E. Adensam
10/31

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

OCT 2 8 1983

MEMORANDUM FOR: R. J. Bosnak, Chief
Mechanical Engineering Branch, DE

FROM: D. Terao
Mechanical Engineering Branch, DE

THRU: H. L. Brammer, Section Leader,
Mechanical Engineering Branch, DE

SUBJECT: TRIP REPORT SUMMARY FOR MIDLAND HVAC DESIGN AUDIT (TAC# 141433)

On October 5-7, 1983, the staff met with the applicant for the Midland plant and its architect-engineer to perform a design review and audit of the Midland HVAC system. The review was performed in response to a Region III task interface agreement as requested in a memorandum from R. L. Spessard to D. G. Eisenhut dated August 4, 1983.

The design review and audit included an extensive review of the Midland HVAC design specifications, design criteria, analytical procedures, drawings, sample calculations, and test report. In addition, the staff toured the Midland plant to view several locations where safety-related HVAC systems were installed.

The review performed for Midland has required significantly more effort than our review effort previously done for LaSalle. The reasons are twofold:

1) For LaSalle, the licensee and its architect-engineer were acutely aware of the HVAC allegations and initiated actions accordingly prior to meeting with the staff to demonstrate that the inherent design margins for the HVAC structural integrity were large. The staff reviewed the licensee's justification for technical adequacy. However, for Midland, the applicant and its architect-engineer did not appear to fully understand the HVAC allegations and, thus, no actions had been initiated by the licensee prior to our meeting to present a justification for the HVAC design adequacy. Thus, it became necessary for the staff to perform an in-depth review of the Midland HVAC design basis to first gain an understanding of the design methodology that was used in the HVAC structural design.

2) With a thorough understanding of the design methodology, the staff was able to proceed in order to quantify the design margins for the HVAC structural integrity. For LaSalle, the architect-engineer did not use AISC Code design rules as was used on Midland. For LaSalle, the HVAC structural design was based on a more conservative screening criteria (0.5 Sy or 18 ksi) which qualified the supports to an allowable value of approximately one-half of the AISC allowables (0.9 Sy). For those supports where this conservative criteria could not be met, the design

was requalified on a case-by-case basis to an increased allowable value of 22,000 psi which was still below AISC allowables. Thus, the LaSalle design had established in its screening criteria a large design margin to the AISC code allowables in addition to the inherent design margins of the code allowables to structural failure. Consequently, it was not necessary to extensively review support calculations to establish the LaSalle design margin because a large design margin was obviously established in the support design screening criteria. A review of actual calculated stresses for LaSalle assured that further design margins existed. For Midland, the architect-engineer used the AISC Code design rules for the HVAC structural design. Consequently, one cannot determine the design margin between the actual calculated stresses and the AISC Code allowables without reviewing the actual calculated stresses. Thus, it became necessary for the staff to audit a sufficient quantity of HVAC support calculations to establish the typical design margins to Code allowables for the Midland HVAC system.

For the above two reasons, the Midland HVAC review effort was considerably more extensive than the LaSalle effort.

The detailed results of our review and audit are attached to this memorandum. Several unresolved concerns remained at the conclusion of our meeting. The applicant will provide a response to our concerns within the next few weeks. We will evaluate the acceptability of the response and address the resolutions in our final safety evaluation to be transmitted to DL.

The HVAC review for Clinton is planned to be performed in mid-November. The Clinton review is expected to be similar to the LaSalle review because of Sargent & Lundy's design role in both facilities.

D. Terao

D. Terao
Mechanical Engineering Branch
Division of Engineering

cc: R. Vollmer, DE
J. Knight, DE
T. Novak, DL
E. Adensam, DL
D. Hood, DL
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F. Hawkins, RIII
W. LaFave, DSI
C.D. Sellers, DE

Staff Design Review and Audit of the Midland HVAC System

On October 5-7, 1983, staff representatives from Region III and NRR met with the applicant (Consumers Power) for the Midland Plant and its architect-engineer (Bechtel Power Corporation - Ann Arbor Office) to discuss the design of the Midland HVAC system. The staff review included the structural design (performed by MEB), the system design (performed by ASB), and the materials review (performed by MTEB). This trip report summary will cover the review performed by the Mechanical Engineering Branch.

The mechanical review was divided into two parts. First, the review of the HVAC design specifications, design criteria, development of procedures, and HVAC duct work calculations was performed at the Bechtel (Ann Arbor, MI) office. Second, the audit of the HVAC component support calculations was performed at the Midland plant site.

The Bechtel resident engineering (Ann Arbor office) was responsible for the development of the HVAC design specifications, design criteria, and procedures. In addition, the calculations to qualify the HVAC duct work was performed by the Ann Arbor office. The Bechtel field engineering was responsible for using the design procedures to qualify the HVAC component supports onsite as the design and installation of the HVAC system progressed. The details of the resident engineering review and the field engineering review will be discussed in the following sections.

HVAC Review Performed at Bechtel (Ann Arbor) Office

On October 4, 1983, the staff met with Consumers Power and Bechtel to review and audit the Midland HVAC system design. The purpose of the meeting was to evaluate the significance of using material which cannot be determined to conform to their specifications. From a structural integrity standpoint, the staff wanted to quantify the actual design margin that existed in the HVAC ducting, supports, bolts, and welds to determine if the strength variability of substituted materials could affect the ability of the HVAC system to perform its intended function.

Bechtel first explained the division of responsibility between the resident and field engineering for the HVAC design. In 1977, the HVAC support design was performed in Ann Arbor. In 1978, Bechtel established the field engineering to resolve non-conformance reports (NCR) and other field-related items. Currently, all civil/structural work for HVAC design is performed at the site. Supporting work is performed in Ann Arbor. Bechtel noted that they do not have a a separate HVAC design group. The mechanical engineers are responsible for the HVAC systems design and the civil/structural engineers are responsible for the structural design (restraint members, ducting, bolts, stiffeners, etc). The HVAC structural members are designed to the same design criteria as the building steel (AISC Code).

The staff requested the design specification, design criteria, and analytical procedures used for the design of HVAC ducting, supports, and bolts. A list of the documents reviewed by the staff are shown in Attachment A to this report.

The staff questioned Bechtel why they were using a draft procedure (unapproved) for the design of HVAC supports and ducting. Bechtel stated that the procedure they have used was based on separate memoranda and individual procedures that were formally issued. The draft design guide was a compilation of the separate procedures. Bechtel stated that they intend to formally issue the draft design guide for HVAC supports by October 31, 1983.

The staff asked if Bechtel follows the design rules of SMACNA standards. Bechtel stated that they do not use SMACNA standards, but, rather, use their generic design as shown in drawings C-842 through C-849.

Bechtel explained the seismic design for the HVAC system. The M-151A design specification stipulates that the ducting span between supports shall not exceed 8 feet (2 feet for a cantilever). This "8 ft" criteria is applicable for all HVAC rectangular duct sizes. If the 8-ft criteria is exceeded, the M-151 spec requires that the exceedance be noted on the drawings. A unique calculation would subsequently be performed using the design guide to qualify the exceedance. Bechtel noted that in reviewing their HVAC drawing, there were approximately 170 spans that exceeded the 8-ft criteria (effecting 340 supports). The largest span that exceeded the 8-ft criteria was approximately 11 feet.

The staff asked Bechtel for the basis of the 8-ft span criteria. Bechtel stated that the 8-ft span was conservatively selected to limit all HVAC duct sizes to a rigid frequency range (greater than 33 hertz). The lowest frequency calculated for all the duct sizes was approximately 55 hertz. Thus, the HVAC ducting when limited to an 8-ft span would not be subjected to the resonant peak accelerations induced by the building response during a seismic event.

The staff reviewed the design specification for HVAC installation (M-151). The staff noted in Section 5.0 of the specification that several types of material are listed for sheet metal and structural members. However, the specification does not specify the particular application for which the various materials are to be used. Bechtel stated that no "exotic" materials are specified. The staff noted that some of the structural steel materials do have minimum yield strengths greater than the typical A36 steel yield strength of 36 ksi; however, it was not clear where these materials were used. Bechtel stated that all materials are stated on their design drawings and that all high-strength materials used (if any) are, thus, identifiable.

The staff reviewed the calculation (Calc. No. SQ-180-Q) for the qualification of the ductwork and stiffeners for the maximum loading. The calculation was based on the 8-ft duct span length and assumed a duct yield strength of 30 ksi and a stiffener yield strength of 36 ksi. The calculation was performed for various duct sizes and was based on an empirical formula derived from testing performed for the Limerick plant. In the calculation, the effects of seismic loads were translated into equivalent pressure loads. Bechtel provided the staff with a summary of the HVAC duct analysis results. The summary showed that for all duct sizes the average design margin to failure was approximately a factor of 4. The most limiting duct size was a 108" x 16" which had a design margin of 1.40. The critical failure mode was stiffener buckling. A summary of the HVAC duct analysis results is provided in Attachment B.

A list of meeting attendees is attached to this report in Attachment C.

HVAC Review Performed at Midland Site

On October 5-6, 1983, the staff met with Consumers Power and Bechtel at the Midland site to review the analytical procedures used and the calculations performed for the HVAC supports and the ducting which exceeds the 8-ft span criteria.

The staff noted that room coolers are used extensively in Midland and asked how much HVAC ducting is actually used in the Midland plant. Bechtel stated that approximately 8000 lineal feet of safety-related ductwork are used in the plant.

The staff asked for the procedure used to calculate HVAC support loads. Bechtel stated that a draft design guide entitled, "Design Guide for HVAC Supports (DRAFT)," Calc. No. 34-71(Q) is used. In addition, Bechtel stated that for the qualification of HVAC duct spans greater than 8 ft, the draft design guide entitled, "Design Guide for Nuclear Power Plant Seismic Category I Rectangular HVAC Ducts (DRAFT)," is used. The HVAC ducting within the 8ft-span criteria was qualified by testing performed by Bechtel for the Limerick plant and analytically qualified for Midland in the Calc. No. SQ-180(Q), Rev. 0. The 8-ft criteria was established conservatively for convenience resulting in a generic HVAC support designs based on maximum (8-ft) spans and maximum loadings.

During the October 5-6, 1983 meeting at the Midland site, the staff review of the HVAC system was divided into five major aspects:

1) review of the design guide for HVAC supports,

2) review of the HVAC duct calculation for spans greater than 8 ft,

3) review of the HVAC support calculations to determine design margins,

4) visual observation of the HVAC system installed in the plant, and

5) review of test report for HVAC duct seismic qualification.

The details of the staff review are included in the following sections of this report. A list of attendees at the October 5, 1983 site meeting is included in this report in Attachment D.

1) Review of HVAC Support Design Guide

The staff reviewed the HVAC Support (Draft) design guide (calc. No. 34-71 Q). Bechtel noted that the seismic response spectra used for the HVAC support design is conservative. The supports (welded structures) are designed using a damping value of 2% for both OBE and SSE loads. Regulatory Guide 1.61 allows for welded steel structures 2% for OBE and 4% for SSE. The ratio of the maximum peak acceleration for the SSE at 2% to the maximum peak acceleration for the SSE at 4% is approximately 1.4. Thus, at the maximum peak acceleration, the use of the 2% damping results in an additional design margin of approximately 1.4 for welded steel structures.

It should be noted that the HVAC duct is more rigid than the HVAC supports because of the conservative 8-ft span criteria. Typically, the HVAC duct fundamental beam bending frequency between support spans of 8 ft is approximately 150 hertz (with the lowest frequency approximately 55 hertz) whereas the fundamental frequency of HVAC supports are typically less than 33 hertz.

The welds for HVAC supports are governed by AWS D1.1-72. Weld tensile strength is assumed to be 60 ksi for E60 electrode. For a 3/16" fillet weld the allowable weld strength is equal to:

$$(3/16)(0.707)(0.3)(60{,}000) = 2386 \text{ lbs/inch}$$

For accident conditions, a 50% increase in the design allowable is used resulting in an allowable strength of 1.5 x 2386 = 3579 lbs/inch. The design margin to tensile failure is, thus, 1/(0.3)(1.5) = 2.22 at the accident condition allowable weld strength.

The structural steel used for the HVAC support member is designed in accordance with the AISC, "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings."

In Section 4.5.1 of the Design Guide for HVAC Supports, the allowable stresses for the structural steel and tube sections were given as follows:

Allowable stress in accident conditions:
bending and torsion = 0.9 Fy
shear = 0.5 Fy

where Fy is the material yield strength.

The applicant noted that in Section 4.5.5 of the design guide, their internal design audit identified that for expansion anchor bolts, the prying action of the baseplate was to be ignored. This item is considered to be open and is to be resolved by Bechtel. In accordance with IE Bulletin 79-02, the effect of prying action of the baseplate on the anchor bolts needs to be considered for the anchor bolt loads.

The staff identified a second concern in the review of the HVAC duct flange bolting. The generic design detail shown on Dwg. No. C-844(Q) specifies a 3/8-inch bolt with a 6-inch maximum spacing for the duct flanges. However, the design guide does not require a calculation for the duct flange bolt loads. Consequently, it was not evident that the 3/8-inch bolts in the duct flanges were qualified for seismic loadings and, thus, the staff was not able to quantify the bolt design margin. At the meeting, Bechtel performed an informal calculation using the worst case loadings and found that the stresses in the flange bolts are acceptable. For a 30 x 30 inch duct with an 8-ft span, the maximum loading resulted in a loading of the bolts to 25% of its ultimate tensile strength. Bechtel stated that they will document the calculation for the 3/8-inch bolts and provide them to the staff when completed. (The shear load was shown to be less governing than the tensile load and is, thus, also acceptable.)

2) Review of the Calculation for Exceedance of 8-ft Span

The staff reviewed the calculation performed by the Bechtel site engineering when the duct span between supports exceeded the 8-ft maximum criteria provided in the M-151 specification (Calc. No. 34-293(Q) Revision 0). The span of the duct was 11.08 ft. The calculation did not calculate the frequency of the duct, but rather used the maximum peak acceleration of the building seismic response spectra to calculate the support loads. The maximum peak accelerations were multiplied by a factor of 1.5 to account for higher mode response contribution. The duct stresses met the allowable of 0.9 Sy for SSE (27,500 psi) and 0.6 Sy for OBE (18,000 psi). Buckling was checked and found acceptable. The shear stress was checked and found to be 6226 psi with an allowable of 0.5 Sy (15,000 psi).

3) Review of Design Margins

The staff reviewed several calculations selected at random for safety-related HVAC supports. The calculated stresses for the structural steel, welds, and expansion anchor bolts are tabulated in Attachment E to this report. The calculated stresses are shown as a percentage of the allowable value (i.e., for an allowable stress of 30,000 psi a calcualated stress value of 15,000 psi will be tabulated as 0.50). It should be noted that in Calc. No. 648-S 1.26 (Rev. 0) for a structural tube steel member purchased to a yield strength of 46 ksi, the calculation conservatively used a yield strength of 36 ksi. Other conservatisms noted in the calculation including grouping similar member sizes and using the largest loading in each direction (axial, bending, and torsion) for the interaction equation. Similarly, weld sizes were grouped to determine the maximum stress.

In reviewing the ratio of the calculated stress to allowable stress, it can be seen that the anchor bolt and welds tend to be the controlling component in HVAC support design. The structural steel members are generally frequency-controlled. Thus, the stresses in the structural steel members are typically small compared to the allowable stress (10-20 percent of the allowable stress) whereas the stresses in the anchor bolt are typically large relative to the structural steel stress (greater than 50% of the allowable stress). It should be noted that expansion anchor bolts are designed with a margin of safety of four to its tensile capacity (i.e., the allowable stress is equal to one-fourth of its tensile strength). The factor of safety provided in IE Bulletin 79-02 accounts for anchor failure due to bolt slippage, not tensile failure. Thus, the use of substitute material for expansion anchor bolts does not appear to be a significant concern when bolt slippage is more likely to be the mode of failure rather than bolt tensile failure.

4) Visual Observation of HVAC Systems

The staff inspected several areas of the Midland plant where safety-related HVAC systems are installed. The purpose of the visual tour was to gain a better understanding of the installed HVAC structural design and to identify any critical areas where the design assumptions could be potentially challenged.

The areas of the plant viewed by the staff were:

a) Diesel Generator Building,
b) ESF Pump Room (B),
c) Fuel Handling Area,
d) Inside Containment,
e) Switch Gear Room,
f) Lower Cable Spreading Room,
g) Upper Cable Spreading Room,
h) HVAC Equipment Room, and
i) Control Room

In the following paragraphs, staff comments based on visual observations are included for each area inspected.

a) Diesel Generator Building

The 8-ft-span criteria appears to be met and appears very conservative for the large ducting in this building. The duct looks very rigid. The supports and duct appear overdesigned. The welds and bolts appear to be the critical component for the HVAC structural integrity.

b) ESF pump Room B

The 8-ft span appears to be met. Room coolers have been used in all ESF Pump Rooms. The only ducting in the room is a round 10-inch (10-gauge) duct used for cooler exhaust.

c) Fuel Handling Area

8-ft span appears to be met. The supports and duct look similar to those in diesel generator building.

d) Inside Containment

Reactor building fan coolers have been used inside containment. There is very little ducting (except for two long vertical round ducting (approximately 3 feet O.D.) along containment wall. The containment spray lines are routed in front of the vertical ducting. The ducting is not safety related but are seismically supported. In two locations the duct spans appear to exceed 8-ft criteria. If the ducting fails, the containment spray lines could be impacted. The ducting was not installed by Zack.

e) Switch Gear Room

An HVAC support was found severed. An attached tag identified that a material sample was taken by MPQAD (RIII sample for testing by Franklin Institute).

f) Lower Cable Spreading Room

No significant observations.

g) Upper Cable Spreading Room.

No significant observations.

h) HVAC Equipment Room

The seismic building response in horizontal direction could be amplified significantly in the top floor of the control tower. A large quantity of heavy HVAC equipment and large size ducting is suspended from ceiling.

i) Control Room

A large quantity of HVAC ducting is suspended from ceiling. The ducting is very tightly packed, and it was difficult to see supports above ducting. The Independent Design Review performed by TERA will inspect the control room HVAC system.

5) Review of HVAC Ductwork Test Report

On October 6, 1983, the staff was provided a copy of a report on testing of HVAC ductwork specimens performed by Bechtel for the Limerick Generating Station. The test results were used to develop the empirical formula utilized in the design guide, "Design Guide for Nuclear Power Plant Seismic Category I Rectangular HVAC Ducts."

The testing was performed by Hales Testing Laboratories of Oakland, California. The testing was based on A526 and A527 ductwork material with a minimum yield strength of 36 ksi. The significant conclusions of the testing included the following results.

- Failure modes of the ducts were not catastrophic and there was a great reserve strength after failure.
- Pressure loading was the most important loading. Live load and seismic loads were less important.
- Effects of seismic loads can be simulated by pressure loads.
- The primary failure modes of rectangular ducts were by corner crippling of sheet and by stiffener buckling.
- Live load stresses in the sheet and stiffeners were low.

The staff review of the test report and the design guide for HVAC ductwork which was developed from the test results resulted in the following concern.

The design specification (M-151) requires that HVAC duct material A526 and A527 be provided with a minimum yield strength of 30 ksi. (Note: the ASTM Specification for A526 and A527 does not require a minimum yield strength). Zack purchase orders were reviewed and found to have specified a 30 ksi minimum yield stress. Several invoices were also reviewed and the A526 and A527 material for safety-related ducting was found to have met the 30 ksi minimum yield strength. However, the design guide for HVAC ductwork states that the minimum yield strength should be 36 ksi. The empirical formula in the design guide is not based on a specific minimum yield strength but includes a term, fy, for the applicable material minimum yield strength. However, the design tables which were generated using the empirical formula and provided in the design guide are based on a 36 ksi minimum yield strength. Thus, it is not clear to the staff that the design guide (which was apparently developed for Limerick) has been properly used for the Midland HVAC duct calculations where the duct spans exceed 8 ft. The design guide does appear to have been properly used for the qualification of the 8-ft span as reviewed in Calc. No. SQ-180(Q), Rev. 0. However, the staff has not seen evidence that the design guide was used in the duct stress calculation for the approximately 170 duct spans which exceeded the 8-ft criteria. The staff requested that the applicant provide these additional calculations which used the design guide for HVAC duct calculations where the 8-ft span criteria was exceeded.

<u>Summary of Unresolved Audit Findings</u>

The following is a summary of the unresolved concerns identified by the staff in the HVAC design audit performed for the Midland plant. The preliminary conclusion of the staff is that the overall structural design of the HVAC system is adequate. However, the following concerns need to be resolved before a final determination of the design margin can be established. The concerns are as follows:

1) It is not evident that Bechtel is properly using the design guide for HVAC ductwork to qualify the ductwork when the span between supports exceeds 8 feet. The applicant must provide a clarification of the design guide procedure.

2) The two seismically supported HVAC ductworks which are not safety related are routed vertically along the containment wall appear to have duct spans exceeding the 8-ft criteria. The applicant must provide the basis for assuring that the duct has been properly qualified for seismic loads.

3) The expansion anchor bolts in the HVAC support baseplates appear to be the most limiting component in the HVAC structural design. Prying action of the baseplate on the bolts have been ignored according to the design guide for HVAC supports. The applicant must provide the effect of the prying action on the bolts in order to establish its impact on the bolt design margin.

4) The qualification of HVAC duct flange bolts (3/8") has not been properly documented for the applicable loadings. The applicant must provide a documented calculation to qualify the 3/8" duct flange bolts in order to establish the bolt design margin.

Attachment A
List of Documents Reviewed

Documents Reviewed at 10/4/83 Meeting

1.* Design Specification "Technical Specification for Seismic Class I Heating, Ventilating, and Air Conditioning Equipment and Ductwork Installation," Revision 15 (including SCN 32-36). Specification No. 7220-M-151A(Q).

2.* Design Criteria "Civil and Structural Design Criteria for the Midland Nuclear Plant, Units 1 and 2," Revision 12, Specification No. C-501(Q).

3.* Design Procedures "Design Guide for Nuclear Power Plant Seismic Category I Rectangular HVAC Ducts (DRAFT)," dated April 15, 1978.

4. Calculations for ductwork/stiffeners Calculation No. SQ-180(Q), dated 5/16/83, Rev. 0.

5. Drawings C-842 thru C-849* (generic duct construction details) C-850 thru C-999 (duct support details) C-1200 (duct support details) C-1300 (duct support details)

6. HVAC Hanger Log (computer listing) - uncontrolled document

Documents Reviewed at 10/5/83 Meeting

1. Calculations "Design Guide for HVAC Supports (DRAFT)," Calc.No. 3471(Q)
2. Calc.No. 34-62 (Q) dated 8-25-82
3. Calc.No. 34-39 (Q) dated 11/5/81
4. Calc.No. 21G (4.4143)(Q) Rev. 0
5. Calc.No. 21G (4.146)(Q) Rev. 0
6. Calc.No. 29D.276 (Q) Rev. 0
7. Calc.No. 648-S 1.26 (Q) Rev. 0
8. Calc.No. 21F (3.136)(Q) Rev. 0
9. Calc.No. 21I (6.95 (Q)
10. Calc.No. 34-292 (Q) Rev. 0

Design Specification

11. Design Specification Q-7 (Containment Building Response Spectra)
12. "Report on Testing of Class 1 Seismic HVAC Duct Specimens for the Limerick Generating Station, Units 1 and 2," April 1976.

*Copies of these documents were obtained by the staff.

Attachment B
Summary of HVAC Duct Analysis Results(3)

Duct Size (inches)(1)	Sheet Metal Gauge	Stiffener	Allowable Pressure (psi) Sheet Metal	Allowable Pressure (psi) Stiffener	Governing Allowable Pressure (psi)	Calculated Worst Loading (psi)(2)	Design Margin
Control Room (Aux Bldg)							
60x26	18	L2x2x3/16	0.86	0.69	0.69	0.294	2.35
36x26	16	L1½x1½x1/8	1.40	1.40	1.40	0.301	4.65
Diesel Generator Bldg							
60x60	16	L2x2x3/16	1.082	0.691	0.69	0.253	2.73
30x40	16	L1½x1½x1/8	1.322	1.40	1.32	0.253	5.22
Service Water Pump Structure							
72x44	16	L3x3x3/16	1.064	1.102	1.102	0.230	4.79
72x24	18	L3x3x3/16	0.865	1.102	0.865	0.223	3.88
52x44	16	L2x2x1/16	1.237	0.98	0.98	0.230	4.26
42x26	18	L1½x1½x1/8	1.111	0.94	0.94	0.223	4.22
28x26	18	L1½x1½x1/8	1.408	1.04	1.04	0.223	4.66
Auxiliary Building							
108x16	14	C 3x5.0	1.14	0.47	0.47	0.335	1.40
108x16	14	C 5x6.7	1.14	1.25	1.14	0.628	1.75
60x32	18	L2x2x3/16	1.15	0.69	0.69	0.326	2.12
38x38	16	L1½x1½x3/16	1.44	1.22	1.22	0.330	3.70
76x40	16	L3x3x3/16	1.04	0.97	0.97	0.254	3.82
50x40	16	L2x2x3/16	1.25	1.08	1.08	0.259	4.17
54x36	18	L2x2x3/16	0.98	0.89	0.89	0.320	2.78
28x14	18	L1x1x1/8	1.41	1.05	1.05	0.234	4.49
24x24	18	L1x1x1/8	1.56	1.59	1.56	0.223	7.00
12x6	13	L1x1x1/8	2.59	11.10	2.59	0.234	11.07
60x36	16	L3x3x3/16	1.15	1.70	1.15	0.593	1.94

(1) Largest duct size for the same gauge sheet metal and stiffener.

(2) Worse case loading is Dead Load + P + W where P - operating pressure W - wind load. The worst case loading bounds seismic load combinations.

(3) Summary of results from Bechtel Calc. No. SQ-180(Q) dated 5/16/83. Stresses due to dead load, seismic load, wind and internal pressures are converted to equivalent internal pressure loads for comparison.

Attachment C-1

NRC HVAC Audit
Attendance
October 4, 1983

Name	Company/Discipline
D. F. Lewis	Bechtel/Asst. Proj. Engr.
G. R. Tree	Civil Resident, BPCO
Jon Rysdon	Bechtel Civil, AAO
D. R. Anderson	Bechtel Resident Project Engineer
F. Hawkins	NRC-RIII
Dennis England	CPC Nuc. Lic.
J. N. Leech	CPCo Licensing
V. P. Provenzano	CPCo Licensing/Legal
D. Terao	NRC/MEB
W. T. LeFave	NRC/DSI/ASB
Darl S. Hood	NRC/DL/LB4
Frank Hand	CPCo/Civil Consultant
G. D. Eichenberger	CPCo/Material
S. S. Petel	Bechtel/AL

Attachment C-2

NRC HVAC Audit
Attendance
October 4, 1983

Name	Company/Discipline
John Gunning	Bechtel/Lic.
Rob Burg	Bechtel/Licensing
Arun Amin	Bechtel/Mech.
W. H. Nielson	Bechtel Construction (AZ)
G. L. Richardson	Bechtel/Proj. Mgt.
Glen E. Crosby	Bechtel/QA
F. [illegible]. Lentz	CPCo/QA
James E. Baiers	Clark, Klein
P. V. Regupathy	Bechtel/Civil
Douglas M. Witt	TERA
E. M. Hughes	Project Engineer
R. C. Hollar	Bechtel PQE
G. Borsteins	Bechtel-Mech. Staff
R. Nicolaus	Bechtel-Mech.
B. Heiberger	CP MPQAD-HOACA
D. Scribner	Bechtel/Civil Staff
R. L. Tenteberg	CPCo/Mechanical Proj. Eng.
Terry Postlewait	CPCo/Mech. Proj. Engrg.

Attachment D

NRR Site Mtg
October 5, 1983

Name	Organization
J. G. Balayer	CPCo, SMO
Gary Tree	BPCO Civil Resident
Carl Miller	BPCO Resident QE
David Terao	NRC/NRR/MEB
Darl Hood	NRC/NRR/DL/LB4
F. Hawkins	NRC/RIII
W. T. LeFave	NRC/NRR/ASB
Frank Hand	CPCo Civil
James Baiers	Clark, Klein
D. T. Scribner	Bechtel/Civil Staff
B. J. Boulton	CPCo, Proj. Engr. - Jackson
B. Heiberger	MPQAO-HVACA
D. England	CPCo Legal/Licensing
V. P. Provenzano	CPCo Legal/Licensing
Sol Esperanzh	Bechtel RE HVAC
A. Amin	Bechtel/Mechanical
Andrew Fok	Bechtel/Civil
Tom Supplee	Bechtel R. E. Plant Design HVAC

Attachment E

Tabulation of Calculated vs. Allowable Stress

Location	Calc. No.	Description	Calculated Stress / Allowable Stress
Control Room	21 G (4.4143)	W 6 x 12	0.23
		L 3 x 3 x ¼	0.19
		L 2 x 2 x ¼	0.13
		L 2 x 2 x ¼	<0.13
		L 3½ x 3½ x ¼	0.05
		weld	0.76
		weld	0.10
		weld	0.61
		weld	0.51
Control Room	21 G (4.146)	all structural members	0.48
		weld	0.03
		anchor bolt	0.50
Control Room	29 D 276	L 3 x 3 x ¼ (all)	0.33
		W 6 x 12	0.04
		TS 2 x 2 x ¼	0.04
		weld	0.42
		weld	0.73
		weld	0.57
Service Water Bldg	648-S126	TS 3 x3 x ¼	0.15
		TS 2 x 2 x ¼	0.09
		L 2 x 2 x ¼	0.13
		weld	0.03
		weld	0.12
		weld	0.68
		weld	0.06
		weld	0.35
		anchor bolt	0.40
		anchor bolt	0.88
		anchor bolt	0.64
		anchor bolt	0.80
Auxiliary Bldg	21 F (3.136)	L 2 x 2 x ¼	0.13
		TS 2 x 2 x ¼	0.14
		weld	0.04
		weld	0.20
		weld	0.15

Location	Calc. No.	Description	Calculated Stress / Allowable Stress
		weld	0.04
		anchor bolt	0.58
		anchor bolt	0.34
Auxiliary Bldg	21 I (6.95)	TS 4 x 4 x ¼	0.32
		TS 2 x 2 x ¼	0.48
		L 2 x 2 x ¼	0.36
		PL ½ x 18	0.13
		weld	0.40
		weld	0.35
		weld	0.15
		weld	0.24
		weld	0.29
		weld	0.25
		weld	0.10
		weld	0.23
		weld	0.32
		L 4 x 4 x ½	0.44 (shear controlling)

19/131

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

OCT 7 1982

Docket Nos: 50-329
and 50-330

MEMORANDUM FOR: Richard H. Vollmer, Director
Division of Engineering

FROM: Thomas M. Novak, Assistant Director
for Licensing
Division of Licensing

SUBJECT: INDEPENDENT REVIEW PROGRAM - MIDLAND UNITS 1 AND 2

This memo forwards for your action the Consumers Power Midland Plant Independent Review Program dated October 5, 1982. As discussed in the attached letter, the ACRS recommended a broader and independent assessment of Midland's design adequacy and construction quality. Consumers Power has proposed a three-part program consisting of biennial quality audits, an INPO-type construction evaluation, and an independent design verification of the auxiliary feedwater system.

The applicant has requested a meeting with the staff to discuss the acceptability of the proposed program. This meeting has tentatively been scheduled for the afternoon of October 19, 1982. You are requested to review the attached program and provide Division of Engineering's views and comment prior to the meeting. Please contact Darl Hood (X28474) or Ron Hernan if you require additional information.

Thomas M. Novak, Assistant Director
for Licensing
Divison of Licensing

Enclosure:
As stated

cc: D. Eisenhut w/encl.
R. Purple "
R. DeYoung "
S. Chestnut "
J. Knight "
E. Sullivan "
D. Allison "
D. Hood "
R. Hernan w/o encl.
J. Keppler - RIII "
R. Warnick - RIII "
W. Shafer - RIII "
E. Adensam
W. Hass

8210280450

-- /.

James W Cook
Vice President - Projects, Engineering and Construction

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

October 5, 1982

Harold R Denton, Director
Office of Nuclear Reactor Regulation
Division of Licensing
US Nuclear Regulatory Commission
Washington, DC 20555

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

MIDLAND NUCLEAR COGENERATION PLANT
MIDLAND DOCKET NOS 50-329, 50-330
MIDLAND PLANT INDEPENDENT REVIEW PROGRAM
FILE: 0485.16 SERIAL: 18879

REFERENCES: (1) R L TEDESCO LETTER TO J W COOK DATED JULY 9, 1982.
(2) J W COOK LETTER TO H R DENTON, SERIAL 18850 DATED SEPTEMBER 17, 1982.

ENCLOSURES: (1) MIDLAND PLANT INDEPENDENT REVIEW PROGRAM
(2) PERFORMANCE OBJECTIVES AND CRITERIA FOR CONSTRUCTION PROJECT EVALUATION INPO, SEPTEMBER 1982

The ACRS interim report on the Midland Plant, dated June 8, 1982, contained a recommendation for a broader assessment of Midland's design adequacy and construction quality. In its correspondence of July 9, 1982, which is Reference 1 above, the NRC endorsed this ACRS recommendation and requested our proposal for performing an independent design adequacy review.

We briefly outlined several assessment activities for the Midland Project in our correspondence of September 17, 1982, identified above as Reference 2. Additional details of the program referred to in Reference 2 are enclosed for the NRC's review.

We have contacted our NRC Project Manager, Darl Hood, to arrange a meeting with the NRC Staff to discuss our Independent Review Program and to receive your concurrence or redirection of our plans. We will complete the planning phase, including team orientation and training, for the INPO program by

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October 29, 1982. We wish to initiate the implementation phase of the INPO program by November 8, 1982, in order to support our own and industry commitments to NRC.

James W. Cook

JWC/GSK/RLT/bjw

CC Atomic Safety and Licensing Appeal Board, w/a 1
CBechhoefer, ASLB, w/a 1
MMCherry, Esq, w/a 1
FPCowan, ASLB, w/a 1
RJCook, Midland Resident Inspector, w/a 1 & 2
RSDecker, ASLB, w/a 1
SGadler, Esq, w/a 1
JHarbour, ASLB, w/a 1
GHarstead, Harstead Engineering, w/a 1
DSHood, NRC, w/a 1 & 2 (2)
FJKelley, Esq, w/a 1
WHMarshall, w/a 1
WDPatton, Esq, w/a 1
WDShafer, NRC, w/a 1 & 2
BStamiris, w/a 1
MSinclair, w/a 1
LLBishop, Esq, w/a 1

BCC RCBauman, P-14-312B, w/o
JBeck, TERA, w/a 1
JEBrunner, M-1079, w/a 1 & 2
EMHughes, Bechtel, w/a 1
RWHuston, Washington, w/a 1
BWMarguglio, JSC-220A, w/a 1
DBMiller, Midland, w/a 1
MIMiller, IL&B, w/a 1
GSKeeley, P-14-113B, w/a 1
LKube, MAC, w/a 1
JARutgers, Bechtel, w/a 1
PSteptoe, IL&B, w/a 1 & 2
TJSullivan/DMBudzik, P-24-624A, w/o
RLTeuteberg, P-24-505, w/a 1
FCWilliams IL&B, w/a 1
JDeMeester, P-24-414, w/o
DFJudd, B&W, w/a 1
NRC Chron File

CONSUMERS POWER COMPANY
Midland Units 1 and 2
Docket No 50-329, 50-330

Letter Serial 18879 Dated October 5, 1982

At the request of the Commission and pursuant to the Atomic Energy Act of 1954, and the Energy Reorganization Act of 1974, as amended and the Commission's Rules and Regulations thereunder, Consumers Power Company submits Midland Plant Independent Review Program.

CONSUMERS POWER COMPANY

By /s/ J W Cook
J W Cook, Vice President
Projects, Engineering and Construction

Sworn and subscribed before me this _____ day of ____________.

/s/ Barbara P Townsend
Notary Public
Jackson County, Michigan

My Commission Expires ________________

20/81

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

July 7, 1983

Docket Nos: 50-329
and 50-330

MEMORANDUM FOR: Darrell G. Eisenhut, Director
for Licensing
Division of Licensing

THRU: Thomas M. Novak, Assistant Director
for Licensing
Division of Licensing

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

FROM: Melanie A. Miller, Project Manager
Licensing Branch No. 4
Division of Licensing

Ronald W. Hernan, Project Manager
Licensing Branch No. 4
Division of Licensing

SUBJECT: SYSTEMATIC ASSESSMENT OF LICENSEE PERFORMANCE
(SALP) - CONSUMERS POWER COMPANY, MIDLAND
NUCLEAR PLANT, UNITS 1 AND 2

Enclosed is the final NRR performance evaluation for the Midland Nuclear Plant, Units 1 and 2. Draft input was transmitted to the appropriate Division Directors in a memorandum of May 2, 1983. Comments were to be directed to a project manager by May 5, 1983, for inclusion in the final report. Comments from EQB were received and were incorporated into the attached.

Melanie A. Miller, Project Manager
Licensing Branch No. 4
Division of Licensing

Ronald W. Hernan

Ronald W. Hernan, Project Manager
Licensing Branch No. 4
Division of Licensing

Enclosure:
As stated

[redacted]

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cc: J. Hind, RIII

6pp.

FACILITY NAME: Midland Nuclear Plant, Units 1 and 2

LICENSEE: Consumers Power Company

NRR PROJECT MANGER: Darl S. Hood

I. INTRODUCTION

This report presents the results of an evaluation of the applicant, Consumers Power Company, in the functional area of licensing activities. It is intended to provide NRR's input to the SALP review process as described in NRC Manual Chapter 0516. The review covers the period July 1, 1981 to March 31, 1983. A distinction of activities between Units 1 and 2 was not considered feasible or appropriate.

The basic approach used for this evaluation was to first select a number of licensing issues which involved a significant amount of staff manpower. Comments were then solicited from the staff. The staff applied the evaluation criteria for the performance attributes based on their experience with the applicant or his products. Finally, this information was assembled in a matrix which allowed an overall evaluation of the applicant's performance.

II. Summary of Results

NRC Manual Chapter 0516 specifies that each functional area evaluated will be assigned a performance category based on a composite of a number of attributes. The single final rating should be tempered with judgment with respect to the significance of the individual elements.

Based on this approach, the performance of Consumers Power Company in the functional area - Licensing Activities - is rated Category 2.

III. Criteria

Evaluation criteria, as given in NRC Manual Chapter Appendix 0516 Table 1, were used for this evaluation.

IV. Performance Analysis

The applicant's performance evaluation is based on a consideration of seven attributes as given in the NRC Manual Chapter. For the licensing actions considered in this evaluation, only four of the attributes were of significance. Therefore, the composite rating is heavily based on the following attributes:

- Management involvement
- Approach to resolution of technical issues
- Responsiveness to NRC initiatives
- Staffing

There was no NRR evaluation basis for Enforcement History, Reportable Events and Training.

The evaluation was based on our evaluation of the following licensing activities:

- Soils and Structures
- Emergency Planning
- Equipment Qualification
- Quality Assurance Program
- Natural Gas Pipeline
- Auxiliary Feedwater System
- Instrumentation and Control Systems Review
- Seismic Spectra
- Fire Protection
- Implementation of NUREG-0737 Items

A. Management Involvement

The overall rating of this criterion is Category 2 with 2 activities receiving individual ratings of Category 1. For the licensing activities evaluated, there appeared to be appropriate management attention with decision making taking place at adequate levels. During numerous audits conducted by NRR, including audits relating to the soils issue, emergency planning, instrumentation and control systems, fire protection and equipment qualification, the records maintained by the licensee were generally complete, well maintained and available. In almost every area, the appropriate level of management participated in meetings with the NRC on safety, technical, and licensing issues and demonstrated knowledge on the meeting's subject matter.

In the soils remedial areas, a reorganization provided an executive manager fully dedicated to this area. While some difficulties occurred in the early phases of this reorganization, this continued involvement in the soils area throughout much of the assessment period results in the NRR staff rating performance in the soils area as Category 2.

Clear lines of responsibility were established in support of the staff's safety evaluation and subsequent issuance of the Safety Evaluation Report. Priorities established by licensee management were generally consistent with and supportive of those priorities established by the staff. Commitments made to incorporate resolutions into FSAR revisions were kept and were generally timely. The licensee also made an objective and extensive effort to track open issues related to the safety evaluation. One issue which involved implementation of a TMI Action Plan item (Item I.B.1.2) reached an apparent impasse between the staff and applicant. However, when the proper level of management attention was focused on the issue, both sides were able to reach an acceptable resolution. Licensee's management failed to recognize the safety signifance of constructing a high pressure gas facility in close proximity to safety structures until after construction completion.

B. Approach to Resolution of Technical Issues

The overall rating for this criterion is Category 2 with the performance rating for one individual licensing area falling into Category 1 and one area falling into Category 3. In general, licensee personnel involved in resolution of technical questions were knowledgeable and clearly understood the issues. During the appraisal period, technical submittals from the licensee to the NRC were usually complete and conservative. Resolution of two technical issues during the safety evaluation required elevation to the Division Director appeals level. In one of these issues, relief was given to the licensee. In the other, the licensee was required to commit to installation of a third auxiliary feedwater pump. In both cases, however, the licensee prepared reasonable technical justification for their position. In addition, the licensee's response once the appeals decision on the auxiliary feedwater pump had been made was excellent. The licensing area of soils and structures needs improvement insofar as the approach to technical issues. In the absence of NRC requirements, there was reluctance by the licensee to perform certain soils remedial work utilizing accepted quality assurance procedures. In regards to the buried piping issue, the licensee appeared to lack a thorough understanding of the safety issues involved. Improvement in the soils area over the appraisal period has been evidenced by more specific and clearer submittals to the NRC.

C. Responsiveness to NRC Initiatives

The overall rating for this area is Category 2 with the performance rating for individual licensing action falling in all 3 categories. In general, responses to the NRC were timely and thorough. The licensee was particularly responsive in the area of instrumentation and control systems. Additionally, in questions concerning the natural gas pipeline, the licensee demonstrated a willingness to address NRC concerns effectively and responsiveness increased accordingly. Responsiveness was rated poorly for those licensing issues which remained unresolved for a long period of time such as resolution of the buried piping problem.

D. Enforcement History

There is no basis for a NRR evaluation of this attribute.

E. Reportable Events

There is no basis for a NRR evaluation of this attribute at this time.

F. Staffing

Overall rating of this criterion is Category 2. Positions appear to be well-defined and responsibilities identified. Staffing is adequate and at levels consistent with the activity for the licensing activities evaluated. The licensee effected reorganizations and personnel replacements within a reasonable time insofar as key positions. In some cases, however, the staff considers that too much reliance was placed upon representation by consultants and by the architect/engineer.

G. Training

There is no basis for a NRR evaluation of this attribute at this time.

V. CONCLUSION

Based on the evaluation of Consumers Power Company's performance for a number of activities in the functional area of licensing, an overall performance rating of Category 2 has been assigned.

Generally, in licensing activities the licensee expressed a willingness to respond to NRC initiatives. Submittals were usually timely and thorough. Especially notable is the degree of management attention directed toward licensing activities as evidenced by meeting participation and the level at which decisions occur. Areas of above average performance in all criteria include instrumentation and control systems reviews. Conversely, although improvement in the soils areas has been seen during this appraisal period, it is imperative for the licensee to continue to focus a high level of management attention on this area in order to maintain an acceptable level of performance insofar as licensing activities.

Midland Evaluation Matrix

icensing ction	Management Involvement	Approach to Resolution-Tech	Responsiveness	Enforcement History	Reportable Events	Staffing	Traininꞔ
oils and Structures	2	3	2	N/A	N/A	2	N/A
mergency Planning	2	2	2	N/A	N/A	2	N/A
quipment Qualifi- ation	2	2	2	N/A	N/A	2	N/A
A Program	2	2	2	N/A	N/A	2	N/A
atural Gas Pipe- ine	2	2	1	N/A	N/A	2	N/A
uxiliary Feedwater ystem	1	2	3	N/A	N/A	No Basis	N/A
nstrumentation and ntrol Systems eview	2	1	1	N/A	N/A	2	N/A
ismic Spectra	2	2	1	N/A	N/A	2	N/A
re Protection	2	2	2	N/A	N/A	N/A	N/A
REG-0737 Items	1	2	2	N/A	N/A	N/A	N/A
erall Rating	2	2	2	N/A	N/A	2	N/A