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Testimony QA (Soils)".

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

_____)	
In the Matter of)	
CONSUMERS POWER COMPANY)	Docket Nos. 50-329-OM
(Midland Plant, Units 1 and 2))	50-330-OM
_____)	50-329-OL
	50-330-OL

NUCLEAR REGULATORY COMMISSION STAFF/CONSUMERS
POWER COMPANY QUALITY ASSURANCE STIPULATION

1. Prior to December, 1979, there were quality assurance deficiencies related to soil construction activities under and around safety-related structures and systems at the Consumers Power Midland Plant construction site ("Midland") in that (i) certain design and construction specifications related to foundation-type material properties and compaction requirements were not followed; (ii) there was a lack of clear direction and support between the contractor's engineering office and construction site as well as within the contractor's engineering office; (iii) there was a lack of control and supervision of plant fill placement activities which contributed to inadequate compaction of foundation material; and (iv) corrective action regarding nonconformances related to plant fill was insufficient or inadequate as evidenced by repeated deviations from specification requirements.

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2. Consumers Power agrees not to contest the NRC Staff's conclusions that the events referred to in paragraph 1 constituted a breakdown in quality assurance with respect to soils placement at Midland and constituted an adequate basis for issuance of the order of December 6, 1979.

3. The quality assurance program satisfies all requisite NRC criteria. Further, as a result of revisions in the quality assurance program, the improved implementation of that program, and other factors discussed in testimony submitted by James G. Keppler, the NRC has reasonable assurance that quality assurance and quality control programs will be appropriately implemented with respect to future soils construction activities including remedial actions taken as a result of inadequate soil placement.

Not until
Adequate technical
SAR coverage
not to be
seen -

Michael J. Miller

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William D. Patten

One of the Attorneys for the Staff
of the Nuclear Regulatory Commission

Date: June 5, 1981

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
)
CONSUMERS POWER COMPANY) Docket Nos. 50-329-OM & OL
)
(Midland Plant, Units 1 and 2)) 50-330-OM & OL

CERTIFICATE OF SERVICE

I hereby certify that copies of NUCLEAR REGULATORY COMMISSION STAFF/CONSUMERS POWER COMPANY QUALITY ASSURANCE STIPULATION in the above-captioned proceeding have been served on the following by deposit in the United States mail, first class or, as indicated by an asterisk, through deposit in the Nuclear Regulatory Commission's internal mail system, this 8th day of June, 1981.

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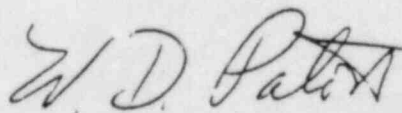
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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
CONSUMERS POWER COMPANY) Docket Nos. 50-329 OM & OL
(Midland Plant, Units 1 and 2)) 50-330 OM & OL

NRC STAFF TESTIMONY OF EUGENE J. GALLAGHER WITH RESPECT TO
QUALITY ASSURANCE PROGRAM IMPLEMENTATION PRIOR TO DECEMBER 6, 1979

Q. 1. Please state your name and position with the NRC.

A. My name is Eugene J. Gallagher. I am a civil engineer with the U.S. Nuclear Regulatory Commission. Since February, 1981, I have been assigned to the Reactor Engineering Branch, Division of Resident and Regional Reactor Inspection, Office of Inspection and Enforcement. Prior to February, 1981, I was a reactor inspector assigned to the Region III, Reactor Construction and Engineering Support Branch, Office of Inspection and Enforcement. I was assigned to the Midland Plant (among others) from October, 1978 until January, 1981.

Since October of 1978, I have spent approximately one year of effort performing inspections, reviewing quality control records and procedures, observing work activities, reviewing Consumers Power Company (hereafter Consumers) responses to 50.54(f) questions 1 and 23, attending meetings and presentations by Consumers and Bechtel regarding the soil settlement matter at the Midland Plant.

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Q. 2. Have you prepared a statement of professional qualifications?

A. Yes, a copy of this statement is attachment No. 17.

Q. 3. Please state the nature of the responsibilities that you had with respect to the Midland Plant, Units 1 & 2, from October, 1978 to December 6, 1979.

A. As a civil engineer inspector for the Region III office of Inspection and Enforcement I conducted five inspections prior to December 6, 1979 in order to (1) ascertain whether adequate quality assurance plans, instructions and procedures had been established for the construction of the foundation of safety related structures, (2) provide an independent evaluation of the performance, work in progress and completed work to ascertain whether activities relative to foundation construction were accomplished in accordance with NRC requirements, and (3) review the quality related records to ascertain whether these records reflected work accomplished consistent with NRC requirements and license commitments. The results of these inspections prior to December 6, 1979 are contained in the following NRC inspection reports:

50-329/78-12; 50-330/78-12, conducted October 24-27, 1978
(Attachment No. 2).

50-329/78-20; 50-330/78-20, conducted December 11, 1978-January 25, 1979 (Attachment No. 7).

50-329/79-06; 50-330/79-06, conducted March 28-29, 1979
(Attachment No. 8).

50-329/79-10; 50-330/79-10, conducted May 14-17, 1979
(Attachment No. 10).

50-329/79-19; 50-330/79-19, conducted September 11-14, 1979
(Attachment No. 12).

Q. 4. Please state the purpose of this testimony.

A. The purpose of this testimony is to identify the quality assurance deficiencies which contributed to the soil settlement problem at the Midland Plant prior to the issuance of the December 6, 1979 Order.

Q. 5. What is "quality assurance" comprised of?

A. "Quality assurance" comprises all those planned and systematic actions necessary to provide adequate confidence that a structure, system, or component will perform satisfactorily in service. Quality assurance includes quality control. (10 CFR 50, Appendix B, Introduction).

Q. 6. What is "quality control" comprised of.

A. Quality control comprises those quality assurance actions related to the physical characteristics of a material, structure, component or system which provide a means to control the quality of the material, structure, component or system to predetermined requirements. (10 CFR 50, Appendix B, Introduction).

Q. 7. Are soils work activities subject to 10 CFR 50, Appendix B?

A. General Design Criterion 1 of 10 CFR 50, Appendix A (Quality Standards and Records) requires that "structures systems and components important to safety be designed, fabricated, erected and tested to quality standards commensurate with the importance to safety functions to be performed ... A quality assurance program shall be established and implemented in order to provide adequate assurance that these structures, systems and components will satisfactorily perform their safety function..."

General Design Criterion 2 of 10 CFR 50, Appendix A (Design bases for protection against natural phenomena) requires "structures, systems and components important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions..."

10 CFR 100, Appendix A, Seismic and Geologic Siting Criteria for Nuclear Power Plants (I-Purpose) states, "It is the purpose of these criteria to set forth the principal seismic and geologic considerations which guide the Commission in its evaluation of the suitability of proposed sites for nuclear power plants and the suitability of the plant design bases established in consideration of the seismic and geologic characteristics of the proposed sites..." Paragraph IV (Required Investigation) states "the investigations shall include the following: "... "Determination of the static and dynamic engineering properties of the materials underlying the site. Included should be properties needed to determine the behavior of the underlying material during earthquakes and the characteristics of the underlying material in transmitting earth-

quake induced motions to the foundation of the plants, such as seismic wave velocities, density, water content, porosity and strength..."

Midland Plant, Units 1 and 2 FSAR, Section 3.2.2.1, "describes the method of identifying and classifying those plant features designed to withstand the effects of earthquakes, and to which the requirements of Appendix B to 10 CFR 50, Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants, have been applied... structures, systems, and components which are required to support seismic Category I structures, components, and systems are also designed for Category I seismic loads". Table 3.2-1 provides a listing of structures, components, and systems and identifies those which are seismic Category I. Those structures include the containment building, auxiliary building, diesel generator building, service water pump structure and retaining walls and foundations for borated water storage tanks.

The soil foundation work activities for these Category I structures are subject to 10 CFR 50, Appendix B requirements in order to assure that these structures will satisfactorily perform their safety functions.

Q. 8. When did Consumers first become aware of the apparent excessive settlement of the diesel generator building?

Consumers first reported the excessive settlement of the diesel generator building orally on August 21, 1978 to the Region III, on-site NRC resident inspector. Written notification was made on September 29, 1978 in the form of a 10 CFR 50.55(e) notification of a significant deficiency in construction (attachment 1). This report states that the

diesel generator building and foundations settlement was greater than anticipated at that time (mid August, 1978). In fact, the settlement values at that time (less than 6 months after the start of construction of the diesel generator building) were approaching the total settlement values for the 40-year life.

Q. 9. Under what circumstance is a 10 CFR 50.55(e) report required?

A. By the terms of the regulation, a 50.55(e) report is required for each deficiency found in design and construction which if it were to remain uncorrected could affect adversely the safety of operations of the nuclear power plant at any time throughout the expected lifetime of the plant and which represents:

(1) A significant breakdown in any portion of the quality assurance program conducted in accordance with the requirements of [10 CFR 50], Appendix B; or

(2) A significant deficiency in 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 or construction permit; or

(3) A significant deficiency in construction of or significant damage to a structure, system, or component which will require extensive evaluation, extensive redesign, or extensive repair to meet the criteria and bases stated in the safety analysis report or construction permit or to otherwise establish the adequacy of the structure, system, or component to perform its intended safety function; or

(4) A significant deviation from performance specifications which will require extensive evaluation, extensive redesign or extensive repair to establish the adequacy of a structure, system, or component to meet the criteria and basis stated in the safety analysis report or construction permit or to otherwise establish the adequacy of the structure, system or component to perform its intended safety function.

Consumers submitted a 50.55(e) report with respect to the soil settlement problem by its letter of September 29, 1978 (Attachment 1). Several interim reports were subsequently submitted through November 2, 1979. Consumers' initial 50.55(e) interim report (Attachment 1) states that the event was reportable under 10 CFR 50.55(e)1(iii) which is the equivalent of (3) above - a significant deficiency in construction.

Q. 10. When did you conduct your first inspection at Midland with respect to soils?

A. An inspection was conducted on October 24-27, 1978 the results of which are contained in NRC inspection report 50-329/78-12; 50-330/78-12 (hereafter NRC Report 78-12) dated November 17, 1978 (Attachment 2). The purpose of the inspection was to provide Region III management with a preliminary evaluation of the extent of the soils problem based on initial investigative borings, the type of foundation material, review of construction specifications and license commitments. Items 1(a) through (f) of that report provided a summary of Consumers 50.55(e) report and information Consumers provided while I was onsite. Items 2 through 8 of that report are the results of my review and observations made during the inspection.

I would like to bring to the attention of the board that the third paragraph of the transmittal letter for NRC Report 78-12 and the inspection summary results therein that indicate that no items of noncompliance were identified are erroneous. At the time of the inspection the identified inconsistencies (item 3) and failure to follow

specifications requirements (item 4) did constitute noncompliances. I intended to (and did in fact) conduct further investigations with respect to the soils work activities and these noncompliances. The results of this further investigation of each of these items described in NRC Report 78-12 are further discussed in NRC Report 78-20 and are identified as items of noncompliances.

Q. 11. What actions did the office of Inspection and Enforcement take subsequent to the initial inspection of October 24-27, 1978?

A. We met with Consumers to discuss the October 24-27, 1978 inspection and NRC Report 78-12 on December 4, 1978 (See Attachment 3). Members of the NRC Office of Nuclear Reactor Regulation (NRR) were also present as a result of a transfer of lead responsibility that had been executed on November 17, 1978. Bechtel initially addressed the items in NRC Report 78-12. The NRC also emphasized that while attention to remedial action is important, determination of the exact cause is also quite important for verifying the adequacy of the remedial action, assessing the extent of the matter relative to other structures, and in precluding repetition of such matters in the future.

The director of the Region III Office of Inspection and Enforcement then initiated an investigation to obtain information concerning the circumstances of the soil settlement occurrence to determine whether (1) a breakdown in the quality assurance program had occurred, (2) whether the occurrence had been reported properly and (3) whether the final

safety analysis report which had been submitted by Consumers was consistent with the design and construction of the Midland project.

Q. 12. Summarize your preliminary investigation findings.

A summary of the preliminary investigation findings were presented to Consumers on February 23, 1979 at the Region III office. These findings are documented in Attachment 4. In summary, the findings related to quality assurance deficiencies, are:

- * The FSAR did not correctly state the type of fill material supporting safety related structures. This is a violation of 10 CFR 50 Appendix B quality assurance criterion III. (Design Control)

- * The FSAR included conflicting values for the settlement of the diesel generator building founded on spread footings. This is a violation of 10 CFR 50 Appendix B quality assurance criterion III. (Design Control)

- * The compaction requirement for clay material was not followed. This is a violation of 10 CFR 50 Appendix B quality assurance criterion V. (Instructions, Procedures and Drawings)

- * The compaction requirement for sand was not correctly translated into the construction specifications. This is a violation of 10 CFR 50 Appendix B quality assurance criterion V. (Instructions, Procedures and Drawings)

- * Moisture control was not properly implemented. This is a violation of 10 CFR 50 Appendix B quality assurance criterion XVI. (Corrective Action)

- * Soil was not protected from frost action nor removed prior to resuming work. This is a violation of 10 CFR 50 Appendix B quality assurance criterion III. (Design Control)

- * The root causes of nonconforming conditions were not adequately corrected to preclude repetition. This is a violation of 10 CFR 50 Appendix B quality assurance criterion XVI. (Corrective Action)

- * The settlement calculations for the diesel generator building were based on conditions of foundation type, load intensity and

soil compressibility other than the actual conditions. This is a violation of 10 CFR 50 Appendix B quality assurance criterion III. (Design Control)

* Consumers did not adequately investigate the extent of the soil problem after the settlement of the administration building footings. This is a violation of 10 CFR 50 Appendix B quality assurance criterion XVI. (Corrective Action)

* Program changes were not implemented to preclude erroneous selection of the laboratory compaction standards (maximum density and optimum moisture content) after the settlement of the administration building footings. This is a violation of 10 CFR 50 Appendix B quality assurance criterion XVI. (Corrective Action)

[We subsequently determined that the last two items should not have been listed as quality assurance deficiencies because the administration building is not subject to quality assurance requirements.]

* Concrete material was permitted to be used in lieu of fill material without consideration of the effects on structures. This is a violation of 10 CFR 50 Appendix B quality assurance criterion V. (Instructions, Procedures and Drawings)

* Personnel directing the soils operation were not trained in the area of soil work, nor was a geotechnical soils engineer present on-site as required. This is a violation of 10 CFR 50 Appendix B quality assurance criterion II. (Quality Assurance program)

* Inspection procedures were relaxed from original procedural requirements which provided insufficient hold points to ascertain back-fill material was installed properly. This is a violation of 10 CFR 50 Appendix B quality assurance criterion X. (Inspection)

* The sampling (surveillance) plan was infrequent and inadequate to verify conformance. This is a violation of 10 CFR 50 Appendix B quality assurance criterion X. (Inspection)

Based on the above findings it was my conclusion and it is my conclusion now that:

- (1) There was inadequate control and supervision of the plant fill.
- (2) Corrective action regarding nonconformances was inadequate.
- (3) Construction specifications and design bases were not followed.
- (4) Interface between design organization and construction was inadequate.

(5) The FSAR contained inconsistent, incorrect and unsupported statements.

Q. 13. Did Consumers respond to these findings?

A. Yes. Subsequent to the February 23, 1979, a meeting was held at the Region III office on March 5, 1979 during which Consumers responded to the NRC investigation findings. Consumers response was documented in their submittal which was revised March 9, 1979 (Attachment 5). During this meeting the NRC Staff reiterated it's concern expressed on December 4, 1978 for assessment of the extent of the matter relative to other structures, and stated that its concern was not limited to the narrow scope of the diesel generator building but extended to various buildings, utilities and other structures located in and on the plant fill. In addition, the NRC Staff expressed concern with the implementation of Consumers quality assurance programs.

Consumers March 9, 1979 response (Attachment 5) failed to identify root causes of the quality assurance deficiencies and corrective actions to preclude repetition of these quality assurance deficiencies.

Q. 14. Did the NRC transmit the detailed investigation results to Consumers?

A. The investigation results were sent to Consumers on March 22, 1979; the details of which are contained in NRC investigation report 50-329/78-20; 50-330/78-20. (Attachment 7). This report indicated that the findings of the investigation continued to be under review by the NRC

Staff and that upon the completion of that review Consumers would be advised of the enforcement action to be taken by the NRC. NRC Report 78-20 contains a more detailed discussion of the investigation findings summarized in response to Question 15 of this testimony.

Q. 15. What action was taken to determine whether enforcement action should be taken?

A. On March 21, 1979 the NRC sent Consumers a request pursuant to 10 CFR 50.54(f) to obtain additional information regarding the adequacy of the plant fill and the quality assurance program for the Midland site. (Attachment 6). I provided input into the 50.54(f) request. Question 1 of 22 of the 50.54(f) letter requested information regarding Consumers implementation of the quality assurance program. On April 24, 1979 Consumers submitted the initial response to Question 1 (Attachment 9). The NRC review concluded that the information provided was not sufficient. During a July 18, 1979 meeting, Consumers presented the results of its investigation into the probable cause of the settlement problem and the NRC expressed several points of disagreement with these results [see meeting summary dated October 16, 1979, Attachment → 13]. On September 11, 1979 the NRC issued Question 23 which contained a request for additional quality assurance information. On November 13, 1979 Consumers Power Co. submitted revision 4 to the 50.54(f) submittals ← which contained their response to Question 23 (Attachment 14) including specific corrective actions and commitments for implementation of its quality assurance program.

In its responses to 50.54(f) Question 23, Consumers identified and discussed the root causes for quality assurance deficiencies. As discussed more fully below, information in the response to Question 23 supports the allegation in NRC's December 6, 1979 Order Modifying Construction Permits (Attachment 15) that there was a breakdown in quality assurance. }

Q. 16. What action was taken with respect to enforcement?

A. On December 6, 1979 an Order Modifying Construction Permits was issued jointly by the NRC Office of Nuclear Reactor Regulation and the Office of Inspection and Enforcement as a result of the investigation findings and the conclusions of the NRC Staff after reviewing responses to the 10 CFR 50.54(f) requests of March 21, 1979 and September 11, 1979. One of the bases for the issuance of the December 6, 1979 Order, was the breakdown in quality assurance with respect to soil activities. (See paragraph III of the December 6, 1979 Order).

As more fully discussed in this affidavit, the facts contained in Part II of the December 6, 1979 Order (including Appendix A) insofar as they relate to quality assurance, are true.

Q. 17. Before discussing what actually occurred at Midland with regard to the implementation of the quality assurance program in the soils area, please state the significance of soil compaction and the factors which affect soil compaction.

A. When soil is employed as a structural or construction material, it must have adequate engineering properties to perform its intended design function without excessive deformation or settlement. Compaction of soils is an effective technique for increasing the soil density and attaining the desired engineering properties of soil materials such as acceptable strength, resistance to deformation and resistance to the flow of water. Specifying the attainment of a maximum soil density is an accepted engineering practice for measuring the effectiveness of the compactive effort.

The density that can be achieved by compaction depends on (1) the soil type, (2) moisture control, (3) type of compaction equipment, (4) placement thickness of the soil layer to be compacted, and (5) the magnitude of the compaction effort (for example the number of passes of the compaction equipment). Satisfactory performance of the soil can be achieved provided these factors are properly specified and controlled during construction under an effective quality control and quality assurance program.

G. P. Tschebotarioff, author of "Foundations, Retaining & Earth Structures", Second Edition, McGraw Hill, states in paragraph 1-8 (Special Need for Construction Quality Control) that "In foundation work this need [for construction quality control] is much greater than in any branch of civil engineering.... Constant attention to every detail of construction procedures is therefore a must in all foundation work. Above all, continuous competent on-the-site inspection is essential..." This illustrates the special character of the geotechnical field, in comparison to other construction activities.

Q. 18. Identify the 13 quality assurance deficiencies discussed by Consumers in its response to 50.54(f) Question 23.

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(19)

A. (1) Inconsistencies between construction specifications and consultant reports.

(20)

(2) Lack of formal revisions of specifications to reflect clarification of specification requirements.

(21)

(3) Inconsistency of design basis within the FSAR relating to diesel generator building fill material and settlement values.

(22)

(4) Inconsistencies between the settlement calculations and the original design basis of the diesel generator building.

(23)

(5) Inadequate design coordination in the design of the duct bank.

(24)

(6) Insufficient compactive effort used in backfill operation.

(25)

(7) Insufficient technical direction in the field.

(26)

(8) Inadequate quality control inspection of placement of fill.

(27)

(9) Inadequate soil moisture testing.

(28)

(10) Incorrect soil test results.

(29)

(11) Inadequate subcontractor test procedure.

(30)

(12) Inadequate corrective action for repetitive nonforming conditions.

(31)

(13) Inadequate quality assurance auditing and monitoring of the plant fill work activities.

These items are discussed below, seriatim.

Q. 19. Summarize Consumers and NRC discussion of inconsistencies identified between construction specifications and consultant reports. (Item 13(1))

A. Discussion of this quality assurance deficiency is contained in (1) NRC Report 78-20, pages 9,10,16 and 17, (2) Consumers response to 50.54(f) Question 1 at appendix I, page 1 (¶ A.1) and page 3 (¶ B.1) (3) Consumers response to 50.54(f) Question 23 at pages 23-6 and 23-7 (sub-section 3.1) and (4) Consumers Answer to Notice of Hearing, appendix 1(e) and (f).

This quality assurance deficiency existed between 1973 through the substantial reduction in construction during 1978-79 without correction.

Consultant reports were submitted by Consumers to the NRC as PSAR attachments. Consumers indicated that consultant reports were subject to being "misconstrued as commitments". The Dames & Moore report, entitled "Foundation Investigation and Preliminary Explorations for Borrow Materials, Proposed Nuclear Power Plant", dated June 28, 1968 was submitted as PSAR amendment 1 and a supplement to this report dated, March 15, 1969 was later submitted as PSAR amendment 3. This report contained criteria relating to compaction and frost protection of the foundation material which were disregarded during actual construction.

In response to an NRC question Consumers also submitted PSAR amendment 9 dated 3/20/70 which states in part, "the design criteria for these Class 1 structures will be modified to remove all natural sands with a relative density less than 75% and to replace these sands with a controlled backfill compacted in accordance with page 16 to the report titled "Foundation Investigation and Preliminary Explorations for Borrow Material Proposed Nuclear Power Plant, dated March 15, 1969." Since the Dames and Moore report was submitted as part of the application, and was

specifically referenced in Amendment No. 9, NRC considered the designated compaction criteria to be design commitments by applicant.

Page 16 of the Dames and Moore report indicated the compaction criterion for sands supporting structures to be a minimum 85% relative density. Contrary to this, Bechtel construction specification C-210 required compaction of sand to not less than 80% relative density. In addition, the 80% relative density criteria was also not met in numerous cases as will be discussed in Question 20 of this testimony.

Page 15 of the Dames and Moore report indicated "that all frozen soils be removed or recompact prior to resumption of operations." Construction specification C-210 ("Construction for Plant Foundation and Cooling Pond Dikes") did not address instructions for removal or recompact of frozen/thawed material upon resumption of soil work.

In addition to the above inconsistencies Dames & Moore report (page 15) states that "all fill and backfill materials should be placed at or near optimum moisture content in nearly horizontal lifts approximately six to eight inches in loose thickness". Contrary to the above, the Bechtel construction specification C-210, section 12.5.3 and C-211 ("Specification for Structural Backfill"), Section 5.2.2 stated, "in no case shall the uncompacted lift thickness exceed 12 inches."

Consumer's states the root cause of these inconsistencies as being that "During the preparation and early revisions of the PSAR there were no procedural requirements or methods for documenting the deposition of consultant recommendations in the PSAR". Consumer's answer of notice of hearing (appendix, allegation 1(e) and 1(f)) "admits to this allegation".

The above response from Consumers supports the NRC finding that inadequate design control measures were established to assure that license requirements to the NRC were translated into construction specifications. These inconsistencies violate 10 CFR 50, Appendix B Criterion III, Design Control.

Q. 20. Summarize Consumers & NRC discussion regarding lack of formal revisions of specifications to reflect clarifications of specification requirements. (Item 18(2))

A. Discussion of this quality assurance deficiency is contained in (1) NRC Report 78-20, pages 9-14, (2) Consumers response to 50.54(f) Question 1 at appendix I, pages 1 (¶ A.2) and page 3 (¶ B.2) (3) Consumers response to 50.54(f) question 23 at pages 23-8 and 23-9 (subsection 3.2), and (4) Consumers answer to Notice of Hearing, appendix, allegation 2(b)(1).

This quality assurance deficiency existed from as early as June 1974 through the substantial reduction in soils construction during 1978-79 without correction.

Bechtel specification C-210 contained conflicting requirements in sections 13.7 and 12.4 relating to the laboratory compaction standard to be used. Bechtel interoffice memoranda, telexes and telecons were used in an attempt to clarify the intent of specification requirements. Clarifications provided through these methods were taken by the user to modify the specification requirements without a design change or specification change notice to the specification requirement. Conse-

quently, certain activities were not accomplished according to instructions and procedures; specifically, the compaction criteria used for fill material was 20,000 foot-pounds (FT-LBS) of energy rather than a compactive energy of 56,000 FT-LBS as specified in Bechtel construction specification C-210, section 13.7.

Consumers states the root cause of this quality assurance deficiency as being "Engineering Project Instruction 4.49.1 did not address the use of interoffice memoranda, memoranda, telexes, twx's, etc. which might be interpreted by the user as modifying the requirements of the specifications." (Attachment 14).

Consumers Answer to Notice of Hearing (appendix, allegation 2(b)(1), "admits to this allegation".

The above response from Consumers supports the NRC finding that inadequate procedures for design control were established for the control of specification changes affecting the design bases. The lack of formal specification revisions violates 10 CFR 50, Appendix B, Criterion V, Instructions, Procedures and Drawings.

Q. 21. Summarize Consumers and NRC discussion of inconsistencies of design bases within the FSAR relating to diesel generator building fill material and settlement values. (Item 18(3))

A. Discussion of this quality assurance deficiency is contained in (1) NRC Report 78-20, pages 6-8, (2) Consumers response to 50.54(f) Question 1 at Appendix I, page 2 (¶ A.3) and page 4 (¶ B.3), (3) Consumers response to 50.54(f) Question 23 at pages 23-10 and 23-11

(subsection 3.3) and (4) Consumers Answer to Notice of Hearing, Appendix, 1(a).

This quality assurance deficiency existed from late 1977 until FSAR revision 18 dated February 28, 1979.

Consumers response states that the FSAR submitted to the NRC (through Amendment 17) contained certain inconsistencies:

"a. Tables 2.5-9 and 2.5-14 identify the foundations under the diesel generator building to be cohesive fill. The actual material specified and used was random fill, [defined in FSAR Table 2.5-21 as any material free of humus, organic, or other deleterious material also referred to as zone 2 material], which includes cohesive and cohesionless material and concrete.

b. FSAR Subsection 3.8.5.5 indicates a settlement of 1/2 inch for shallow spread footings (such as the diesel generator building). FSAR Table 2.5-48 [which is referenced in FSAR section 2.5.4] indicates a settlement of the diesel generator building of approximately 3 inches."

Consumers response continues:

"The inconsistency between subsections 2.5.4 and 3.8.5 with respect to the settlement values [$\frac{1}{2}$ inch vs. 3 inches] resulted because the two subsections were prepared by separate organizations (Geotechnical Services and Civil Engineering), neither of which were aware of the multiple display of similar information in the opposite subsection. The inconsistency between FSAR Subsection 2.5.4 and the project design drawing (Drawing 7220-C-45) with respect to the fill material resulted because at the time of FSAR preparation the Geotechnical Services personnel preparing the FSAR were unaware, in this case, of the status of the design drawing prepared by Civil Engineering."

Consumers stated the root cause of these inconsistencies as being "the control document did not provide sufficient procedural control for preparation and review of the FSAR." (The control document establishes procedure for preparation and control of Safety Analysis Reports.)

Consumers Answer to Notice of Hearing (Appendix 1(a)), "Admits to this allegation" that "inconsistencies were identified in the license application and in other design basis documents".

The above response from Consumers supports the NRC finding that inadequate design control measures were established.

These inconsistencies of design bases violates 10 CFR 50, Appendix 3, Criterion III, Design Control.

Q. 22. Summarize Consumers and NRC discussion of inconsistencies that were identified between the settlement calculations and the original design basis of the diesel generator building. (Item 18(4))

A. Discussion of this quality assurance deficiency is contained in (1) NRC Report 78-20, pp. 20-1, (2) Consumers response to 50.54(f) Question 1 at Appendix I, page 2 (¶ A.4) and page 4 (¶ B.4), (3) Consumers response to 50.54(f) Question 23 at pages 23-12 and 23-13 (subsection 3.4), and (4) Consumers Answer to Notice of Hearing, Appendix, allegations 1(b),(c) and (d).

This quality assurance deficiency existed from March 1977 until it was identified during an NRC investigation in 1978.

Consumers reponse to 50.54(f) states that:

"Settlement calculations for the diesel generator building differ from the design requirements in the following ways:

(1) A uniform load of 3,000 psf was used rather than the 4,000 psf shown in Figure 2.5-47 in the FSAR.

(2) An index of .001 was used rather than the index of .003 shown in Table 2.5-16 in the FSAR.

(3) The calculations assumed a mat foundation rather than a spread footing foundation, which is the actual design condition.

and that,

"The results of these erroneous calculations were included in the FSAR."

Consumers states one of the root causes of this quality assurance deficiency is:

"Diesel generator building foundation design changes initiated by Project Engineering were not coordinated with Geotechnical Services, as required by the control documents."

Consumer's Answer to Notice of Hearing (appendix, allegations 1(b), (c) and (d)) admits to this allegation for the diesel generator building.

The above response from Consumers supports the NRC finding that inadequate design control measures were established to assure proper design control interfaces for the diesel generator building. These inconsistencies violate 10 CFR 50, Appendix B, Criterion III, Design Control.

Q. 23. Summarize Consumers and NRC discussion of the inadequate design coordination in the design of the electrical duct banks of the diesel generator building. (Item 13(5))

A. Discussion of this quality assurance deficiency is contained in (1) NRC Report 78-20, pages 23-24, (2) Consumers response to 50.54(f) question 1 at appendix I, page 3 (¶ A.5) and page 5 (¶ B.5), (3) Con-

sumers response to 50.54(f) question 23, pages 14-16 (subsection 3.5), and (4) Consumers Answer to Notice of Hearing (appendix, 2(a)).

NRC determined that lean concrete material was permitted to be used in lieu of soil materials without qualification as to location. Consequently, lean concrete material was used around the electrical duct banks which were to pass through the foundation of the diesel generator building. This resulted in restricting the free movement of the foundation which contributed to the differential settlement of the building.

Consumers response states that,

"Four vertical duct banks were designed and constructed without sufficient clearance to allow a relative vertical movement between the duct bank and the building, and therefore restricted the settlement of the diesel generator building."

and that,

"Neither electrical nor civil drawings show how or where to accomplish the transition from the stub-up size to the underground duct size, nor do they show firm definition of duct size."

Consumers identified the root cause of this quality assurance deficiency as being,

"Failure of the drawings to provide Construction with the information necessary to prevent interference."

Consumers Answer to Notice of Hearing (appendix, 2(a)), however, denies that instructions provided to field construction for substituting lean concrete for zone 2 material caused differential settlement.

Based on the NRC review if lean concrete material had not been used around the electrical duct banks, free movement could be achieved between the diesel generator building foundation and duct banks. This lack of free movement did contribute to the lack of uniform settlement. This was demonstrated by the immediate vertical movement of the structure once it was freed from the duct bank.

This failure to provide adequate procedure and instructions to assure activities have been satisfactorily accomplished violates 10 CFR 50, Appendix B, Criterion V, Instruction, Procedures and Drawings.

Q. 24. Summarize Consumers and NRC discussion of insufficient compactive effort used in backfill operation. (Item 18(6))

A. Discussion of this quality assurance deficiency is contained in (1) NRC Report 78-20 pages 9-14, (2) Consumers response 50.54(f) question 1 at appendix I, page 10 (¶ A.1, B.1) and (3) Consumers response to 50.54(f) question 23, pages 23-17 and 23-18 (subsection 3.6)

This quality assurance deficiency existed from the inception of the plant fill operation in 1974 through the substantial reduction in soils construction in 1978-79.

Effective compactive effort depends on the size and type of compaction equipment, the number of passes of the equipment and the thickness of the soil layer being compacted. Soil specifications and field procedures should have required a "test fill" to demonstrate that a specific piece of compaction equipment with a specific method (i.e., number of passes and soil layer thickness) could achieve the required in-place density. The in-process density tests would then serve as a continuous verification that the equipment selected and established method could consistently satisfy the requirements. The practice of qualifying compaction equipment to a specified method is an acceptable industry practice. The practice of qualifying equipment was not employed at the Midland site prior to placement of plant area fill activities.

Consumers response stated that,

"There are no records available to indicate that the various types of compaction equipment used for structural backfill were evaluated or qualified to handle the specified lift thicknesses and that appropriate lift thicknesses were established for each type of equipment,"

and that,

"There were no field control documents or procedures to define requirements for the qualification of soils compaction equipment. There were no control documents to govern the requirements for control measures pertaining to soils placement and compaction."

Consumers stated that the root causes of insufficient compactive effort used in backfill operations are,

(1) "The Quality Assurance Program requirement to establish responsibility for measures to control the placement and compaction of soils and the qualification of construction equipment was not adequately implemented, and

(2) "Reliance was placed on in-place test results, or on the evaluation of the test results, for evaluating compaction equipment. Satisfactory soil test results, or evaluations of test results, implied that adequate compactive effort was obtained and equipment capability and fill placement methods were not questioned."

Consumers also admitted that,

"These [in-place] soil test results or their evaluations were in error in numerous cases."

Incorrect soil test results will be discussed below in Question 31.

The above response from Consumers supports the NRC finding that inadequate procedures were developed for the construction of the plant area fill in order to assure that equipment and methods used were capable of obtaining the required compaction.

The failure to establish adequate procedures to assure use of appropriate compaction equipment violates 10 CFR 50, Appendix B, Criterion V, Instructions, Procedures and Drawings.

Q. 25. Summarize Consumers and HRC discussion of insufficient technical direction in the field. (Item 18(7))

A. Discussion of this quality assurance deficiency is contained in (1) HRC Report 78-20, pages 24-26, (2) Consumers response to 50.54(f), question 1 at appendix I, page 10 (¶ A.2 and B.2), (3) Consumers response to 50.54(f) question 23, pages 23-19 and 23-20 (subsection 3.7) and (4) Consumers Answer to Notice of Hearing, appendix, allegation 2(b)(2).

This quality assurance deficiency existed from 1974 through the substantial reduction in construction in 1978-79.

Consumers response to 50.54(f) stated:

"The Dames & Moore Report [pg. 16] and the Civil-Structural Design Criteria 722C-C-501, Revision 9, Section 6.1.1 state, in part, "Filling operations shall be performed under the technical supervision of a qualified soils engineer...."

"Technical direction and supervision were provided by Field Engineers and Superintendents who were assigned the responsibility for soils placement. The direction and supervision were not sufficiently employed."

and that,

"The technical direction and supervision provided were not properly deployed to overcome the lack of documented instructions and procedural controls."

Consumers states the root cause of this quality assurance deficiency as,

"Reliance on test results, or the evaluations of test results, and surveillance by quality control instead of providing sufficient technical direction though documented instructions and procedural controls."

Consumers Answer to Notice of Hearing (appendix, 2(b)(2)), "Admits to this allegation" that soil activities were not accomplished under the

technical supervision of a qualified soils engineer who would verify that all materials would be placed and compacted in accordance with specifications criteria.

The above response from Consumers supports the NRC finding that technical supervision by a qualified soils engineer was not provided as required by procedures and instructions. The failure to implement procedures to assure sufficient technical direction in the field violates 10 CFR 50, Appendix B, Criterion V, Instructions, Procedures and Drawings.

Q. 25. Summarize Consumers and NRC discussion of inadequate quality control inspection of placement of fill. (Item 13(8))

Discussion of this quality assurance deficiency is contained in (1) NRC Report 73-20, pages 25-29, (2) Consumers response to 50.54(f) question 1 at appendix I, page 13 (¶ A.1) and page 14 (¶ B.1), (3) Consumers response to 50.54(f) question 23, pages 23-21 and page 23-22 (subsection 3.3) and (3) Consumers Answer to Notice of Hearing (Appendix 3).

This quality assurance deficiency existed from 1974 through the substantial reduction in construction in 1978-79.

Consumers response stated that,

"Quality Control inspection of soils work did not identify deficiencies which may have contributed to placement of fill that appears to have densities in place that are lower than those specified."

and that,

"The inspection of soils was accomplished by "surveillance," and did not require verification of the controls specified in Specifications 7220-C-210 and 7220-C-211. Soil test results, or the evaluations of soil test results, were used as the basis for quality verification."

Consequently, adequate quality control verification of the soils work was not accomplished and resulted in the work not being performed in accordance with requirements to achieve the required compaction.

Consumers states two of the root causes as being,

(1) "Too much reliance was placed on the Quality Control Inspector's ability, without sufficiently specific inspection instructions," and

(2) "Reliance was place on soil test results, or on the evaluation of soil test results, which were in error in numerous cases."

Consumers Answer to Notice of Hearing (appendix,3) admits "the degree of inspection or witnessing was reduced by going to a surveillance (sampling plan)" and that "the sampling (surveillance) plan was inadequate in that it did not specify conditions or criteria under which there would be increased sampling or a return to 100% inspection."

The above responses from Consumers supports the NRC finding that adequate quality control inspection was not provided for the verification of soil work activities.

The inadequate quality control inspection of placement of fill violates 10 CFR 50, Appendix B, Criterion X, Inspection.

Q. 27. Summarize Consumers and NRC discussion of inadequate soil moisture testing. (Item 18(9))

Consumers identifies three of the root causes of inadequate moisture testing as being,

(1) "Reliance was placed on the informal incorrect interpretations of the specification relative to moisture testing.

(2) Reliance was placed on Quality Control surveillances of moisture testing.

(3) Reliance was placed on the incorrect results of the density tests, or on the incorrect evaluation of the results, to the exclusion of the moisture test results."

Incorrect soil test results are discussed in response to Question 28.

Consumers Answer to Notice of Hearing, (appendix, 4(a)) "denies this allegation to the extent that it is inconsistent with" a prior response submitted by Consumers. That prior response is preliminary finding 6 of Attachment 5. My reading of that prior response leads me to conclude that the requirements for moisture conditioning prior to compaction (as set forth in the second paragraph of this answer) was not verified in that "prior to August 1, 1977 there were no moisture measurements made at the borrow area or when the loose fill was placed prior to or during compaction" and after August 1, 1977 "moisture measurements were made at the borrow area but were not compared to the laboratory standards".

This failure to take adequate corrective action to assure appropriate soil moisture testing violates 10 CFR 50, Appendix B, Criterion XVI, Corrective Action.

Q. 28. Summarize Consumers and NRC discussion of incorrect soil test results. (Item 18(10))

A. Discussion of this quality assurance deficiency is contained in (1) Consumers response to 50.54(f) Question 1 at appendix I, page 13 (§ A.3) and page 15 (§ 13.3) and (2) Consumers response to 50.54(f) Question 23, pages 23-26, 23-27 and 23-28 (subsection 3.10).

This quality assurance deficiency existed from 1975 through the substantial reduction in construction in 1978-79.

A review of the soil test reports indicated fill density tests contain the following types of errors: (1) incorrect soil identification, (2) incorrect selection of laboratory standard (maximum density and optimum moisture content) to be used for field control of in-place field density tests, (3) erroneous field density test data for those tests which indicate the soil to be in excess of 100% saturated, a physical impossibility, (4) calculation errors, and (5) improper clearing of failed test results. (See Bechtel July 1973 report referenced below.)

Based on a Bechtel report to Consumers entitled, "Review Of U.S. Testing Field & Laboratory Tests On Soils", dated July 1979 (Attachment 11), "Since more than one half of the test results for relative density and percent compaction fall outside the possible theoretical comparison limits, it must be concluded that these results are suspect and should not be used alone for acceptance of the plant area fill". The Bechtel report also concludes that as a result of incorrect soil identification, incorrect selection of the laboratory standard, and erroneous field density test data, "there is no rational means of determining which test results are valid and which are not."

Consumers response to 50.54(f) requests identified the root cause of incorrect soil test results as,

"Technical procedures available to control the testing were inadequate, and the technical direction of the testing operations did not avoid or detect the incorrect soil test results."

This failure to provide adequate procedure to assure correct soil test results violates 10 CFR 50, Appendix B, Criterion V, Instructions, Procedures and Drawings.

Q. 29. Summarize Consumers and NRC discussion of inadequate subcontractor test procedures. (Item 13(11))

A. Discussion of this quality assurance deficiency is contained in (1) Consumers response to 50.54(f) Question 1, at appendix I, page 13 (¶ A.4) and page 15 (¶ B.4) and (2) Consumers response to 50.54(f) Question 23, pages 23-29, 23-30 and 23-31 (subsection 3.11).

This quality assurance deficiency existed from 1974 through the substantial reduction in construction in 1973-79.

Consumers response to 50.54(f) states that,

"The procedures used for soils testing did not cover the following activities:

1. Developing and updating the family of proctor curves;
2. Visually selecting the proper proctor curves;
3. Developing additional proctor curves for changing materials occurring between normal frequency curves; and
4. Using alternative methods of determining the proper laboratory maximum density where visual comparison is not adequate."

Consumers identifies the root cause of this quality assurance deficiency as being,

"Adequate technical procedures for control of the testing were not prepared."

This failure to provide adequate procedural controls for the soil testing activities violates 10 CFR 50, Appendix B, Criterion V, Instructions, Procedures and Drawings.

Q. 30. Summarize Consumers and NRC discussion of inadequate corrective action for repetitive nonconforming conditions. (Item 18(12))

A. Discussion of this quality assurance deficiency is contained in (1) NRC Report 78-20 pages 17-20, (2) Consumers response to 50.54(f) Question 1 at Appendix I, pages 21 (¶ A.1 and B.1) and (3) Consumers response to 50.54(f) Question 23, pages 23-32 and 23-33 (subsection 3.12), and (4) Consumers Answer to Notice of Hearing, Appendix 4(b).

This quality assurance deficiency existed from 1974 through the substantial reduction in construction in 1978-79.

Consumers response states that,

"There were nonconformances reported which are considered to be repetitive. These include, but are not limited to: CPCo [Consumers] Nonconformance Reports QF-29, QF-52, QF-68, QF-120, QF-130, QF-147, QF-172, QF-174, QF-199, and QF-203; CPCo Audit Findings F-77-21 and F-77-32; and Bechtel Nonconformance Reports 421, 686, 693, and 1005."

A full description and supporting details of each of the above nonconformances are discussed in Attachment 5, item 8.

Consumers states that the root causes of inadequate corrective action for these repetitive nonconforming conditions as being,

"1. The conditions under which nonconformances are considered to be repetitive are not adequately defined in the control documents.

2. The trending activity did not provide timely responses to repetitive product nonconforming conditions."

Consumers Answer to Notice of Hearing, appendix 4(b) states that the,

"Licensee admits that corrective action it initially took with regard to nonconformance reports related to plant fill did not prevent nonconformances at a later date in the area of plant fill construction."

Consumers reponse supports the NRC finding that inadequate corrective action was taken to assure that the cause of the condition was determined and corrective action taken to preclude repetition.

This failure to take adequate corrective action to preclude repetitive conditions violates 10 CFR 50, Appendix B, Criterion XVI, Corrective Action.

Q. 31. Summarize Consumers and NRC discussion of inadequate quality assurance auditing and monitoring of plant fill work activities. (Item 18(13))

A. Discussion of this quality assurance deficiency is contained in (1) Consumers response to 50.54(f) Question 1 at appendix I, page 21 (¶ A.2) and page 22 (¶ B.2) and (2) Consumers response to 50.54(f) Question 23, pages 23-34 and 23-35 (Subsection 3.13).

This quality assurance deficiency existed from 1974 through the substantial reduction in construction in 1978-79.

Consumers response states that,

"The Bechtel Quality Assurance Audit and Monitor Program did not identify the problems relating to the settlement. This lack of identification of problems by the audit program contributed to a conclusion that soils operations were adequately controlled."

and that,

"In the case of soils operations, Quality Assurance auditing and monitoring found that quality-related activities were being performed as planned, quality verification activities (primarily soil testing) were being performed, and the soil test results, or their evaluation, provided evidence of compliance with the established standards. The auditing and monitoring did not identify the policy and procedure inadequacies."

Consumers identified the root cause of inadequate quality assurance auditing and monitoring as being,

"Quality Assurance audit and monitoring was oriented more toward evaluating the degree of compliance with established procedures rather than toward the assessment of policy and procedural adequacy or toward the assessment of product quality."

This failure to provide adequate quality assurance auditing and monitoring of the plant area fill violates 10 CFR 50, Appendix B, Criterion XVIII, Audits.

Q. 32. What is the cause of the soil settlement problem at the Midland Plant, Units 1 and 2?

Since the quality assurance program in effect from 1974 through 1979 was ineffective in establishing and implementing sufficient quality assurance/quality controls to assure proper design, inspection and control of soils work under and around safety related structures I conclude that prior to December 5, 1979 there was a breakdown in the quality assurance program.

The foregoing quality assurance deficiencies resulted in the plant area fill being insufficiently compacted. This failure to properly compact the plant area fill was the cause of the soil settlement problem at the Midland Plant, Units 1 and 2.

CONCLUSION

The quality assurance deficiencies related to soil construction activities under and around safety related structures and systems arising from improper implementation of the quality assurance program provide adequate bases to modify the construction permits by suspending those soil construction activities.

LIST OF ATTACHMENTS

1. September 29, 1978: Initial 10 CFR 50.55(e) Report from Consumers Power Co.
2. November 17, 1978: NRC Inspection Report 78-12.
3. January 12, 1979: Summary of December 4, 1978 meeting.
4. February 23, 1979: NRC Presentation of Preliminary Investigation Findings of the Settlement of the Diesel Generator Building.

5. March 9, 1979: Consumers Discussion of NRC Inspection Facts Resulting From NRC Investigation of the diesel generator building.
6. March 21, 1979: NRC 10 CFR 50.54(f) Request Regarding Plant Fill.
- * 7. March 22, 1979: NRC Inspection Report 78-20.
8. April 9, 1979: NRC Inspection Report 79-06. *Trans. March 28-29, 1979 - General Status of Soils Activities & Plans*
9. April 24, 1979: Consumers Response to 10 CFR 50.54(f), Question 1.
- * 10. June 6, 1979: NRC Inspection Report 79-10. *May 14-17, 1979
Inst. Qual. of Post-testing Insp.*
11. August 10, 1979: Bechtel Review of U.S. Testing Co. Field & Laboratory Tests on Soils.
- * 12. October 1, 1979: NRC Inspection Report 79-19. *Trans. Sept 11-14, 1979.
① "Q" us "non-Q" concrete for soil
② Fielding and Qual of Q.C Insp.*
13. October 16, 1979: Summary of July 18, 1979 Meeting.
14. November 13, 1979: Consumers Response to 10 CFR 50.54(f), Question 23.
- ~~15.~~ December 6, 1979: Order Modifying Construction Permits.
- ~~16.~~ April 16, 1980: Consumers Answer to Notice of Hearing.
- ~~17.~~ Professional Qualifications of Eugene J. Gallagher.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
CONSUMERS POWER COMPANY) Docket Nos. 50-329 OM & OL
(Midland Plant, Units 1 and 2)) 50-330 OM & OL

TESTIMONY OF JOSEPH D. KANE WITH RESPECT TO THE QUALITY
QUALITY ASSURANCE PROGRAM IMPLEMENTATION PRIOR TO DECEMBER 6, 1979

Q.1. Please state your name and position with the NRC.

A. My name is Joseph D. Kane. My position with the U.S. Nuclear Regulatory Commission is Principal Geotechnical Engineer and I am assigned to the Geotechnical Engineering Section of the Hydrologic and Geotechnical Engineering Branch, Division of Engineering, Office of Nuclear Reactor Regulation.

Q.2. Have you prepared a statement of professional qualifications?

A. Yes. A copy of this statement is attached.

Q.3. Please state the nature of the responsibilities that you have had with respect to the Midland Plant, Units 1 & 2.

A. My review involvement with the Midland project essentially began in November 1979 when I was assigned the responsibility of serving as technical monitor for the interagency contract between the NRC and the U.S. Army Corps of Engineers, Detroit District (hereafter the Corps). The purpose of this interagency contract was to obtain the

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service of expert technical personnel from the Corps to assist the NRC in the safety review of the Midland project in the field of geotechnical engineering. My responsibilities as contract technical monitor include assisting the Corps in their review efforts, examining and commenting on their evaluation reports and coordinating the Corps review efforts with other NRC Branches in technical areas of overlapping safety concern. In addition I have assisted in preparation of interrogatories and responses to interrogatories with regards to the soil settlement problem at the Midland plant. Since November 1979 my involvement in the review of the Midland project has steadily increased to the point that it is now the major portion of my work at NRC. In addition to responding to Consumers appeal actions (e.g., the appeal of the June 30, 1980 request for additional borings and laboratory testing) and participation in discovery deposition proceedings, I am extensively involved in the assessment of the adequacy of the remedial measures proposed by Consumers. These remedial fixes are necessary to address the many problems caused by the unanticipated settlement of safety related structures and piping due to the improperly compacted plant fill.

Q.4. Please state the purpose of this testimony.

A. The purpose of this testimony is to supplement the testimony prepared by Eugene J. Gallagher. In response to question 32, Mr. Gallagher stated that quality assurance deficiencies resulted in the plant

fill being insufficiently compacted. My testimony demonstrates that if the original compaction control requirements set forth in the PSAR had been followed, the plant fill settlement problem would not have occurred.

Q.5. What is the basis for your response to Question 4?

A. As indicated in Mr. Gallagher's testimony in response to Question 22, the NRC at the PSAR licensing stage considered the designated minimum compaction criteria and recommended moisture content placement control to be design and construction commitments by CPC. (The compaction criteria and moisture control requirement at the PSAR stage are summarized in Table 2.5.4, sheet 3 of the FSAR in response to NRC question 362.15). The significance of these commitments is extremely important to the expected performance of the plant fill. The engineering profession widely recognizes the importance of adequate controls on compaction and moisture content for soils which are intended to satisfactorily support structures. This wide recognition comes about because of the acknowledged relationship between the state of a soil's compactness and the soil's accepted behavior as an engineering material. CPC, when they indicated that soils which were to support structures would be compacted to a stated percentage of a laboratory established maximum density at a moisture content near optimum, were, in effect, convincing the NRC Staff at the CP Stage that engineering properties of compressibility and shear strength would be acceptable. What has been experienced at Midland (i.e., the plant fill significantly

settling under its own weight; foundation supporting safety related structures having very low penetration resistance to spoon samplers; and extensive cracking of structures founded on compacted fill) proves that soils were not compacted to the designated minimum compaction criteria established at the PSAR stage.

Q.6. Do other engineers share your conclusion that the cause of the plant fill settlement problem resulted from inadequate compaction or construction of an unsatisfactory plant fill?

A. Yes. Engineers from both the Corps and the NRC staff have the opinion that inadequate compaction and failure to attain the minimum compaction criteria designated at the PSAR stage are the major reasons for the settlement problem at Midland. In addition, in my opinion, statements obtained in the discovery depositions from Bechtel and their consultants support this conclusion. The following is from lines 7-10 at page 97 of the deposition of Sherif Afifi (Bechtel employee) taken on October 29, 1980;

BY MR.PATON:

Q. Doctor, do you have any opinion as to what caused the extensive settlement problem in the plant fill at Midland?

A. Inadequate compaction.

The following is from lines 13-25 at page 15 and lines 1-3 at page 16 of the deposition of Dr. Ralph B. Peck (Bechtel consultant) taken on January 13, 1981;

Q. All right. What is your opinion of the quality of the soils placement that had taken place prior to your being hired on the Midland project?

MR. FARNELL: Are you talking about the whole power plant? Or are you talking about specific parts of it?

MR. JONES: The soils portions of the project with which he was closely associated.

- A. My opinion, or perhaps you could say it was my conclusion was that the fill beneath the diesel generator building area and some neighboring areas was not a satisfactory fill.

The following is from lines 5-16 at page 41 of the deposition of Dr.

Alfred J. Hendron (Bechtel consultant) taken on January 27, 1981;

- Q. With respect to your construction of the fill do you have any opinion as to the quality of that work?

Were you going to speak?

MS. BLOOM: Yes, I was going to -- I think we have outlined what kind of work we are talking about here.

MR. JONES: Construction of fill?

THE WITNESS: I think when a fill is settle two to four inches under its own weight, and some places have a very low slow [sic] count which obviously something went wrong and I cannot say whose fault or what it might have been, but, there were some bad fills there, not as good as it should have been. I shouldn't say bad fills, there is a difference.

PROFESSIONAL QUALIFICATIONS AND EXPERIENCE

NAME: Joseph D. Kane

ADDRESS: 7421 Miller Fall Road
Derwood, MD 20855

EDUCATION: B.S. Civil Engineering 1961
Villanova University

M.S. Civil Engineering 1973
Villanova University

Post-degree studies, Soils and Foundation Engineering
University of California 1972
University of Maryland 1978

PROFESSIONAL REGISTRATION:

Registered Professional Engineer (1966) - Pennsylvania 12032E

PROFESSIONAL SOCIETY:

American Society of Civil Engineers

EMPLOYMENT POSITIONS:

February 1980 - Present	Principal Geotechnical Engineer U.S. Nuclear Regulatory Commission
May 1977 - February 1980	Geotechnical Engineer U.S. Nuclear Regulatory Commission
October 1975 - May 1977	Soils Engineer U.S. Nuclear Regulatory Commission
August 1973 - October 1975	Supervisory Civil Engineer Chief, Soils Design Section U.S. Army Corps of Engineers Philadelphia District
January 1963 - August 1973	Civil Engineer Soils Design Section U.S. Army Corps of Engineers Philadelphia District
January 1962 - January 1963	Design Engineer McCormick - Taylor Associates Philadelphia, Pa.

PROFESSIONAL EXPERIENCE SUMMARY:

1975 to Present

In NRC Division of Engineering, Geotechnical Engineering Section, Mr. Kane has specialized in soil mechanics and foundation engineering. Experiences in this position have included the following:

- a. Evaluation of the foundation adequacy of proposed sites for nuclear facilities with respect to design and operational safety. This work has included evaluation of geotechnical, soils and rock mechanics, foundation and earthquake engineering related aspects. The results of this review effort are summarized in a safety evaluation report for each of the proposed facilities which have included nuclear power plants, nuclear fuel reprocessing plants and uranium mill tailings waste systems.
- b. Serving as a technical adviser for soil and foundation engineering related aspects in the development of regulatory guides, acceptance and performance criteria that are intended to assure construction and operational safety of nuclear facilities.
- c. Serving as a technical representative for the Office of Nuclear Reactor Regulation on the NRC Advisory Group concerned with federal dam safety.
- d. Serving as an instructor for the Office of State Programs in the training of state personnel who are responsible for construction and operational inspections of uranium mill tailings embankment retention systems.

1963 to 1975

During this period Mr. Kane was employed with the U.S. Army Corps of Engineers, Philadelphia District and attained the position, Chief, Soils Design Section, Foundations and Materials Branch, in 1973. Professional experiences with the Corps of Engineers have included the following:

- a. The embankment and foundation design of four large multi-purpose earth and rockfill dams with appurtenant structures (spillways, inlet and outlet structures, control towers, flood protection facilities, etc.). Responsibilities ranged from the initial planning of

subsurface investigations to select the most feasible sites through all design stages which were culminated in the final preparation of construction plans and specifications. This work included planning and evaluation of laboratory testing programs, studies on slope stability, seepage control and dewatering systems, settlement, bearing capacity, liquefaction, embankment safety instrumentation and slope protection.

- b. Served as a technical consultant to field offices charged with construction inspections for assuring completion of structures in compliance with design analysis and contract specifications. Participated in the development of needed modifications during construction whenever significant changed site conditions were uncovered.
- c. Directed the efforts of engineers in the Soils Design Section in other fields of civil work projects that included the embankment and foundation design of levees, waterfront pile supported structures and disposal basins for the retention of hydraulic dredge waste.

1962 to 1963

Served as design and project engineer for private consulting firm. This work included the design of large federally funded highways, a race track and various structures constructed to provide a Pennsylvania State park marina.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
CONSUMERS POWER COMPANY) Docket Nos. 50-329 OM & OL
(Midland Plant, Units 1 and 2) 50-330 OM & OL

NRC STAFF TESTIMONY OF JAMES G. KEPPLER WITH RESPECT TO THE
QUALITY ASSURANCE PROGRAM IMPLEMENTATION PRIOR TO DECEMBER 6, 1979

Q. 1. Please state your name and position with the NRC.

A. My name is James G. Keppler. I am Director of the U.S. Nuclear Regulatory Commission's Region III (Chicago) Office and have held that position since September, 1973. A statement of my professional experience is attachment 1.

Q. 2. Please summarize your past involvement with Consumers Power Company's implementation of quality assurance at the Midland site prior to December 6, 1979.

A. In connection with our on-going assessment of quality assurance implementation at Midland, my staff developed a chronological listing of major events and problems at the site which includes quality assurance deficiencies. These events and problems are set forth in attachment 2 (dated February 15, 1979) and attachment 3 (dated October 18, 1979). I was personally involved in deciding the regulatory actions taken for the more significant problems described in attachments 2 and 3.

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Q. 3. When did you first learn of the apparent excessive settlement of the diesel generator building?

A. I'm not certain as to the actual date I personally became aware of the diesel generator building settlement problem; however, a written 10 CFR 50.55(e) notification was made to Region III by the licensee on September 25, 1978 concerning the problem. I became personally involved with the problem following an NRC inspection on October 24-27, 1978 which was conducted as a followup to the licensee's report of the matter. This inspection was conducted by Eugene J. Gallagher of my staff and is documented in attachment 2 of his testimony. After being briefed on the inspection findings by Mr. Gallagher, I directed my staff to conduct a comprehensive investigation into the matter to determine whether the problem had been reported to the NRC in a timely manner, to verify the degree of conformance with commitments made by the licensee in the Final Safety Analysis Report, and to assess the root cause(s) of the problem.

Q. 4. Summarize the investigation findings and your role in the assessment of these findings.

A. The detailed investigation findings are discussed in Attachments 4 and 7 to the testimony of Eugene J. Gallagher. Five Region III management representatives (including myself) were briefed initially by the investigation team on February 16, 1979. Based on those detailed investigation findings, it was our unanimous conclusion that the

implementation of the quality assurance/quality control program for assuring the proper soil foundation for the site was ineffective. In addition, several of the commitments in the FSAR related to this work had not been adhered to. With respect to the reportability consideration, we agreed that the NRC had been informed of the problem in a timely manner once it had been identified. Based on this briefing, I instructed my staff to set up a meeting with Consumers Power Company to inform them of our investigation findings. Two meetings were held with the licensee relative to this investigation (February 23, 1979 and March 5, 1979). I participated in both meetings. A summary report of these meetings (Attachments 4 and 5 to the testimony of Eugene J. Gallagher) was provided to the licensee in my letter dated March 15, 1979.

Q. 5. Summarize subsequent actions taken by you with respect to the soil settlement problem.

A. Following the NRC investigation and related meetings with the licensee, Region III management reached the following conclusions:

(1) The technical issues associated with improperly compacted soil needed review and evaluation by NRR. This conclusion resulted in my memorandum of March 12, 1979 to Mr. Thornburg (attachment 5).

(2) The deficiencies identified with respect to implementation of the quality assurance program were limited to soils work. Since the original soil placement activities had been substantially completed, no attempt was made at this time to stop soil work.

(3) Several commitments in the FSAR were incorrect and required review by NRR and ELD to determine whether they constituted material false statements. This conclusion resulted in my memorandum of April 3, 1979 to Mr. Thornburg.

Q. 6. What was the disposition of your recommendations and how does that action relate to the Order that was issued on December 6, 1979?

A. On March 21, 1979 the NRC's Office of Nuclear Reactor Regulation issued a 10 CFR 50.54(f) request to Consumers Power Company requiring the licensee to provide additional information regarding the adequacy of the plant fill and the root causes and corrective actions to be taken regarding quality assurance deficiencies.

I participated in meetings at headquarters which led to the issuance of the December 6, 1979 Order Modifying Construction Permits. I supported issuance of that Order.

JAMES G. KEPPLER - BIOGRAPHICAL INFORMATION

James G. Keppler has been Regional Director of the Nuclear Regulatory Commission's Region III Office of Inspection and Enforcement since 1973. (The Nuclear Regulatory Commission was formed in January 1975 to take over the regulatory functions of the old Atomic Energy Commission (AEC). The research and development activities of the AEC were assumed by the Department of Energy.)

The Regional Office in Glen Ellyn is responsible for inspection and enforcement activities at NRC licensed facilities in eight midwestern states. This encompasses 20 nuclear power plants now in operation, 21 plants licensed for construction or under licensing review, 12 operating research reactors, four fuel facilities and approximately 3700 byproduct materials licenses -- generally for medical, industrial, research or educational applications.

Mr. Keppler joined the AEC in 1965 as a reactor inspector. Prior to his present post as Regional Director, he was Chief of the Reactor Testing and Operations Branch in the AEC Headquarters in Bethesda, Maryland.

He is a 1956 graduate of LeMoyne College in New York State. Mr. Keppler's experience in the nuclear field includes nine years with General Electric Company, first in its Aircraft Nuclear Propulsion Department and later in its Atomic Power Equipment Department.

February 15, 1979

MEMORANDUM FOR: H. D. Thornburg, Director, Division of Reactor
Construction Inspection, IE

FROM: James G. Kappler, Director

SUBJECT: MIDLAND SUMMARY REPORT

The attached report, which represents Region III's overall assessment of the Midland construction project to date from a regulatory standpoint, was discussed with you and representatives from your staff, NRR, and OELD during our meeting at HQ's on February 6, 1979. During that meeting, it was concluded that this report should be provided to OELD for transmittal to the Licensing Board and the various parties to the Hearing. As such, this information is being forwarded for your action.

We believe the meeting was quite useful in receiving feedback from the various NRC people involved relative to our position on the status of this facility.

Please contact me if you have any questions regarding this matter.

James G. Kappler
Director

Attachment:
Midland Summary Report

~~8104160335~~ 33pp

OFFICE	RIII	RIII	RIII	RIII		
SURNAME	Heishman/jr	Fiorelli	Norelius	Kappler		
DATE	2/15/79		2/15/79	2/15/79		

MIDLAND SUMMARY REPORT

Facility Data

Docket Numbers - 50-329 and 50-330
Construction Permits - CPPR-81 and CPPR-82
Permits Issued - December 14, 1972
Type Reactor - PWR; Unit 1, 492 MWe*; Unit 2, 818 MWe
NSSS Supplier - Babcox & Wilcox
Design/Constructor - Bechtel Power Corporation
Fuel Load Dates - Unit 1, 11/81; Unit 2, 11/80
Status of Construction - Unit 1, 52%, Unit 2, 56%; Engineering 80%

*Approximately one-half the steam production for Unit 1 is dedicated, by contract, to be supplied to Dow Chemical Corporation, through appropriate isolation heat exchangers. Capability exists to alternate to Unit 2 for the steam source upon demand.

Chronological Listing of Major Events

July 1970 Start of Construction under exemption
9/29-30 & 10/1/70 Site inspection, four items of noncompliance identified, extensive review during CP hearings
1971 - 1972 Plant in mothballs pending CP
12/14/72 CP issued
9/73 Inspection at Bechtel Ann Arbor offices, five items of noncompliance identified
11/73 Inspection at site, four items of noncompliance identified (cadweld problem) precipitated the Show Cause Order
12/29/73 Licensee answers Show Cause Order commits to improvements on QA program and QA/QC staff
12/3/73 Show Cause Order issued suspending cadwelding operation
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3/5 & 10/75 CP reported that 63 #6 rebar were either missing or
misplaced in Auxiliary Building

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8/21/75 CP reported that 42 sets of #6 tie bars were missing in Auxiliary Building

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3/26/76 RIII inspector requested CP to inform RIII when stop-work order to be lifted and to investigate the cause and the extent of the problem. Additional rebar problems identified during site inspection

3/31/76 CP lifted the stop-work order

4/19 thru 5/14/76 RIII performed in-depth QA inspection at Midland

5/14/76 RIII management discussed inspection findings with site personnel

5/20/76 RIII management meeting with CP President, Vice President, and others.

6/7 & 8/76 RIII follow up meeting with CP management and discussed the CP 21 correction commitments

6/1-7/1/76 Overall rebar omission reviewed by R. E. Shewmaker

7/28/76 CP stops concrete placement work when further rebar placement errors found by their overview program. PN-III-76-52 issued by RIII

8/2/76 RIII recommends HQ notice of violation be issued

8/9 - 9/9/76 Five week full-time RIII inspection conducted

8/13/76 Notice issued

10/29/76 CP responded to HQ Notice of Violations

12/10/76 CP revised Midland QA program accepted by NRR

2/28/77 Unit 2 bulge of containment liner discovered

4/19/77 Tendon sheath omissions of Unit 1 reported

4/29/77 IAL issued relative to tendon sheath placement errors

5/5/77 Management meeting at CP Corporate Office relative to IAL regarding tendon sheath problem

- 5/24-27/77 Special inspection by RIII, RI and HQ personnel to determine adequacy of QA program implementation at Midland site
- 6/75 - 7/77 Series of meetings and letters between CP and NRP on applicability of Regulatory Guides to Midland. Commitments by CP to the guides was responsive
- 7/24/78 Construction resident inspection assigned
- 8/21/78 Measurements by Bechtel indicate excessive settlement of Diesel Generator Building. Officially reported to RIII on September 7, 1978
- 12/78 - 1/79 Special investigation/inspection conducted at Midland sites Bechtel Ann Arbor Engineering offices and at CP corporate offices relative to Midland plant fill and Diesel Generator building settlement problem

Selected Major Events

Past Problems

1. Cadweld Splicing Problem and Show Cause Order

A routine inspection, conducted on November 6-8, 1973, as a result of intervenor information, identified eleven examples of four noncompliance items relative to rebar Cadwelding operations. These items were summarized as: (1) untrained Cadweld inspectors; (2) rejectable Cadwelds accepted by QC inspectors; (3) records inadequate to establish cadwelds met requirements; and (4) inadequate procedures.

As a result, the licensee stopped work on cadweld operations on November 9, 1973 which in turn stopped rebar installation. The licensee agreed not to resume work until the NRC reviewed and accepted their corrective action. However, Show Cause Order was issued on December 3, 1973, suspending Cadwelding operations. On December 6-7, 1973 RIII and HQ personnel conducted a special inspection and determined that construction activity could be resumed in a manner consistent with quality criteria. The show cause order was modified on December 17, 1973, allowing resumption of Cadwelding operations based on the inspection results.

The licensee answered the Show Cause Order on December 29, 1973, committing to revise and improve the QA manuals and procedures and make QA/QC personnel changes.

Prehearing conferences were held on March 28 and May 30, 1974, and the hearing began on July 16, 1974. On September 25, 1974, the Hearing Board found that the licensee was implementing its QA program in compliance with regulations and that construction should not be stopped.

2. Rebar Omission/Placements Errors Leading to IAL

Initial identification and report of rebar nonconformances occurred during an NRC inspection conducted on December 11-13, 1974. The licensee informed the inspector that an audit, had identified rebar spacing problems at elevations 642' - 7" to 652' - 9" of Unit 2 containment. This item was subsequently reported per 10 CFR 50.55(e) and was identified as a item of noncompliance in report Nos. 50-329/74-11 and 50-330/74-11.

Additional rebar deviations and omissions were identified in March and August 1975 and in April, May and June 1976. Inspection report Nos. 50-329/76-04 and 50-330/76-04 identified five noncompliance items regarding reinforcement steel deficiencies.

and concrete placement work.

Licensee response dated June 18, 1976, listed 21 separate items (commitments) for corrective action. A June 24, 1976 letter provided a plan of action schedule for implementing the 21 items. The licensee committed not to resume concrete placement work until the items addressed in licensee's June 24 letter were resolved or implemented. This commitment was documented in a RIII letter to the licensee dated June 25, 1976. Although not stamped as an IAL, in-house memos referred to it as such.

Rebar installation and concrete placement activities were resumed in early July 1976, following completion of the items and verification by RIII.

Additional action taken is as follows:

a. By the NRC

- (1) Assignment of an inspector full-time on site for five weeks to observe civil work in progress
- (2) IE management meetings with the licensee at their corporate offices
- (3) Inspection and evaluation by Headquarter personnel

b. By the Licensee

- (1) June 18, 1976 letter committing to 21 items of corrective action
- (2) Establishment of an overview inspection program to provide 100% reinspection of embedments by the licensee following acceptance by the contractor QC personnel

c. By the Contractor

- (1) Personnel changes and retraining of personnel
- (2) Prepared technical evaluation for acceptability of each identified construction deficiency
- (3) Improvement in their QA/QC program coverage of civil work (this was imposed by the licensee)

3. Tendon Sheath Placement Errors and Resulting Immediate Action Letter (IAL)

On April 19, 1977, the licensee reported, as a Part 50, Section 50.55(e) item, the inadvertent omission of two hoop tendon sheaths from a Unit 1 containment concrete placement at

elevation 703' - 7". The tendon sheaths were, for the most part, located at an elevation in the next higher concrete placement lift, except that they were diverted to the lower placement lift to pass under a steam line penetration and it was where they were omitted. Failure to rely on the proper source documents by construction and inspection personnel, contributed to the omission.

An IAL was issued to the licensee on April 29, 1977, which spelled out six licensee commitments for correction which included: (1) repairs and cause corrective action; (2) expansion of the licensee's QC over view program; (3) revisions to procedures and training of construction and inspection personnel.

A special QA program inspection was conducted in early May 1977. The inspection team was made up of personnel from RI, RIII, and HQ. Although five items of noncompliance were identified, it was the consensus of the inspectors that the licensee's program was an acceptable program and that the Midland construction activities were comparable to most other construction projects.

The licensee issued its final report on August 12, 1977. Final review on site was conducted and documented in report No. 50-329/77-08.

Current Problems

1. Plant Fill - Diesel Generator Building Settlement

The licensee informed the RIII office on September 8, 1978, of per requirements of 10 CFR 50.55(e) that settlement of the diesel generator foundations and structures were greater than expected.

Fill material in this area was placed between 1975 and 1977, with construction starting on diesel generator building in mid-1977. Filling of the cooling pond began in early 1978 with the spring run-off water. Over the year the water level has increased approximately 21 feet and in turn increasing the site ground water level. It is not known at this time what effect (if any) the higher site ground water level has had on the plan fill and excessive settlement of the Diesel Generator Building. It is interesting to note however, that initially the PSAR indicated an underdrain system would be installed to maintain the ground water at its normal (pre pond) level but that it later was deleted.

The NRC activities, to date, include:

- a. Transfer of lead responsibility to NRR from IE by memo dated November 17, 1978
- b. Site meeting on December 3-4, 1978, between NRR, IE, Consumers Power and Bechtel to discuss the plant fill problem and proposed corrective action relative to the Diesel Generator Building settlement
- c. RIII conducted an investigation/inspection relative to the plant fill and Diesel Generator Building settlement

The Constructor/Designer activities include:

- a. Issued NCR-1482 (August 21, 1978)
- b. Issued Management Corrective Action Report (MCAR) No. 24 (September 7, 1978)
- c. Prepared a proposed corrective action option regarding placement of sand overburden surcharge to accelerate and achieve proper compaction of diesel generator building sub soils

Preliminary review of the results of the RIII investigation/inspection into the plant fill/Diesel Generator Building settlement problem indicate many events occurred between late 1973 and early 1978 which should have alerted Bechtel and the licensee to the pending problem. These events included nonconformance reports, audit findings, field memos to engineering and problems with the administration building fill which caused modification and replacement of the already poured footing and replacement of the fill material with lean concrete.

2. Inspection and Quality Documentation to Establish Acceptability of Equipment

This problem consists of two parts and has just recently been identified by RIII inspectors relative to Midland. The scope and depth of the problem has not been determined.

The first part concerns the adequacy of engineering evaluation of quality documentation (test reports, etc.) to determine if the documentation establishes that the equipment meets specification and environmental requirements. The licensee,

by the Licensee's
QA Review Program

on November 13, 1978, issued a construction deficiency report (10 CFR 50.55(e)) relative to this matter. Whether the report was triggered by RIII inspector inquiries or by IE Circular or Bulletin is not known. An interim report dated November 28, 1978 was received and stated Consumers Power was pursuing this matter not only for Bechtel procured equipment but also for NSS supplied equipment.

The second part of the problem concerns the adequacy of equipment acceptance inspection by Bechtel shop inspectors. Examples of this problem include: (1) Decay Heat Removal Pumps released by the shop inspector and shipped to the site with one pump assembled backwards, (2) electrical penetrations inspected and released by the shop inspector for shipment to the site. Site inspections to date indicate about 25% of the vendor wire terminations were improperly crimped.

Inspection History

The construction inspection program for Midland Units 1 and 2 is approximately 50% complete. This is consistent with status of construction of the two units. (Unit 1 - 52%; Unit 2 - 56%) In terms of required inspection procedures approximately 25 have been completed, 33 are in progress and 36 have not been initiated.

The routine inspection program has not identified an unusual number of enforcement items. Of the selected major events described above, only one is directly attributable to RIII enforcement activity (Coldweld splicing). The other were identified by the licensee and reported through the deficiency report system (50.55(e)). The Midland data for 1976 - 78 is tabulated below.

<u>Year</u>	<u>Number of Noncompliances</u>	<u>Number of Inspections</u>	<u>Inspector Hours On Site</u>
1976	14	9	646
1977	5	12	648
1978	11	18	706

A resident inspector was assigned to the Midland site in July 1978. The on site inspection hours shown above does not include his inspection time.

The licensee's QA program has repeatedly been subject to in-depth review by IE inspectors. Included are:

1. July 23-26 and August 8-10, 1973, inspection report Nos. 50-329/73-06 and 50-330/73-06: A detailed review was conducted relative to the implementation of the Consumers Power Company's QA manual and Bechtel Corporation's QA program for design activities at the Bechtel Ann Arbor office. The identified concerns were reported as discrepancies relative to the Part 50, Appendix B, criteria requirements.

2. September 10-11, 1973, report Nos. 50-329/73-08 and 50-330/73-08: A detailed review of the Bechtel Power Corporation QA program for Midland was performed. Noncompliances involving three separate Appendix B criteria with five different examples, were identified.
3. February 6-7, 1974, reports No. 50-329/74-03 and 50-330/74-03: A followup inspection at the licensee's corporate office, relative to the items identified during the September 1973 inspection (above) along with other followup.
4. June 16-17, 1975, report Nos. 50-329/75-05 and 50-330/75-05: Special inspection conducted at the licensee's corporate office to review the new corporate QA program manual.
5. August 9 through September 9, 1976, report Nos. 50-329/76-08 and 50-330/76-08: Special five-week inspection regarding QA program implementation on site primarily for rebar installation and other civil engineering work.
6. May 24-27, 1977, report Nos. 50-329/77-05 and 50-330/77-08: Special inspection conducted at the site by RIII, IE and RI personnel to examine the QA program implementation on site by Consumers Power Company and by Bechtel Corporation. Although five examples of noncompliance to Appendix B, Criterion V, were identified, the consensus of the inspectors involved was that the program and its implementation for Midland was considered to be adequate.

Although the licensee's Quality Assurance program has undergone a number of revisions to strengthen its provisions, no current concern exist regarding its adequacy. Their Topical QA Plan has been reviewed and accepted by NRR through revision 7. Implementation of the program has been and continues to be subject to further review with the mid-construction program review presently scheduled for March or April 1979.

Consumers Power Company expanded their QA/QC auditing and surveillance coverage to provide extensive overview inspection coverage. This began in 1975 with a commitment early in their experience with rebar installation problems and was further committed by the licensee in his letter of June 18, 1976, responding to report Nos. 50-329/76-04 and 50-330/76-04. This overview inspection activity by the licensee has been very effective as a supplement to the constructor's own program. Currently, this program is functioning across all significant activities at the site.

Enforcement History

Approximately 6 months after restart of construction activities (11 months after CP issuance) an inspection identified four noncompliance items regarding cadwelding activities. This resulted in a show cause order being issued on December 3, 1973. This enforcement action was aired publicly during hearings held by the Atomic Safety Licensing Board in May 1974. The hearing board issued its decision in September 1974

that concluded that construction could proceed with adequate assurance of quality.

Identification of reinforcing bar problems began in December of 1974 with the licensee reporting improper spacing of rebar in the Unit 2 containment wall. Further reinforcing bar spacing and/or omission of rebar was identified in August 1975 and again in May 1976 with the citations of 5 noncompliances in an inspection report. An IE:HQ notice of violation was issued regarding the citations in addition to the licensee issuing a stop work order. The licensee issued a response letter dated June 18, 1976 committing to 21 items of corrective action. A Bechtel prepared technical assessment for each instance of rebar deficiency was submitted to and review by IE:HQ who concluded that the structures involved will satisfy the SAR criteria and that the function of these structures will be maintained during all design conditions. The RIII office of NRC performed a special five week inspection to assess the corrective action implementation without further citation.

The licensee reported that two hoop tendon sheaths were omitted in concrete placements of Unit 2 containment wall in April 1977. An Immediate Action Letter was issued to the licensee on April 29, 1977 listing six items of licensee commitments to be completed. A special inspection was performed on May 24-27, 1977 with four NRC inspectors (1-HQ, 1-RI, and 2-RIII). Although five items of noncompliance were identified, it was the consensus of the inspectors that the QA/QC program in effect was adequate. The constructors nonconformance report provided an alternate method of installation for the tendon sheaths that was accepted.

The RIII office of inspection and enforcement instituted an augmented on site inspection coverage program during 1974, this program has continued in effect ever since and is still in effect. It is noted that the noncompliance history with this program is essentially the same as the history of other RIII facilities with a comparable status of construction. Further on site inspection augmentations was accomplished with the assignment of a full time resident inspector in August, 1978.

The noncompliance history for the Midland Project is provided in the following table.

ENFORCEMENT ACTIONS

Noncompliances

<u>Year</u>	<u># Total</u>	<u>Criteria (10 CFR 50 Appendix B)</u> <u>() Number of Occurrences</u>
1970	4	V, X, XI, XVI
1971-1972	0	Construction halted pending CP
1973	9	II V(5) XIII, XV, XVII
1974	3	V(2) XI
1975	0	
1976	10	V(4) X, XII, XV, XVI, XVII, XVIII
1977	5	V(5) 10 CFR 50.55(e) item
1978	11	V(4) VI(2), VII, IX(3), XVI

Criteria

- II QA Program
- V Instructions Procedures Drawing Control Work
- VI Document Control
- VII Control of Purchased Material
- IX Control of Special Processes
- X Inspection
- XII Control Measuring - Test Equipment
- XIII Handling - Storage
- XV Nonconforming Parts
- XVI Corrective Actions
- XVII QA Records
- XVIII Audits

Summary and Conclusions

Since the start of construction Midland has experienced some significant problems resulting in enforcement action. In evaluating these problems they have occurred in clumps: (1) in September 1970 relative to improper placement, sampling and testing of concrete and failure of QA/QC to act on identified deficiencies; (2) in September 1973 relative to drawing control and lack of or inadequate procedures for control of design and procurement activities at the Bechtel Engineering offices; (3) in November 1973 relative to inadequate training, procedures and inspection of cadweld activities; (4) in April, May and June 1976 resulting from a series of RIII in-depth QA inspections and meetings to identify underlying causes of weakness in the Midland QA program implementation relative to embedments. (The noncompliance items identified involved inadequate quality inspection, corrective action, procedures and documentation, all primarily concerned with installation of reinforcement steel); (5) in April 1977 relative to tendon sheath omissions; and (6) in August 1978 concerning plant soil foundations and excessive settlement of the Diesel Generator Building.

Following each of these problem periods (excluding the last which is still under investigation), the licensee has been responsive and has taken extensive action to evaluate and correct the problem and to upgrade his QA program and QA/QC staff. The most effective of these licensee actions has been an overview program which has been steadily expanded to cover almost all safety related activities.

The evaluation both by the licensee and IE of the structures and equipment affected by these problems (again except the last) has established that they fully meet design requirements.

Since 1974 these problems have either been identified by the licensee's quality program or provided direction to our inspectors.

Looking at the underlying causes of these problems two common threads emerge: (1) Consumers Power historically has tended to over rely on Bechtel, and (2) insensitivity on the part of both Bechtel and Consumers Power to recognize the significance of isolated events or failure to adequately evaluate possible generic application of these events either of which would have led to early identification and avoidance of the problem including the last on plant fill and diesel generator building settlement.

Notwithstanding the above, it is our conclusion that the problems experienced are not indicative of a broadbreakdown in the overall quality assurance program. Admittedly, deficiencies have occurred which should have been identified earlier by quality control personnel, but the licensee's program has been effective in the ultimate identification and subsequent correction of these deficiencies. While we cannot dismiss the possibility that problems may have gone undetected by the licensee's overall quality assurance program, our inspection program has not identified significant problems overlooked by the licensee --- and this inspection effort has utilized many different inspectors.

The RIII project inspectors believe that continuation of: (1) resident site coverage, (2) the licensee overview program including its recent expansion into engineering design/review activities, and (3) a continuing inspection program by regional inspectors will provide adequate assurance that construction will be performed in accordance with requirements and that any significant errors and deficiencies will be identified and corrected.



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

Attachment 3

October 18, 1979

01111

MEMORANDUM FOR: R. C. Knop
 D. W. Hayes
 D. H. Danielson
 K. Naidu
 G. Maxwell
 W. Hansen
 P. Barrett

R. Cook
 T. Vandel
 F. Jablonski
 E. Lee
 G. Gallagher
 K. Ward
 I. Yin

FROM: G. Fiorelli, Chief, Reactor Construction and
 Engineering Support Branch

SUBJECT: MIDLAND CONSTRUCTION STATUS REPORT AS OF
 OCTOBER 1, 1979

The attached report was finalized based on your feedback requested in my memo of October 5, 1979. If you still feel adjustments are necessary please contact me. If you consider the report characterizes your current assessment of the Midland project, please concur and pass it along promptly.

G. Fiorelli
 G. Fiorelli, Chief
 Reactor Construction and
 Engineering Support Branch

Enclosure: As stated

cc: J. G. Keppler

~~841523-475~~ COR

16pp

MIDLAND SUMMARY REPORT UPDATE

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- 6/75 - 7/77 Series of meetings and letters between CP and NRR on applicability of Regulatory Guides to Midland. Commitments by CP to the guides was responsive.

7/24/78 Construction resident inspection assigned.

8/21/78 Measurements by Bechtel indicate excessive settlement of Diesel Generator Building. Officially reported to RIII on September 7, 1978.

12/78 - 1/79 Special investigation/inspection conducted at Midland sites, Bechtel Ann Arbor Engineering offices and at CP corporate offices relative to Midland plant fill and Diesel Generator building settlement problem.

2/7/79 Corporate meeting between RIII and CPC to discuss project status and future inspection activities. CPC informed construction performance on track with exception of diesel/fill problem.

2/23/79 Meeting held in RIII with Consumers Power to discuss diesel generator building and plant area fill problems.

3/5/79 Meeting held with CPC to discuss diesel generator building and plant area fill problems.

3/21/79 10 CFR 50.54 request for information regarding plant fill sent to CPC by NRR.

5/5/79 Congressman Albosta and aides visited Midland site to discuss TMI effect on Midland.

5/8-11/79 Mid-QA inspection conducted.

Significant Major Events

Past Problems

1. Cadweld Splicing Problem and Show Cause Order

A routine inspection, conducted on November 6-8, 1973, as a result of intervenor information, identified eleven examples of four noncompliance items relative to rebar Cadwelding operations. These items were summarized as: (1) untrained Cadweld inspectors; (2) rejectable Cadwelds accepted by QC inspectors; (3) records inadequate to establish cadwelds met requirements; and (4) inadequate procedures.

As a result, the licensee stopped work on cadweld operations on November 9, 1973 which in turn stopped rebar installation and concrete placement work. The licensee agreed not to resume work until the NRC reviewed and accepted their corrective action. However, Show Cause Order was issued on December 3, 1973, suspending Cadwelding operations. On December 6-7, 1973, RIII and HQ personnel conducted a special inspection and determined that construction activity could be resumed in a manner consistent with quality criteria. The Show Cause Order was modified on December 17, 1973, allowing resumption of Cadwelding operations based on the inspection results.

The licensee answered the Show Cause Order on December 29, 1973, committing to revise and improve the QA manuals and procedures and make QA/QC personnel changes.

Prehearing conferences were held on March 28 and May 30, 1974, and the hearing began on July 16, 1974. On September 25, 1974, the Hearing Board found that the licensee was implementing its QA program in compliance with regulations and that construction should not be stopped.

2. Rebar Omission/Placements Errors Leading to IAL

Initial identification and report of rebar nonconformances occurred during an NRC inspection conducted on December 11-13, 1974. The licensee informed the inspector that an audit, had identified rebar spacing problems at elevations 642' - 7" to 652' - 9" of Unit 2 containment. This item was subsequently reported per 10 CFR 50.55(e) and was identified as a item of noncompliance in reports Nos. 50-329/74-11 and 50-330/74-11.

Additional rebar deviations and omissions were identified in March and August 1975 and in April, May and June 1976. Inspection report Nos. 50-329/76-04 and 50-330/76-04 identified five noncompliance items regarding reinforcement steel deficiencies.

Licensee response dated June 18, 1976, listed 21 separate items (commitments) for corrective action. A June 24, 1976 letter provided a plan of action schedule for implementing the 21 items. The licensee suspended concrete placement work until the items addressed in licensee's June 24 letter were resolved or implemented. This commitment was documented in a RIII letter to the licensee dated June 25, 1976. Although not stamped as an IAL, in-house memos referred to it as such.

Rebar installation and concrete placement activities were satisfactorily resumed in early July 1976, following completion of the items and verification by RIII.

Additional action taken is as follows:

a. By the NRC

- (1) Assignment of an inspector full-time onsite for five weeks to observe civil work in progress.
- (2) IE management meetings with the licensee at their corporate offices
- (3) Inspection and evaluation by Headquarters personnel

b. By the Licensee

- (1) June 18, 1976 letter committing to 21 items of corrective action.
- (2) Establishment of an overview inspection program to provide 100% reinspection of embedments by the licensee following acceptance by the contractor QC personnel.

c. By the Contractor

- (1) Personnel changes and retraining of personnel.
- (2) Prepared technical evaluation for acceptability of each identified construction deficiency.
- (3) Improvement in their QA/QC program coverage of civil work (this was imposed by the licensee).

3. Tendon Sheath Placement Errors and Resulting Immediate Action Letter (IAL)

On April 19, 1977, the licensee reported, as a Part 50, Section 50.55(e) item, the inadvertent omission of two hoop tendon sheaths

from a Unit 1 containment concrete placement at elevation 703' - 7" due to having already poured concrete in an area where the tendons were to be directed under a steam line. The tendons were subsequently rerouted in the next higher concrete lift.

An IAL was issued to the licensee on April 29, 1977, which spelled out six licensee commitments for correction which included: (1) repairs and cause corrective action; (2) expansion of the licensee's QC overview program; (3) revisions to procedures and training of construction and inspection personnel.

A special QA program inspection was conducted in early May 1977. The inspection team was made up of personnel from RI, RIII and HQ. Although five items of noncompliance were identified, it was the consensus of the inspectors that the licensee's program was an acceptable program.

The licensee issued its final report on August 12, 1977. Final review onsite was conducted and documented in report No. 50-329/77-08.

Current Problems

1. The licensee informed the RIII office on September 8, 1978, per requirements of 10 CFR 50.55(e) that settlement of the diesel generator foundations and structures were greater than expected.

Fill material in this area was placed between 1975 and 1977, with construction starting on the diesel generator building in mid-1977. Review of the results of the RIII investigation/inspection into the plant fill/Diesel Generator Building settlement problem indicate many events occurred between late 1973 and early 1978 which should have alerted Bechtel and the licensee to the pending problem. These events included nonconformance reports, audit findings, field memos to engineering and problems with the administration building fill which caused modification and replacement of the already poured footing and replacement of the fill material with lean concrete.

Causes of the excessive settlement include: (1) inadequate placement method - unqualified compaction equipment and excessive lift thickness; (2) inadequate testing of the soil material; (3) inadequate QC inspection procedures; (4) unqualified quality control inspectors and field engineers; (5) over reliance on inadequate test results.

The proposed remedial work and corrective action are as follows:

- (1) Diesel Generator Building - apply surcharge load in and around building to preconsolidate the foundation material. Continue to monitor soil response to predict long-term settlement.
- (2) Service Water Pump Structure - Install piles to hard glacial till to support that portion of the structure founded on plant fill material.
- (3) Tank Farm - Fill has been determined to be suitable for the support of Borated Water Storage Tanks. Tanks are to be constructed and hydro tested while monitoring soil response to confirm support of structures.
- (4) Diesel Oil Tanks - No remedial measure; backfill is considered adequate.
- (5) Underground Facilities - No remedial work is anticipated with regards to buried piping.
- (6) Auxiliary Building and F. W. Isolation Valve Pits - Installed a number of caissons to glacial till material and replace soil material with concrete material under valve pits.
- (7) Dewatering System - Installed site dewatering system to provide assurance against soil liquidification during a seismic event

The above remedial measures were proposed to the NRC staff on July 18, 1979. No endorsement of the proposed actions have been issued to the licensee to date. The licensee is proceeding with the above plans.

The NRC activities, to date, include:

- a. Lead technical responsibility and program review was transferred to NRR from IE by memo dated November 17, 1978.
- b. Site meeting on December 3-4, 1978, between NRR, IE, Consumers Power and Bechtel to discuss the plant fill problem and proposed corrective action related to the Diesel Generator Building settlement.
- c. RIII conducted an investigation/inspection relative to the plant fill and Diesel Generator Building settlement. Findings are contained in Report 50-329/78-20; 330/78-20 dated March 1979.
- d. NRC/Consumers Power Company/Bechtel meetings held in RIII office to discuss finding of investigation/inspection of site settlement (February 23, 1979 and March 5, 1979).

- e. NRC issue of 10 CFR 50.54(f) regarding plant fill dated March 21, 1979.
- f. Several inspections of Midland site settlement have been performed.

The Constructor/Designer activities include:

- a. Issued NCR-1482 (August 21, 1978)
- b. Issued Management Corrective Action Report (MCAR) No. 24 (September 7, 1978)
- c. Prepared a proposed corrective action option regarding placement of sand overburden surcharge to accelerate and achieve proper compaction of diesel generator building sub-soils.
- d. Issued 10 CFR 50.55(e) interim report number 1 dated September 29, 1978.
- e. Issued interim report No. 2 dated November 7, 1978.
- f. Issued interim report No. 3 dated June 5, 1979.
- g. Issued interim report No. 4 dated February 23, 1979
- h. Issued interim report No. 5 dated April 30, 1979
- i. Responded to NRC 10 CFR 50.54(f) request for information onsite settlement dated April 24, 1979. Subsequent revision 1 dated May 31, 1979, revision 2 dated July 7, 1979 and revision 3 dated September 13, 1979.
- j. Meeting with NRC to discuss site settlement causes and proposed resolution and corrective action taken dated July 18, 1979. Information discussed at this meeting is documented in letter from CFCo to NRC dated August 10, 1979.
- k. Issued interim report No. 6 dated August 10, 1979
- l. Issued interim report No. 7 dated September 5, 1979

2. Review of Quality Documentation to Establish Acceptability of Equipment

The adequacy of engineering evaluation of quality documentation (test reports, etc.) to determine if the documentation establishes that the equipment meets specification and environmental requirements is of concern. The licensee, on November 13, 1978, issued a construction deficiency report (10 CFR 50.55(e)) relative to this matter. An interim report dated November 18, 1978 was received

and stated Consumers Power was pursuing this matter not only for Bechtel procured equipment but also for NSS supplied equipment.

3. Source Inspection to Confirm Conformance to Specifications

The adequacy of equipment acceptance inspection by Bechtel shop inspectors has been the subject of several noncompliance/nonconformance reports. Consumers Power has put heavy reliance on the creditability of the Bechtel vendor inspection program to insure that only quality equipment has been sent to the site. However, the referenced nonconformance reports raise questions that the Bechtel vendor inspection program may not be effectively working in all disciplines for supplied equipment. Some significant examples are as follows:

- (1) Decay heat removal pump being received with inadequate radiography. The pumps were returned to the vendor for re-radiography and repair. The pumps were returned to the site with one pump assembled backwards. This pump was again shipped to the vendor for reassembly. CPCo witnessed a portion of this reassembly and noted in their audit that some questionable techniques for establishing reference geometry were employed by the vendor. The pumps had been shop inspected by Bechtel.
- (2) Containment personnel air lock hatches were received and installed with vendor supplied structural weld geometry which does not agree with manufacturing drawings. The personnel air lock doors had been vendor inspected.
- (3) Containment electrical penetrations were received and installed with approximately 25% of the vendor installed terminations showing blatant signs of inadequate crimping. These penetrations were shop inspected by 3 or 4 Bechtel supplier quality representatives (vendor inspectors).
- (4) 350 MCM, 3 phase power cable was received and installed in some safety related circuits with water being emitted from one phase.
- (5) A primary coolant pump casing was received and installed without all the threads in one casing stud hole being intact. The casings were vendor inspected by both Bechtel and B&W.

Additional IE inspections will be conducted to determine if CP has thoroughly completed an overview of the Bechtel shop inspector's function and that equipment already purchased has been reviewed to confirm it meets requirements.

4. "Q" List Equipment

- (1) There have been instances wherein safety related construction components and their installation activities have not been identified on the "Q" list.

This shortcoming could have affected the quality of work performed during fabrication due to the absence of quality controls identified with "Q" list items. Examples of non-"Q" list activities identified which should be "Q" listed include:

Cable Trays
Components of Heating and Ventilation System

The licensee will be advised to review past as well as future construction activities to confirm that they were properly defined as "Q" list work or components.

5. Management Controls

- a. Throughout the construction period CPCo has identified some of the problems that have occurred and reported them under the requirements of 10 CFR 50.55(e). Management has demonstrated an openness by promptly identifying these problems. However, CPCo has on repeated occasions not reviewed problems to the depth required for full and timely resolution. Examples are:

Rebar omissions (1974)
Tendon sheath location error (1977)
Diesel generator building settlement (1978)
Containment personnel access hatches (1978)

In each of the cases listed above the NRC in it's investigation has determined that the problem was of greater significance than first reported or the problem was more generic than identified by CPCo.

This incomplete wringing out of problems identified has been discussed with CPCo on numerous occasions in connection with CPCo's management of the Midland project.

- b. There have been many cases wherein nonconformances have been identified, reviewed and accepted "as is." The extent of review given by the licensee prior to resolving problems is currently in progress. In one case dealing with the repair of airlock hatches, a determination was made that an incomplete engineering review was given the matter.

Inspection History

The construction inspection program for Midland Units 1 and 2 is approximately 60% complete. This is consistent with status of construction of the two units. (Unit 1 - 54%; Unit 2 - 61%). The licensee's QA program has repeatedly been subject to in-depth review by IE inspectors. The following highlight these inspections.

1. July 23-26, and August 8-10, 1973, inspection report Nos. 50-329/73-06 and 50-330/73-06: A detailed review was conducted relative to the implementation of the Consumers Power Company's QA manual and Bechtel Corporation's QA program for design activities at the Bechtel Ann Arbor office. The identified concerns were reported as discrepancies relative to the Part 50, Appendix B, criteria requirements.

2. September 10-11, 1973 report Nos. 50-329/73-08 and 50-330/73-08: A detailed review of the Bechtel Power Corporation QA program for Midland was performed. Noncompliances involving three separate Appendix B criteria with five different examples, were identified.
3. February 6-7, 1974, report Nos. 50-329/74-03 and 50-330/74-03: A followup inspection at the licensee's corporate office, relative to the items identified during the September 1973 inspection (above) along with other followup.
4. June 16-17, 1975, report Nos. 50-329/75-05 and 50-330/75-05: Special inspection conducted at the licensee's corporate office to review the new corporate QA program manual.
5. August 9 through September 9, 1976, report Nos. 50-329/76-08 and 50-330/76-08: Special five-week inspection regarding QA program implementation onsite primarily for rebar installation and other civil engineering work.
6. May 24-27, 1977, report Nos. 50-329/77-05 and 50-330/77-08: Special inspection conducted at the site by RIII, IE AND RI personnel to examine the QA program implementation onsite by Consumers Power Company and by Bechtel Corporation. Although five examples of noncompliance to Appendix B, Criterion V, were identified, the consensus of the inspectors involved was that the program and its implementation for Midland was considered to be adequate.
7. May 8-11, 1979, a mid-construction QA inspection covering purchase control and inspection of received materials design control and site auditing and surveillance activities was conducted by a team of inspectors. While some items will require resolution, it was concluded the program was adequate.

The licensee's Quality Assurance program has undergone a number of revisions to strengthen its provisions. The company has expanded its QA/QC auditing and surveillance coverage to provide extensive overview inspection coverage. This was done in 1975 with a commitment early in their experience with rebar installation problems and was further committed by the licensee in his letter of June 18, 1976, responding to report Nos. 50-329/76-04 and 50-330/76-04. This overview inspection activity by the licensee has been a positive supplement to the constructor's own program, however, currently our inspectors perceive the overview activities cover a small percentage of the work in some disciplines. This has been brought to the licensee's attention who has responded with a revised overview plan. RIII inspectors are reviewing the plan as well as determining its effectiveness through observation of construction work. A specific area brought to the attention of the licensee was the lack of overview in the instrumentation installation area. The licensee has responded to this matter with increased staff and this item is under review by RIII inspectors.

The RIII office of inspection and enforcement instituted an augmented onsite inspection coverage program during 1974, this program has continued in effect until the installation of the resident inspector in July 1978.

Enforcement History

a. Noncompliance Statistics

Year	Number of Noncompliances	Number of Inspections	Inspector Hours Onsite
1976	14	9	646
1977	5	12	648
1978	18	23	1180
*1979 to date	7	10	429

A resident inspector was assigned to the Midland site in July 1978. The onsite inspection hours shown above does not include his inspection time.

*Through August 1979

- b. An investigation of the current soils placement/diesel generator building settlement problem has revealed the existence of a material false statement. Issuance of a Civil Penalty is currently being contemplated.

Summary and Conclusions

Since the start of construction Midland has experienced some significant problems resulting in enforcement action. These actions are related (1) to improper placement, sampling and testing of concrete and failure of QA/QC to act on identified deficiencies in September 1970; (2) to drawing control and lack of or inadequate procedures for control of design and procurement activities at the Bechtel Engineering offices in September 1973; (3) to inadequate training, procedures and inspection of cadweld activities in November 1973; (4) to a series of RIII in-depth QA inspections and meetings which identified underlying causes of weakness in the Midland QA program implementation relative to embedments in April, May and June 1976. (The noncompliance items identified involved inadequate quality inspection, corrective action, procedures and documentation, all primarily concerned with installation of reinforcement steel); (5) to tendon sheath omissions in April 1977; and (6) to plant soil foundations and excessive settlement of the Diesel Generator Building relative to inadequate compacted soil and inspection activities in August 1978 through 1979.

Following each of these problem periods, the licensee has taken action to correct the problems and to upgrade his QA program and QA/QC staff. The most prominent action has been an overview program which has been steadily expanded to cover safety related activities.

The evaluation both by the licensee and IE of the structures and equipment affected by these problems (again except the last) has established that they fully meet design requirements.

- Looking at the underlying causes of these problems two common threads emerge: (1) utilities historically have tended to over rely on A-E's (in this case, Bechtel) and (2) insensitivity on the part of both Bechtel and Consumers Power to recognize the significance of isolated events or failure to adequately evaluate possible generic application of these events either of which would have led to early identification and avoidance of the problem.

Admittedly construction deficiencies have occurred which should have been identified earlier but the licensee's QA program has ultimately identified and subsequently, corrected or in process of correcting these deficiencies.

The RIII inspectors believe that continuation of (1) resident site coverage, (2) the licensee overview program, (3) the licensee's attention and resolution of identified problems in this report, (4) ceasing to permit work to continue when quality related problems are identified with construction activities and (5) a continuing inspection program by regional inspectors will provide adequate assurance that construction will be performed in accordance with requirements and that any significant errors and deficiencies will be identified and corrected.

Concurrence: Knop Hayes Danielson Maxwell
Hansen Barrett Cook Vandel Jablonski
Lee #2 Ward Yin Gallagher Fiorelli



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

MAR 15 1979

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 meetings conducted on February 23, 1979, and March 5, 1979, between Consumers Power Company, Bechtel Corporation and NRC representatives held at the Region III office. Listing of attendees to the meetings are enclosed as Attachment No. 4. The meetings, conducted in connection with the investigation of the settlement of the Midland diesel generator building and plant area fill, represent a continuation of that effort.

A separate report of the investigation conducted during December 11-13, 18-20, 1978, and January 4-5, 9-11, 22-25, 1979, by Messrs. E. J. Gallagher, G. A. Phillip and G. F. Maxwell of this office will be issued in the near future.

During the meeting of February 23, 1979, the NRC summarized their preliminary investigation findings. These summary findings are provided in Attachment No. 1. That meeting was subsequently followed by a second meeting held on March 5, 1979, during which Consumers Power Company representatives responded to the preliminary investigation findings identified in Attachment No. 1. Those responses, which include a revised "Consumers Power Company Discussion of NRC Inspection Facts" report, are provided in Attachments No. 2 and No. 3.

Based on our investigation, review of your responses, as well as discussions during the March 5, 1979, meeting, our findings are as follows:

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MAR 15 1979

Consumers Power
Company

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- a. The quality assurance program for obtaining proper soil compaction of the Midland Site was deficient in a number of areas.
- b. Soil of the type used in the foundation of the diesel generator building is also located, to varying degrees, under other Class I structures and plant area piping.
- c. Several inaccurate statements are contained in the FSAR with respect to the soil foundations.

In addition to the above findings, we continue to be concerned with the following matters:

- a. Although you have stated that inadequate soil compaction contributed to the settlement of the D/G building, you have not determined what other factors contributed to the settlement.
- b. Because similar foundation materials were placed under other Class I structures, identified on page 3 of Attachment No. 3, we have concerns regarding the ability of the structures and components to fulfill their intended design functions under all required design bases for the life of the plant.
- c. We are concerned whether your current course of action on the settlement, which consists of preloading and consolidating the underlying supporting materials, will resolve the problem on a long term basis.

As you are aware, the March 5, 1979, meeting was concluded with your informing us that within two weeks you would provide additional soils exploratory information that might account for the differences between the fill supporting the diesel generator building and that of the other Class I structures. You also stated that in the event the available information is insufficient to demonstrate resolution of the settlement problem, a further course of action would be provided.

In that this matter is related to plant design, we are forwarding it to our NRC Headquarters staff for further review and evaluation. We will keep you informed of their action in this matter.

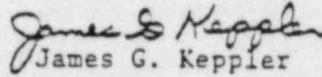
MAR 15 1979

Consumers Power
Company

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Based on a March 9, 1979, telephone conversation with a member of your staff who informed us that the report contains no proprietary information, this report will be placed in the NRC's Public Document Room.

Sincerely,


James G. Keppier
Director

Attachments:

1. NRC Presentation of Investigation Findings of the settlement of the Diesel Generator Building and Plant Area Fill dtd 2/23/79
2. Consumers Power Company Discussion of NRC Inspection Facts Resulting from the NRC Investigation of the Diesel Generator Building Settlement (revised 3/9/79)
3. Consumers Power Company Response to NRC Question on the Condition of Soils Under All Other Plant Areas dtd 3/5/79
4. Attendance List at 2/23/79 and 3/5/79 Meetings

cc w/attachments:

Central Files
Reproduction Unit NRC 20b
PDR
Local PDR
NSIC
TIC
Ronald Callen, Michigan Public
Service Commission
Dr. Wayne E. North
Myron M. Cherry, Chicago