CIRCLED ITEMS ARE COVERED BY THE SCRE DATED 4-20-81

3) OTHER ITEMS MAY BE ADDED TO SCRE NO. 19 COVERAGE FOLLOWING ADDITIONAL CPC/BECHTEL REVIEW AND COMPLETION OF THE NRC STRUCTURAL AUDIT. R Brauer 4/22/81

STRUCTURAL AUDIT LIST OF ITEMS
AUXILIARY BUILDING

Auxiliary Building	NRC Page No.	Inappropriate or Omitted Calculations	Compliance with FSAR Commitments	General Condition of Calculations	Significance or Disposition	Cognizant Engineer	Originator/ Checker Group Leader	Status
Part I - General Analysis								
I. Basic Design Criteria	1							
A. Seismic criteria	1	T.H. response spectra comparison to site spectra. (typical for all buildings)	BC-TOP-4 to 71 frequencies. Frequencies used may not be consistent.		Not significant	J.Chien	W.Tseng	Being generated (shows dip not in FSAR)
B. Design loads	2			Fair				
II. Analysis Method	8						S.Poelber/ W.Tseng	
A. Seismic analysis		Model is being revised to consider the tornado missile shield and the connection of the control tower to the main auxiliary building.	NCAR 87	Good	Change spectra	W.Tseng	S.Poelber/ W.Tseng K.C.Hsu	Revision in
1. Material properties	4	1. Basis for the fill parameters 2. As-built concrete modulus		Fair	Unknown	W.Tseng	K.C.Hsu	1. Search in progress 2. No action planned
2. Time history, response spectrum, etc (general)	6	The integration time interval used was .01 second instead of .005 second. (Typical for all buildings)		Fair	Not significant	W.Tseng	K.C.Hsu	.005 will be used in future.
3. Selection of number of masses	6			Good		W.Tseng	K.C.Hsu	

STRUCTURAL AUDIT LIST OF ITEMS
AUXILIARY BUILDING

Auxiliary Building	NPC Page No.	Inappropriate or Omitted Calculations	Compliance with FSAR Commitments	General Condition of Calculations	Significance or Disposition	Cognizant Engineer	Originator/ Checker Group Leader	Status
4. Modal responses	7		The combination of motions for the components was not consistent with the FSAR. (typical for all buildings)	Good	Not significant	W.Tseng	K.C.Haw	SCR approved
5. Soil-structure interaction	9	The ±50% variation in soil properties is also identified by CPCo and is addressed in SCRE 9. SCRE 9 also addresses modifications of building response spectra. (typical for all buildings)	The effect of ±50% variation in the the soil properties was not considered	Fair	Significant if SAR change not (implemented)	W.Tseng	K.C.Haw	SCR approved; calculations in progress
6. Hydrodynamic effect of spent fuel pool	10	Not considered in seismic analysis.		Poor	Not significant	V.Lakshmi/ D.Magnuson		Calculations in progress
6a. Fuel pool walls and floors	10	Seismic effects not completely accounted for in design. Slosh height not calculated walls and slab appear to be designed for temperature effects only. Other loads not considered in combination.	Loads not combined in accordance with Section 3.8.6.3.	Poor	Calculations need to be redone	V.Lakshmi/ D.Magnuson	S.Puri/ M.Tsao/ K.Lau	Calculations in progress
7. Response spectra (specific)	11			Good				

STRUCTURAL AUDIT LIST OF ITEMS
AUXILIARY BUILDING

28161

Auxiliary Building	NRC Page No.	Inappropriate or Omitted Calculations	Compliance with FSAR Commitments	General Condition of Calculations	Significance or Disposition	Cognizant Engineer	Originator/ Checker Group Leader	Status
B. Vertical analysis	15	Floor flexibility was not included in the calculations. (typical for all buildings)	FSAR does not address floor flexibility.	Fair	Study in progress	W.Tseng	None	Waiting for piping response
B. Stress analysis	12	A superseded seismic analysis was used for design.		Fair	Not significant			Calculations in progress
1. Shear walls and floors	12	The loading combination including tornado wind was not checked.		Fair	Not significant	J.Ross/	P.Regupathy/ V.Verma/ K.Lam	Justification being prepared.
2. Foundation mat		1. The dead load increased after the analysis was completed. 2. The loading combination including tornado wind was not checked.	All the load combinations specified in the FSAR have not been checked.	Fair	Not significant	V.Verma/ Lakshmi	P.Regupathy/ K.Lam	Calculations scheduled
C. Joint filler between buildings	14	NA	NA			J.Ross		
D. Computer verification	16	Verification has not been completed for several programs. (typical for all buildings)	No FSAR commitment.		Not significant			Verification being developed.
E. Overall stability	18			Good		D.Magnuson	Lakshmi	Calculation approved.

Auxiliary Building	NPC Page No.	Inappropriate or Omitted Calculations	Compliance with FSAR Commitments	General Condition of Calculations	Significance or Disposition	Cognizant Engineer	Originator/ Checker Group Leader	Status
F. Interaction with non-Category I structures	20	Auxiliary building calculations do not include interaction with turbine building during tornado and seismic events. Turbine building seismic analysis and tornado calculations to be finalized.	See as calculations column	Not available	Calculations necessary to show that turbine building will not damage auxiliary building.	J.Ross	Lakshai	Turbine building calculations to be finalized.
G. Tornado missiles	21					D.Magnuson	Lakshai	Calculations complete
III. Conformance to Staff's Criteria (Deviations)	23							
Part II - Key Designs								
A. Exterior shear walls	24	1. Walls were not designed for plate bending for seismic and tornado loads. 2. Consider thermal gradient in design		Fair	This will probably not be critical to design but calculations need to be made to check this.	J.Ross	P.Regupathy/ V.Verma/ K.Lam	Calculations in progress.
B. Interior shear walls	25	Flexural design considers only compartment presurization. Seismic load was not included.	Missing load combination pressure plus seismic	Poor Difficult to follow	Calculations need to be made including seismic affects on walls. (transverse bending)	J.Ross	H.Tsao/ H.Kelley/ K.Lam	Calculations in progress
C. Main floors and roofs	26	Roof not checked for uplift during tornado		Fair	Not significant	D.Magnuson	K.Lam/ J.Arora	Calculations in progress

STRUCTURAL AUDIT LIST OF ITEMS
AUXILIARY BUILDING

Auxiliary Building	NPC Page No.	Inappropriate or Omitted Calculations	Compliance with FSAR Commitments	General Condition of Calculations	Significance or Disposition	Cognizant Engineer	Originator/ Checker Group Leader	Status
D. Structural steel bracing	29	Generally designed for dead load and live loads only.	All the load combinations given in the FSAR have not been considered.	Fair	Probably not significant	D.Magnuson	K.Lam/ J.Arora	Justification being prepared.
E. Foundation mat	29			Fair		V.Verma	V.Verma/ P.Regupathy/ K.Lam	
F. Main frame concrete column design			NA	NA				
G. Secondary floors	31	Same as main floors.						
H. Floor-wall junction details	32					J.Ross		
I. Dynamic effects of machinery	33				Not significant (speeds higher than 30 Hz)			
Added items not covered in audit		1. Probable maximum flood elevation of 632', instead of 635.5'	Probable maximum flood elevation of 632' instead of elevation 635.5' was used in the analysis and design.	Fair	Not significant 635.5 is wave runup	D.Magnuson	D.Magnuson/ V.Lakshmi	

STRUCTURAL AUDIT LIST OF ITEMS
SERVICE WATER PUMP STRUCTURE

Service Water Pump Structure	NPC Page No.	Inappropriate or Omitted Calculations	Compliance with FSAR Commitments	General Condition of Calculations	Significance or Disposition	Cognizant Engineer	Originator/ Checker Group Leader	Status
Part I - General Analysis								
I. Basic Design Criteria	1							
A. Seismic criteria	1			Fair		J.Chein/ P.Fujawa	S.Sobkowski/ G.Tuveson	
B. Design loads	2	Tornado wind speed of 300 mph used to check missile local effects.	300 mph tornado wind used instead of 360 mph wind.	Fair	Redo tornado analysis	D.Griffith/ L.Ho	M.Makim/ P.Goffas/ P.Shea	Tornado reanalysis complete
II. Analysis Method	4							
A. Seismic analysis	4		Refer to aux	Fair				
1. Material properties	4	1. Concrete modulus (E) based on f'c = 3,000 psi instead of specified concrete strength of f'c = 4,000 psi. 2. Analysis did not consider fill.			Not significant	J.Chien		Consider in current efforts
2. Time history, response spectrum, etc (general)	6	Refer to aux						
3. Selection of number of masses	6			Good				
4. Modal responses	7	Refer to aux		Fair				

STRUCTURAL AUDIT LIST OF ITEMS
SERVICE WATER PUMP STRUCTURE

Service Water Pump Structure	SRC Page No.	Inappropriate or Omitted Calculations	Compliance with FSAR Commitments	General Condition of Calculations	Significance or Disposition	Cognizant Engineer	Originator/ Checker Group Leader	Status
5. Hydrodynamic forces	8	1. Hydrodynamic effects are not considered.		Poor	Probably not significant			Consider in current efforts
		2. Torsional effect of combinations of bays filled or empty should be considered.						
6. Response spectra (specific)	9			Poor			F.Hsiu/ K.Hsu/ G.Tuveson	New analysis not begun.
7. Vertical seismic [illegible]	10	[illegible]						
8. Intake conduits (discharge)	11							
a. Sump section								
9. Intake structure (hydrodynamic forces)	12	[illegible] Table 3.8-22	[illegible]	[illegible]	Probably not significant	D.Griffith/ L.Ho	Y.Kim/ P.Parikh/ M.Kumre (P.Shen)	Consider in current efforts
b. Intake conduits (discharge)								
c. Concrete [illegible]								
3. Foundation soil [illegible]				[illegible]		D.Griffith/ L.Ho M.Kumre/ (P.Shen)	Y.Kim/ P.Parikh/	
C. Concrete [illegible]				Good		B.Mozafari		
D. Overall stability	17	Refer to above		Incomplete, fair		D.Griffith/ L.Ho	Y.Kim/ P.Parikh/ (.P.Shen)	

Service Water Pump Structure	NRC Page No.	Inappropriate or Omitted Calculations	Compliance with FSAR Commitments	General Condition of Calculations	Significance or Disposition	Cognizant Engineer	Originator/ Checker Group Leader	Status
E. Interaction with non-Category I structures	19	Calculations have not been located for the interaction of the circulating water intake structure with SWPS.	FSAR work not completed	No calculation showing the interaction	Preliminary study shows no problem.	P.Shen/ D.Griffith		Perform seismic analysis on circulating water structure and check of structure
Part II - Key Designs								
A. Exterior shear walls	21	1. Loads from Method I seismic analysis not considered in design.	The required load combinations in the FSAR have not all been checked.		Probably not significant	D.Griffith/ J.Gobster/ L.Ho	R.Narl/ P.Parikh/ M.Kuara (P.Shen)	Consider in current efforts
		2. North and south walls not checked for tornado loads.						
		3. Temperature gradient acorss walls						
B. Interior shear walls	22	Refer to A						
C. Main floors and	23	Refer to A						
D. Foundation mat	24	Refer to A						
E. Floor-wall joint details	25	Refer to A						
F. Seismic restraint of pumps	26							
1. Tanks			Section 3.8	Good		Rao/Desai	Diesel oil tank: Rao/ A.Bandopodhyaya Pressurization tank: V.Patankar/ C.Dirnbauer	Complete

STRUCTURAL AUDIT LIST OF ITEMS
SERVICE WATER PUMP STRUCTURE

Service Water Pump Structure	NRC Page No.	Inappropriate or Omitted Calculations	Compliance with FSAR Commitments	General Condition of Calculations	Significance or Disposition	Cognizant Engineer	Originator/ Checker Group Leader	Status
2. Piping			Section 3.8	Vendor calculation for pipes Good		Rao/Desai		
B. Seismic Analysis								
1. Tanks		The stress summary for the diesel oil tanks is incomplete. Pressures not addresses are given in FSAR Table 3.9-5.1, Sheet 5. Vertical earthquake not considered for diesel oil storage tank design.		Vendor/ Good		C.Otal		Go back to vendor. Rev
2. Piping (concrete)		Flexibility of pipe bends was not considered in the analysis. Parameters in analysis need to be revised: F for pipe and shear wave velocity.		Fair free field only.		D.Reeves	N.Tseng/ C.Tveson	Revise calculations.
C. Structural Analysis								
1. Tanks				Good			Vendor calculations	
2. Piping (conc)		Missile impact was considered for the steel pipe and not concrete pipe.		Good	Not significant	Rao/Desai	Vendor calculations/Rao	Update for concrete pipe.

STRUCTURAL AUDIT LIST OF ITEMS
SERVICE WATER PUMP STRUCTURE

Service Water Pump Structure	NPC Page No.	Inappropriate or Omitted Calculations	Compliance with FSAR Commitments	General Condition of Calculations	Significance or Disposition	Cognizant Engineer	Originator/ Checker Group Leader	Status
D. Soil Settlement Pipes								
1. Differential support movement		Not considered.						Revise design.
2. Seismic settlement		Not considered.						
3. Connections to structures		Not considered.						
4. Effects of non-Category I piping		Not considered.						
E. Damage to piping due to differential settlement		NA for concrete Seismic Category 1 pipe. Concrete pipes are 40' away from the structure and buried in natural soil.						
Part IV - Items Not Covered in Questions Which Should be Identified								
Electrical Duct banks and conduit design				In review				

STRUCTURAL AUDIT LIST OF ITEMS
DIESEL GENERATOR BUILDING

Diesel Generator Building	SRP Page No.	Appropriate Criteria	Compliance with FSAR Commitments	General Condition of Calculations	Significance and Disposition	Cognizant Engineer	Originator/ Checker Group Leader	Status	
Part I - General Analysis									508 509
I. Basic Design Criteria	1								511 512
A. Seismic criteria	1			Site spectra is for foundation at natural ground level.					515 516 | 517 518
B. Design loads	2				Good		R.Little/ O.Otal	B.Tseng/ E.Hao	521 522
II. Analysis Method	4								525
A. Seismic analysis	4								| 527
1. Material properties	4	Till properties were used for fill material. — SCALE		Fair		R.Little		Fixed in soil calculations	| 8 | 8 | 529
2. Time history, response spectras, etc (general)	6	Refer to sus		Good					| 534 | 535 536
3. Selection of number of masses	6			Good					539 548
4. Modal response	7	Refer to sus		Good					| 543
5. Soil-structure	9	Refer to sus							| 546
								No action, FSE peak widening covers for large range of soil velocities from 500 to 1,359.	| 548 | 549 | 550 | 551 | 55 | 553 | 554 | 555 | 556

3707

STRUCTURAL AUDIT LIST OF ITEMS
DIESEL GENERATOR BUILDING

Diesel Generator Building	SPC Page No.	Inappropriate or Omitted Calculations	Compliance with FSAR Commitments	General Condition of Calculations	Significance and Disposition	Cognizant Engineer	Originator/ Checker Group Leader	Status	
A. Response spectra (specific)	1	Diesel pedestal spectra do not envelop horizontal building base spectra.		Fair				Vendor requalify	560 561 562 563 564
7. Vertical seismic	15								567
B. Stress analysis									570
1. Shear walls and floors		Complete		Good	BA		T.Huang/ A.Bandyopadhyaya/ P.Shen	BSA	572 573 574 575
2. Foundation	13	Complete		Good	BA		T.Huang/ A.Bandyopadhyaya/ P.Shen	BA	577 578 579 580
C. Joint filler between structures	14	BA			BA	BA		BA BA	583 584
D. Computer verification	16	Complete	Good	BA	B.Bosefari	BA	BA		587 588
E. Overall stability	18				Good	Uplift	J.Gobatar	T.Huang/ BA A.Bandyopadhyaya/ P.Shen	59 592 593 594
F. Interaction with non-Category I structures	20								597 598 599
G. Tornado missiles	21	Refer to auxiliary building		Good		J.Gobatar	T.Huang/ A.Bandyopadhyaya/ P.Shen		602 603 604 605
III. Conformance to Staff's Criteria (Deviations)									606 609 610

Sheet 12
4/10/81

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15

3705

PRINCIPAL AUDIT LIST OF ITEMS
FISCAL GENERATOR BUILDING

Model Seismic Building	SRP Page No.	Inappropriate or Omitted Calculations	Compliance with FSAR Commitments	General Condition of Calculations	Significance and Disposition	Cognizant Engineer	Originator/ Checker Group Leader	Status	
Part II - Ext. Regions									
A. Exterior shear walls		Complete		Good		J.Gobster & Bandyopadhyaya/	T.Huang/ P.Shen	Complete	
B. Interior shear walls		Complete		Good	NA	NA	T.Huang/ A.Bandyopadhyaya/ P.Shen	Complete	
C. Main floors and roofs		Complete			Good	Reanalyze	J.Gobster	T.Huang/ A.Bandyopadhyaya/ P.Shen	Complete
D. Steel structural bracing		No structural steel bracing has been used.		NA	NA	NA	NA	NA	
E. Foundation		Complete		Good		J.Gobster & Bandyopadhyaya/ P.Shen	T.Huang/	Complete	
F. Main frame concrete columns		No concrete column column has been used.		NA	NA	NA	NA	NA	
G. Secondary floors		No secondary floor has been used.		NA	NA	NA	NA	NA	
H. Floor-wall joint details		Complete		Good	NA	NA	T.Huang/ A.Bandyopadhyaya/ P.Shen	Complete	
I. Dynamic effects of machinery		Complete		Good	NA	NA	A.Bandyopadhyaya/ H.Soleehi/ P.Shen	Complete	

Sheet 13
4/16/81

3703

STRUCTURAL AUDIT LIST OF ITEMS
CONTAINMENT BUILDING

Containment Building	BPC Page No.	Inappropriate or Omitted Calculations	Compliance with FSAR Commitments	General Condition of Calculations	Significance and Disposition	Cognizant Engineer	Originator/ Checker Group Leader	4/17/81A Status
Part I - General Analysis	1							
I. Basic Design								
A. Seismic criteria Criteria	1	Refer to aux						
B. Design loads	2	1. Wind and tornado loads are not addressed.		Fair	Not significant. Add calculation	Ader	T.Salyanaranay/ ana/ C.Yen	Calculations in progress.
		2. The 1978 FIREL model has comments requiring resolution and program must be verified.			Wind and tornado are not governing loads.	Vel/Twan	R.Tuholski/B.Dhar	Calculations to be performed.
				Fair	Not significant		R.Tuholski/B.Dhar	Analysis to be reviewed.
II. Analysis Method								
A. Seismic analysis	4							
1. Material properties	4	1. Cracked section properties not used.		Good	Probably not significant	Hu/ G.Lah		No action planned
		2. Tested concrete modulus not used						
2. Method of analysis (time history, response spectrum, etc)	6	Refer to aux		Fair				
3. Selection of number of masses	6	1. Backup required for reducing number of NSSS masses is required.		Fair	Not significant. Compare frequencies.			Not reduced in in new calculations. Calculations in progress

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Containment Building	NRC Page No.	Inappropriate or Omitted Calculations	Compliance with FSAR Commitments	General Condition of Calculations	Significance and Disposition	Cognizant Engineer	Originator/ Checker Group Leader	Status
		2. Applicability of specifying only translational and base rotational DDOF.						
4. Modal responses	8	Refer to aux						
5. Soil structure	9	1. Refer to aux						
		2. Hydrodynamic effects of a flooded refueling canal not considered.		Good	Could be significant for equipment			Calculations scheduled
6. Response spectra (specific)	11							
7. Vertical analysis	16	Refer to aux						
8. Polar crane	17	1. Multi-modal response horizontal response change. program must be		Fair	Probably not significant			discuss with CPCo Verification of this assumption in progress.
9. Buried piping	18	Refer to buried piping						
B. Containment general analysis	19							
1. Containment shell	19	1. Seismic separation of base may not considered.	FSAR Tables 3.8-1 through 3.8-17 contain typographical errors.	Good (4)	Verified by 11/6/81 Review design calculations.	Vel/ D.Tuan	K.Huang/ B.Dhar	Calculations in progress

Containment Building	NPC Page No.	Inappropriate or Omitted Calculations	Compliance with FSAR Commitments	General Condition of Calculations	Significance and Disposition	Cognizant Engineer	Originator/ Checker Group Leader	4/17/81A Status
		2. Sizing calculation has not been checked.			Not significant	G.Kwong		In progress
		3. FINEL analysis of shell does not include stiffnesses of internal structures			Not significant known.	D.Yuan	NA	Justification in progress
		4. Primary load alone was not checked	Not required	NA	Probably not significant	D.Yuan	NA	Calculations scheduled
		5. Deviations from design criteria a) membrane comp. stress b) radial tension in dome c) allow. reinf. stress d) allow. effective tendon stresses			Probably not significant	D.Yuan	N.Tolhoski	Calculations scheduled
		6. Section resultant at Section 3 of ring girder (05E) has to be checked.			Calculation to be checked			Check scheduled
2. Containment internals	20			Bad				
		1. Loads from RV were not included in FINEL analysis of primary shield wall.			Calculation is being revised.	D.Chow		Being performed
		2. Seismic load not checked for laydown area and sump wall.		Fair	Not significant	W.Hagedorn		To be addressed

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Containment Building	NRC Page No.	Inappropriate or Omitted Calculations	Compliance with FSAR Commitments	General Condition of Calculations	Significance and Disposition	Cognizant Engineer	Originator/ Checker Group Leader	4/17/81 Status
		3. Primary shield wall loads in the FSAR have not been verified.			Additional calculation might be required.	C.Boyak		New calculations completed
		4. Pinned boundary condition is			Modify model	D.Chow		Future work
3. Foundation mat		8. Soil property (F) variation not evaluated.		(*)	Probably not significant			Calculation scheduled
C. Computer program verification	23	A number of computer programs have not been verified.	FSAR Subsection 3.8.1.4.8 and Appendix 3C do not list all of the programs used for analysis of the containment.		Verified by 11/81.	D.Yuan/ Y.Tsang	NA	
D. Overall stability	24	Seismic separation of basement not considered.	Calculations supporting FSAR Table 2.5-14, bearing pressure, cannot be located.	(*)	Not significant	D.Yuan	K.Kuang/ B.Dhar	Calc in progress
E. Interaction with non-Category I structures	26	1. Interaction between tendon access shaft and containment.	See NRC Page 2		Not significant (no interaction)			New calculations complete

Containment Building	NRC Page No.	Inappropriate or Omitted Calculations	Compliance with FSAR Commitments	General Condition of Calculations	Significance and Disposition	Cognizant Engineer	Originator/ Checker Group Leader	8/17/81A Status
III. Conformance to Deviations	27							
Part II - Key Designs								
A. Liner design	28	1. A full calculation for liner plate has not been located (Compare to RC-TOP-11)		Fair	Add calculation.	D.Yuan	C.Yen	Calculations scheduled
		2. No calculations located for some penetrations in liner.			Provide calculations			Calculations scheduled
		3. Calculations are required for the bridge under the liner plate.			Provide calculation cover sheet and reference staff report.	T.Brozo		Calculations scheduled
B. Notch design	31	1. Liner plate effect not considered.		Fair	Not significant.	Vel	J.Shi/ B.Thoski/ C.Yen	Covered by by NCAR 51
		2. Tangential shear has not been checked.			Not significant			Calculations scheduled
		3. Shear reinforcing appears low			May be significant			Calculations in progress
C. Base slab	34	1. There is no bearing calculation located.		Poor/ Average	Vel			Calculations in progress
D. Wall-base slab junction	37	See shell response		Poor/ Average		Vel	J.Shi/ J.Hink	

STRUCTURAL AUDIT LIST OF ITEMS
CONTAINMENT BUILDING

Containment Building	NRC Page No.	Inappropriate or Omitted Calculations	Compliance with FSAR Commitments	General Condition of Calculations	Significance and Disposition	Cognizant Engineer	Originator/ Checker Group Leader	8/17/81 Status
E. Membrane shear	40	The equipment hatch area has not been evaluated for membrane shear.	The equipment hatch area has not been evaluated for membrane shear. (FSAR Subsection 3.8.1.5.1.4)		May be significant			Calculations in progress
F. Dome-to-cylinder junction	42	See shell response		Fair	Not significant	Wei	J.Shi/	
G. Primary shield wall base mat junction	44	1. No verification of rebar adequacy at junction.		Poor	Calculation is being developed.	D.Chow	C.Tan/ J.Hink	
H. Operating floors	47	1. Seismic load was not considered.		Fair (20)	Vertical-not governing; Horizontal-may be significant.	W.Hagedorn/ R.Lightcap	M.Elgaaly/ G.Tuveson	Calculations in progress
I. Polar crane supports	48	1. Consideration of seismic loads is not clear.		Fair (21)	Probably not significant	W.Hagedorn/ D.Tuan	M.Elgaaly/ G.Tuveson	Calculations in progress
		2. Global effect on shell is not clear.			Not significant			Calculations in progress
		3. Containment movement due to pressure and temperature has not been considered.			To be revieved in future.			Calculations scheduled
J. Reactor vessel	51							
K. Steam generato sayr support	53	1. The calculation for the 24"-concrete slab is not available.	Revise FSAR to state that bolts do not take shear		Not sifnificant.	D.Chow/ D.Tuan	M.Elgaaly/ J.Hink	Calculations scheduled
L. Coolant pump support	55	1. NCAR 45 - anchor bolt		(25)	Case by case evaluation.	W.Hagedorn	K.Bandeki/	

Containment Building	NPC Page No.	Inappropriate or Omitted Calculations		Compliance with FSAR Commitments	General Condition of Calculations	Significance and Disposition	Cognizant Engineer	Originator/ Checker Group Leader	8/17/81 Status
		2. Snubber spring rates do not consider cold condition or as-built pin to pin lengths.				Probably not significant			
B. Secondary shield walls	57	Computer run needs additional checking.			Poor	B.Yuan	B.Hagedorn/ B.Dhar	C.Chung/	Check calculation
H. Other steel structures	59	Seismic loads were not considered on all platforms.	NA		Fair (??)	Not controlling load.	W.Hagedorn/ D.Yuan	J.Rink/ G.Tuveson/ M.Elgaaly/ B.Dhar/ D.Yuan	Redo calculations
O. Post-tensioning system	61	Neither Bechtel nor vendor calcs include pressurization effects.	1.	Preliminary calculations indicate that the allowables in FSAR Subsections 3.8.1.5.1 and 3.8.1.5.2 for prestressing tendons and concrete are exceeded under pressure conditions.	Good	Significance unknown Calculation is being checked.	Vel/ T.Bronze	M.Duchon/ M.Benoit/ C.Unknown	Rerun
			2.	Pretensioning tendons stress level exceeds 0.7 fu (allowable in accordance with FSAR Subsections 3.8.1.5.1.8 and 3.8.1.5.2.7) at transfer.		Not significant			Revise FSAR

STRUCTURAL AUDIT LIST OF ITEMS
BORATED WATER STORAGE TANK

Borated Water Storage Tank	NRC Page No.	Inappropriate or Omitted Calculations	Compliance with FSAR Commitments	General Condition of Calculations	Significance and Disposition	Cognizant Engineer	Originator/ Checker Group Leader	Status
Part I - General Analysis			Yes	Good		Rao/Desai	Rao/ A. Bandopadhyaya/ C. Udogi	Complete
I. Basic Design Criteria	1							
A. Seismic design criteria	1	None				McConnel/ Mozafari/	Banby/ Donnelly/	
B. Design loads	2			Good		Rao/Desai	Rao/Bando/ Udogi	Complete
TBL 3-17								
II. Analysis Method	4							
A. Seismic analysis	4	Dynamic analysis was performed using TID-7024 techniques.		Tank fair Foundation good		Otel Pierce	Banby/Donnelly/Huang	
1. Material properties	4	1. soil structure interaction 2. Shear modulus, subgrade reactions and bearing capabilities of soil were taken from unchecked and unapproved calculations.		Not significant				Calcs in progress
2. Time history, response spectrum, etc (general)	6	Not performed	N/A	N/A		N/A	N/A	
3. Selection of number of masses	6	Based on TID-7024	-	Tank - no		Otel Pierce	N/A N/A	
4. Modal response	7	N/A	N/A	N/A		N/A	N/A	

STRUCTURAL AUDIT LIST OF ITEMS
BORATED WATER STORAGE TANK

Borated Water Storage Tank	BPC Page No.	Inappropriate or Omitted Calculations	Compliance with FSAR Commitments	General Condition of Calculations	Significance and Disposition	Cognizant Engineer	Originator/ Checker Group Leader	Status
5. Soil structure	9	Refer to aux		N/A		N/A	N/A	
6. Response spectra (specific)	11						Bandy/Mc-Connel	Complete
7. Vertical seismic	15			Tank - sparse		Otal	Bandy/Mc-Connel	Complete
				Foundation - good		Pierce	Bandy/Mc-Connel	Complete
B. Stress analysis								
1. Steel tank	12	Vendor design	Yes	Good		Rao/Desai	Vendor	Complete
2. Foundation	13			Good		Rao/Desai	Bandy/ Udogi/Rao	Complete
C. Joint filler between structures	14		N/A					
D. Computer verification	16							
E. Overall stability	18			Good		Rao/Desai	Bandy/ Udogi/Rao	Complete
F. Interaction with non-Category I structures	20							
G. Tornado missiles	21							
III. Conformance to Staff's Criteria (Deviations)	23							
Part II - Key Designs								
A. Steel tank				Good		Rao/Desai	Vendor/ Rao	Complete
B. Foundation				Good		Rao/Desai	Bandy/ Udogi/Rao	Complete

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STRUCTURAL AUDIT LIST OF ITEMS
BORATED WATER STORAGE TANK

Borated Water Storage Tank	BPC Page No.	Inappropriate or Omitted Calculations	Compliance with FSAR Commitments	General Condition of Calculations	Significance and Disposition	Cognizant Engineer	Originator/ Checker Group Leader	Status
Part III - Justification of Proposed Repair								
A. Effects of thru cracks	26							
B. Test Procedure to Evaluate Settlement Effects	26							
Part IV - Items Not Covered in Questions that Should Be Identified								

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STRUCTURAL AUDIT LIST OF ITEMS
POSATED WATER STORAGE TANK

Borated Water Storage Tank	NRC Page No.	Inappropriate or Omitted Calculations	Compliance with FSAR Commitments	General Condition of Calculations	Significance and Disposition	Cognizant Engineer	Originator/ Checker Group Leader	Status

NOTES:

(1) Calculation Q23 overturning and sliding S.F. check.
(2) Calculation Q24A buttress access shaft
(3) Calculation Q25 feedwater isolation valve chamber
(4) Calculation Q26 containment shell and base slab analysis (FINEL)
(5) Calculation Q27 containment analysis for seismic loading (ASHSD)
(6) Calculation Q56 combination of Q26 and Q27 to develop FSAR Tables 2.8-1 and 3.8-17 (for additional relevant calculations see NRC page 2)

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(7) (For primary shield wall calculations Q14A see NRC page 44)(for secondary shield wall calculations Q33, Q34A, and Q35A see NRC page 57)
(8) Calculation Q4, Q4a foundation mat reinforcement design (for additional relevant calculations see NRC page 19 calculation Q26 and Q27)
(10) (for Q24A see NRC page 2)
(11) Calculation Q46, Q50, and Q55
(12) Question 5B, Q5B, and 5G
(13) Calculation Q9 - equipment hatch reinforcement design
(14) Jooley calculations for steel equipment hatch 7220-508-17, 7220-508-18
(15) Calculation Q4 and Q4a foundation mat reinforcement design
(15) Calculation Q10 wall reinforcement (see NRC pages 19 and 21 for calculations Q4, Q4A, Q26, Q27, and Q5b)
(17) (for other relevant calculatins Q10, Q26, Q27, and Q.6 see NRC pages 2, 19, 24, 21, 34, and 37)
(18) Calculation Q141
(19) Calculation Q14A
(21) Calculation Q17D, Q17E-1, Q18C, Q18G-1 structural steel, concrete, steel plate and grating
(21) Calculations Q56, Q5-C4 concrete, reinforcement (recent) girders, brackets, concrete, and reinf. at bracket locations
(22) Calculation Q12 fold) Q144-6 (new) Q23B-10 Q14C
(23) Lower support Calculation Q12
(24) Calculation Q12A upper lateral support
(25) Calculations Q13-a(CPDC) Q33, Q34A, Q55A-good condition. Calculatins Q42 stress summary-good condition (components of snubbers, support anchor bolts, rear brackets, tubing, res.)
(26) Calculations Q33, Q34A, and Q35A wall reinforcement and details-poor condition
(27) Calculations Q12G, Q61, Q65, Q18R-1 Q13B-5 through Q13F-23, Q13F-24, Q37, Q64, Q20C-2 press-structural steel, fan supports etc, core flood support, pipe restraint, jet barriers, missile shields-fair
(28) Calculation Q6, Q6a post tensioning design and input-poor. Inryco calculations 7220-C2-49, 7220-C2-50, and 7220-C2-56-good.
(29) Calculation Q7, Q7a buttress reinforcement design

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