Consumers Power Company

General Offices: 212 West Michigan Avenue, Jackson, Michigan 49201 • Area Code 517 788-0550

December 1, 1975

Director of Nuclear Reaction Regulation
Attention: Mr. Roger Boyd, Acting Director
Division of Reactor Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

MIDLAND PROJECT
DOCKET NUMBERS 50-329, 50-330
REGULATORY GUIDE MEETINGS
FILE: 0505 SERIAL: 1962

The enclosed information responds to Mr. A. Schwencer's October 31, 1975 letter requesting additional information regarding implementation of Regulatory Guides for the Midland Plant. These guides deal with structural engineering, the emergency cooling pond and flooding, and were discussed with your staff on September 24, 1975.

R. C. Bauman
Project Engineer

RCB/fw

130.1 Reg. Guide 1.10

12-1-75

In the proposed exception to the subject Regulatory Guide specify the criteria that will be followed by the Project Engineer to assure that the quality assurance and control will follow the general intent of the current revision of Reg. Guide 1.10, (Rev. 1, Jan. 2, 1973).

Response

Relative to Regulatory Guide 1.10, paragraph C.5.a, should "two or more splices fail to meet the tensile test...", the condition will be handled in the following manner. First of all, Bechtel Quality Control would document the event by issuing a Non-Conformance Report (NCR) addressing the situation. Quality Control would also physically identify the questionable cadwelds and notify Bechtel Quality Assurance that a situation existed which might be reportable in accordance with 10CFR50.55(e). Bechtel Quality Assurance would forward this notification to CPCo Quality Assurance for their possible notification to the NRC.

After review in the Field, the NCR would be transmitted to the Design Office for dispositioning along with appropriate data to allow the Design Office to evaluate the condition. This evaluation would be performed in accordance with approved procedures leading to an Engineering direction to accept or reject the questionable cadwelds. This direction would be transmitted back to the Field on the NCR. Should this direction be to accept the cadwelds, Engineering must provide the engineering rational for their decision.

Upon receipt of the Engineering disposition of the NCR, its completion by Construction, and its acceptance by Quality Control, a copy of the completed NCR is:

1) Transmitted to CPCo Field Quality Assurance, if the Bechtel decision is to accept the cadwelds.

2) Routed to Construction to initiate appropriate action to prevent recurrence.

3) Routed to Bechtel site Quality Assurance for evaluation and use in determining the need for corrective action to prevent recurrence.

130.1 Response (cont.)

The entire process described above is monitored throughout by Bechtel Quality Assurance. They review the various steps as necessary, and may request additional actions or clarifications at any step. They also audit the entire cadwelding process at periodic intervals.

130.2 Reg. Guide 1.12

To respond to the basic concern of this guide, you should provide at least one triaxial response spectrum recorder at the reactor containment foundation level to measure the earthquake input response spectra.

Response:

A response spectrum analyzer is included as part of the control room seismic instrumentation in lieu of discrete response spectrum recorders. This analyzer calculates the response spectrum, at specific damping valves, for comparison to the plant design criteria and evaluation of the earthquake effects. Fourier analyzers will not be used.

A response spectrum analyzer, permanently installed in the control room, presents more complete information than that presented by response spectrum recorders. Data from the strong motion accelerometers is recorded on magnetic tape and then fed into a playback unit that is cable-connected to the response spectrum analyzer to produce earthquake response spectra immediately following an earthquake. All locations where response spectrum recorders are required by the Regulatory Guide are monitored in 3 direction by strong motion accelerometers. This system provides all information required by Regulatory Guide 1.12, Revision 1.

130.3 Reg. Guide 1.15

(1) Reg. Position C.1.a:

We find that the proposed position is acceptable with the understanding that the frequency of testing for future construction will be as specified in Reg. Guide 1.15, viz, at least one full-diameter specimen from each bar size for each 50 tons or fraction thereof.

(2) Regulatory Position C.1.c:

Provide the criteria in sufficient detail that will show the intended use of the rejected material.

Response

(1) Upon reactivation of the Midland Project in 1973, project specifications were revised to specify a frequency of testing such that one full-diameter specimen is tested from each bar size for each 50 tons or fraction thereof. These requirements have been implemented since that time.

(2) Rejected material is identified and controlled to prevent inadvertent or arbitrary use in any Category I structure. Generally, such material is either scrapped or used in a non-safety related structure for which its material properties are satisfactory. The rejected material would be used in a Category I structure only under rare circumstances and then only under the following restraints:

a) Design Engineering would specify in detail all structural requirements for the intended usage of the rejected material.

b) Documentary evidence would be obtained that the rejected material met all requirements specified by Engineering.

c) Written authorization from Design Engineering for the use of previously rejected material would be available prior to usage. This would include any restructions and/or restraints as to areas where the rejected materials could be used.

d) Quality Assurance would be kept abreast of the process to allow monitoring of the actions of the other groups.

130.4 Reg. Guide 1.18

(1 & 2) Paragraph C.1:

Discuss the proposed exception to demonstrate that it would not be detrimental to the reliability of structural integrity test.

(3) Paragraph C3:

Provide the instrumentation for measuring the tangential deflection unless an alternate method of monitoring the deformation of openings is provided.

(4 & 5) Paragraph C5:

Provide sufficient information to make a determination whether the Midland Plant should be considered a prototype or not. The requirements pertaining to paragraph C.5 will be established on the basis of this determination.

(6 & 7) Paragraph C9 and C10:

We believe that there is no need for taking exceptions to the Guide at this time. However, the test reported should describe the weather conditions during the test and demonstrate that those conditions did not have a significant effect on the reliability of the test results.

(8) Paragraph C.12:

Provide a description of structural test prior to the actual tests as part of the application rather than as a separate report.

RESPONSE

The exceptions taken in our response to Regulatory Guide 1.18 paragraphs C.1, C.3, C.9 and C.10 are withdrawn. These exceptions will not appear in our position to the Regulatory Guide submitted under a PSAR amendment. This resolves items (1 & 2), (3), and (6 & 7) of question 130.4.

Item (4 & 5): The Midland Preliminary Safety Analysis Report was submitted in 1969 and a construction permit issued in 1972. Appendix 5H of the PSAR does describe the type of testing during the Structural Integrity Test (SIT) and does not include any strain measurements. The November 12, 1970 Midland Safety Evaluation performed by the Division of

Reactor Licensing found the pre-operational testing program, as described in the PSAR, to be acceptable. The discussion of Containment Testing and Surveillance can be found in Section 6.24 of the Midland DRL Safety Evaluation. The base mat and lower portion of the walls of both containments are presently in place, thus it is not possible at this time to instrument the containment for strain measurements. As indicated in the PSAR, both Turkey Point and Palisades were instrumented for strain measurements and data gathered during their SITS. Although not completely identical to Midland, the applicant considers Turkey Point and Palisades to adequately represent Midland as its prototype, based on this data. Furthermore, the Midland containments are similar to the Bechtel designed containments at Arkansas Nuclear One, Units 1 and 2. The Arkansas' units are a three buttress system with 1,000 ton capacity tendons and Unit 1 containment has undergone SIT but was not instrumented for strain measurements. The displacements measured at selected points during this SIT agreed well within acceptable limits with the predicted response. In addition, no unusual response, either in terms of displacements or cracking, was noted.

Therefore, Midland should not be treated as a prototype containment (1) since its three buttress system with 1,000 ton capacity tendons has been tested satisfactorily at Arkansas Nuclear One, Unit 1, and (2) construction of both Midland containments has progressed beyond the point of possible installation of strain measuring devices.

Item (8): A descriptiion of the structural test will be provided in the FSAR prior to conducting the actual test.

130.5 Reg. Guide 1.55

In order to show that you intend to meet the requirements of Reg. Guide 1.55, describe the Q/A program pertaining to periodic monitoring by the design engineering office to assure the correctness and conformance of the shop drawings to the design drawings. In your Q/A program describe the measures taken to assure that the construction joints are located in agreement with the intent of the designer.

Response

The division of responsibility for rebar design, detailing and checking of shop drawings, and installation on the Midland project is spread among various Bechtel organizations. The design engineering office generates and transmits to the field engineering office design drawings. The field engineering office sends the design drawings to the rebar fabricator for detailing and also performs the checking of the detail drawings when received from the fabricator. If necessary the field engineering office may also prepare rebar shop drawings from the design drawings. These details are checked in the field by individuals other than those who did the detailing. The Quality Control group inspects rebar placement against the design engineering drawings as well as the shop drawings so as to ensure proper implementation of the design engineering requirements. The Quality Assurance group monitors and audits all of the above activities to insure that functions are performed in accordance with formally approved procedures.

The assignment of responsibility described above ensures the implementation of design requirements for Category I structures, while at the same time allowing the field adequate flexibility for expedient construction.

Correctness and conformance of shop drawings to design drawings are assured in the following manner:

a) For approximately 18 months after restart of construction the design engineering office reviewed rebar shop drawings. This established in the design office the appropriate level of confidence that their designs were being implemented properly, and thus allowed engineering review only when requested.

b) Field engineering activity is controlled by QA-approved procedures, including a procedure for incorporating design engineering comments on rebar shop drawings. These procedures bind the field to follow proper industry standards in their detailing work, including appropriate portions of the ACE code. Procedure implementation is monitored and audited by QA.

c) The design engineering office receives for information copies of rebar shop drawings. Should reason arise, the design office can review any rebar drawing. As indicated above, the field office has procedures for addressing any comments the design engineering office might make.

d) Independent of the engineering groups, Quality Control inspects rebar placement against both design and shop drawings and identifies any discrepancies. Discrepancies from the design drawings must be resolved with the design engineering office prior to concrete placement.

Construction joint location is handled within the framework described above. The design office locates joints critical to structural integrity on their design drawings. In other areas, the field locates construction joints based on requirements and restraints described in the design office-generated concrete placement specification. Deviations from drawing and specification requirements and restraints must be approved by design engineering prior to placement.

321.1 Regulatory Guide 1.27

Please provide the following information so that we can perform an independent analysis to determine the adequacy of the emergency pond and verify your results.

(1) Meteorological Data

Case 1. Data based on historical regional measurements combining the worst recorded 30-day period (30-day average) of maximum difference between dry bulb temperature, delta T, and the highest wind speeds recorded during the same 30-day period such that the combination of delta T and wind speeds occurring simultaneously results in the maximum amount of evaporation and drift loss. Provide average daily dry bulb temperature, wind speed and solar radiation for the 30-day period.

Case 2. Data based on the worst 1-day and worst 30-day periods of meteorological record in the region resulting in minimum heat transfer to the atmosphere and maximum plant intake temperature. Provide hourly dry bulb and dewpoint temperatures for the first day (worst 1 day) and daily dry bulb and dewpoint temperatures for the rest of the 30-day period. Also provide average daily wind speed and solar radiation for the 30-day period;

(2) Initial emergency pond temperature;

(3) Emergency pond geometry (and figure of pond) and normal operating level;

(4) Location on emergency pond intakes and discharges (locate on figure provide for item (3));

(5) The heat curve (in BTU-hour) for various times throughout the entire 30-day period.

Response

I. Description of Emergency Cooling Pond System

The emergency pond and associated structures are displayed on attached Sketch SK-C-466, Rev. A, titled Study of Emergency Cooling Water Reservoir. This drawing shows the emergency cooling pond to be at the cold leg of the Midland cooling reservoir. The emergency pond has an 8 foot depth with an approximate 37 acre surface area. The initial water surface elevation is 604 feet assuming loss of the main pond. The details of the pond outlet (service water inlet) are shown in detail 1 and section A. The pond inlet (service water outlet) is also shown in Section B. Note that the vertical pipes for the pond inlet are capped to reduce silting.

II. Meteorological Data and Analysis Sources

Regulatory Guide 1.27 requirements were used to establish design meteorology for the pond thermal analysis. Design data was obtained from the following sources: 1) 1910-1973 meteorological data recorded at Lansing, Michigan; 2) 1953-1972 direct measured solar radiation data recorded at East Lansing, Michigan; and 3) pre-1953 solar radiation data calculated using clear sky solar radiation and cloud cover values. These sources were used to obtain values for dry bulb temperature, relative humidity, wind speed, cloud cover, and solar radiation for use in the cooling pond thermal performance simulation.

The basic procedure used in the Midland emergency pond simulation was presented by P. J. Ryan and D. R. F. Harleman in "An Analytical and Experimental Study of Transient Cooling Pond Behavior," Ralph M. Parsons Laboratory for Water Resources and Hydrodynamics, Report No. 161, January 1973.

Case 2 requested the meteorological data for the worst case 1-day and 30-day periods of meteorology be identified and the worst 1-day period be assumed to be the first day of the 30-day period. The first stage of determining worst case meteorology was an observation and evaluation of data sources referenced above. The following periods of severe meteorology were determined:

a) Maximum Absolute Dry-Bulb Temperature

b) Maximum Daily Mean Dry-Bulb Temperature

c) Maximum Monthly Mean Dry-Bulb Temperature

d) Maximum Monthly Dewpoint Temperature

e) Minimum Monthly Wind Speed

f) Maximum Monthly Percent of Possible Sunshine

The severe periods of meteorology for five of the six items listed above were found to occur during the summer of 1916 or the summer of 1921. The sixth, the minimum monthly wind speed, did not occur during either of these two time periods, but the monthly average wind speed during the summer of 1916 was only 0.4 mph above the recorded minimum monthly average wind speed. It was concluded from these observations that the worst case 1-day and 30-day meteorology periods for thermal performance would probably occur during the April through September months (summer) of 1916 or 1921. Detailed observations were made to determine the group of time periods expected to include the most severe 1-day and 30-day period of equilibrium temperature. Equilibrium temperature is defined as the water surface temperature, which for a given set of meteorological conditions would result in a zero net heat transfer flux across the water surface. A thermal performance model for the Midland emergency pond was simulated to determine the most severe 1-day period and 30-day period included in the previously isolated group of time periods. The resulting worst case is summarized in Tables 1 and 2.

Regulatory Guide 1.27 requires evaluation of the effect of daily fluctuations in meteorology on pond outlet temperatures. The available recorded data provided the following information for the worst case 1-day period:

Wind Speed - hourly velocities, daily average velocities

Dry Bulb Temperature - daily maximum, daily minimum, daily mean

Relative Humidity - 7 a.m., 2 p.m., and 7 p.m. values

Cloud Cover - average daily value

Solar Radiation - computed daily totals

Estimated values for diurnal fluctuations in dry bulb temperature and wind speed were derived from the available sources of meteorological data. The dry bulb temperatures were used in conjunction with recorded average dewpoint temperatures to estimate the diurnal fluctuations in relative humidity. For the worst case 1-day period of meteorology, there is no cloud cover, so no computation of diurnal fluctuations is necessary.

Diurnal fluctuations in solar radiation were estimated using hourly solar radiation values found in the "ASHRAE Handbook of Fundamentals." The required meteorology data for the worst case 1-day period is presented in Table 3. Table 4 lists the dry bulb temperature, dewpoint temperature and relative humidity data which are available for July 29, 1916.

The time period of 0.75-1.0 on Table 3 shows that the minimum daily value of wind speed, maximum daily value of dry-bulb temperature, and maximum daily value of solar radiation are assumed to occur simultaneously, this should result in a conservative model of meteorological fluctuations on pond performance.

The peak pond temperature was attained within the first day of operation; thus a detailed evaluation of diurnal fluctuations for the worst case 30-day period was not included in the thermal pond performance study.

Case 2 requested the meteorological data for the 30-day period of meteorology with the maximum average dewpoint depression (dry bulb temperature - dew-point temperature). Meteorology corresponding to the monthly period of maximum dewpoint depression was used in the Midland pond analysis. This data may be slightly less severe than that corresponding to the worst case 30-day period, but it is felt that the analysis procedure used for the Midland pond analysis was very conservative and the results are acceptable. The maximum monthly wind speed recorded in the data sources available was used for the worst case 30-day period. The data used is summarized in Table 5.

Case 1 of Question 321.1 asks for average daily dry bulb temperatures, wind speed, and solar radiation for the worst case 30-day period for use in calculating the maximum evaporation from the emergency pond. The Midland analysis and simulation were performed using monthly data for this calculation and daily values were never obtained by the Midland Project. If the independent analysis requires the daily values of dry bulb temperature, they can be obtained from the National Climatic Center in Ashville, North Carolina.

Data recorded in Lansing, Michigan during the time period of 1910 to 1928 was used in the estimate of wind speeds. This recorded data was measured at an elevation of 62 feet above the ground. The simulation model used for the Midland emergency pond required alterations of the recorded wind speeds because the wind speed was required at an elevation of 26 feet above the water surface. Alterations were also required because the emergency pond will be sheltered by large reservoir dikes, (see SK-C-446). To account for these required alterations, the wind speeds which were recorded in Lansing (Tables 1 and 2) were reduced by 70% of the measured value. However, in order to obtain a conservative estimated total water loss, wind speeds used for evaporative water loss calculations were not reduced.

III. Simulation of Emergency Pond Performance

Regulatory Guide 1.27 requires that a transient thermal analysis be performed for ultimate heat sinks where the water supply may become limited or the temperature of the pond outlet water may become critical. The model used for analysis of the Midland emergency cooling pond is a simplified version of the numerical model referenced in Subsection II. Worst case meteorology was determined as outlined in the Subsection II. The resulting worst case meteorology is summarized in Tables 1, 2, 3, 4, and 5.

The design basis heat load corresponds to a safe shutdown on one unit while the other unit experiences a LOCA (loss of coolant accident). The heat load data is summarized in Figure 1. The service water system flow rate for the design basis accident is 66.3 cfs. The initial pond temperature used for the Midland emergency pond was 96°F, the temperature at which the Unit 2 turbine attains its back pressure limit when under full load. The initial temperature of the emergency pond was assumed to be equal to the lowest temperature in the surface layer of the large cooling reservoir at the time of the design basis accident. This assumption can be made since the emergency pond is submerged at the cold end of the large cooling reservoir.

IV. Summary

The ultimate heat sink for the Midland Plant, Units 1 and 2, has been analyzed in accordance with Regulatory Guide 1.27, Rev. 1. Analysis of the ultimate heat sink, consisting of a cooling pond, included computation of a worst case time-temperature relationship for water losses for the first 30 days of pond operation following a design basis accident. The time-temperature relationship for pond outlet water is given in Figure 2.

The peak pond outlet temperature following a design basis accident was computed to be about 108.5°F for an initial emergency pond temperature of 96°F. Total pond evaporative water loss during the first 30 days of operation following the design basis accident was computed to be approximately 17 inches.

Evaporative water loss from the cooling pond during the first 30 days of operation will not compromise its performance capabilities.

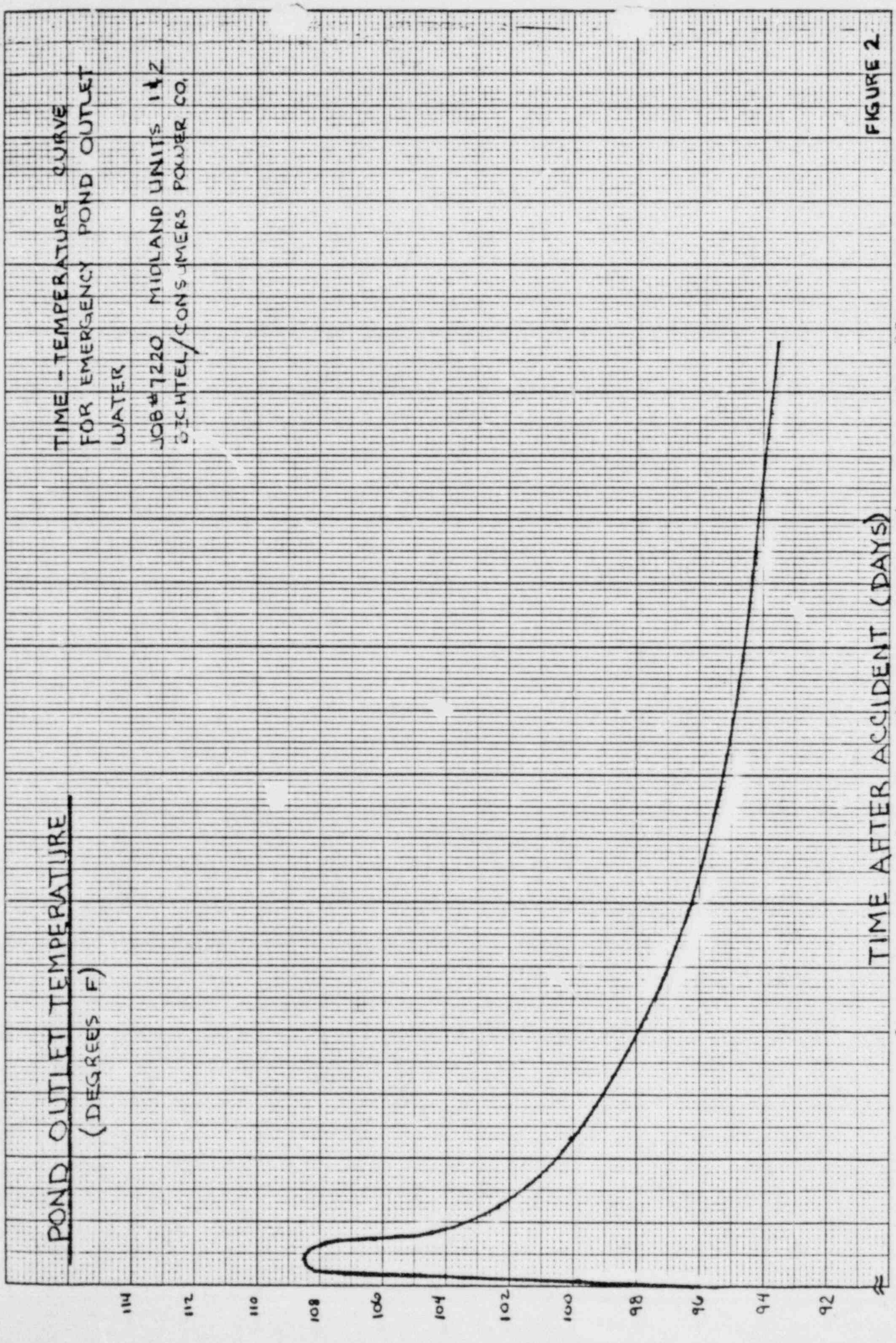
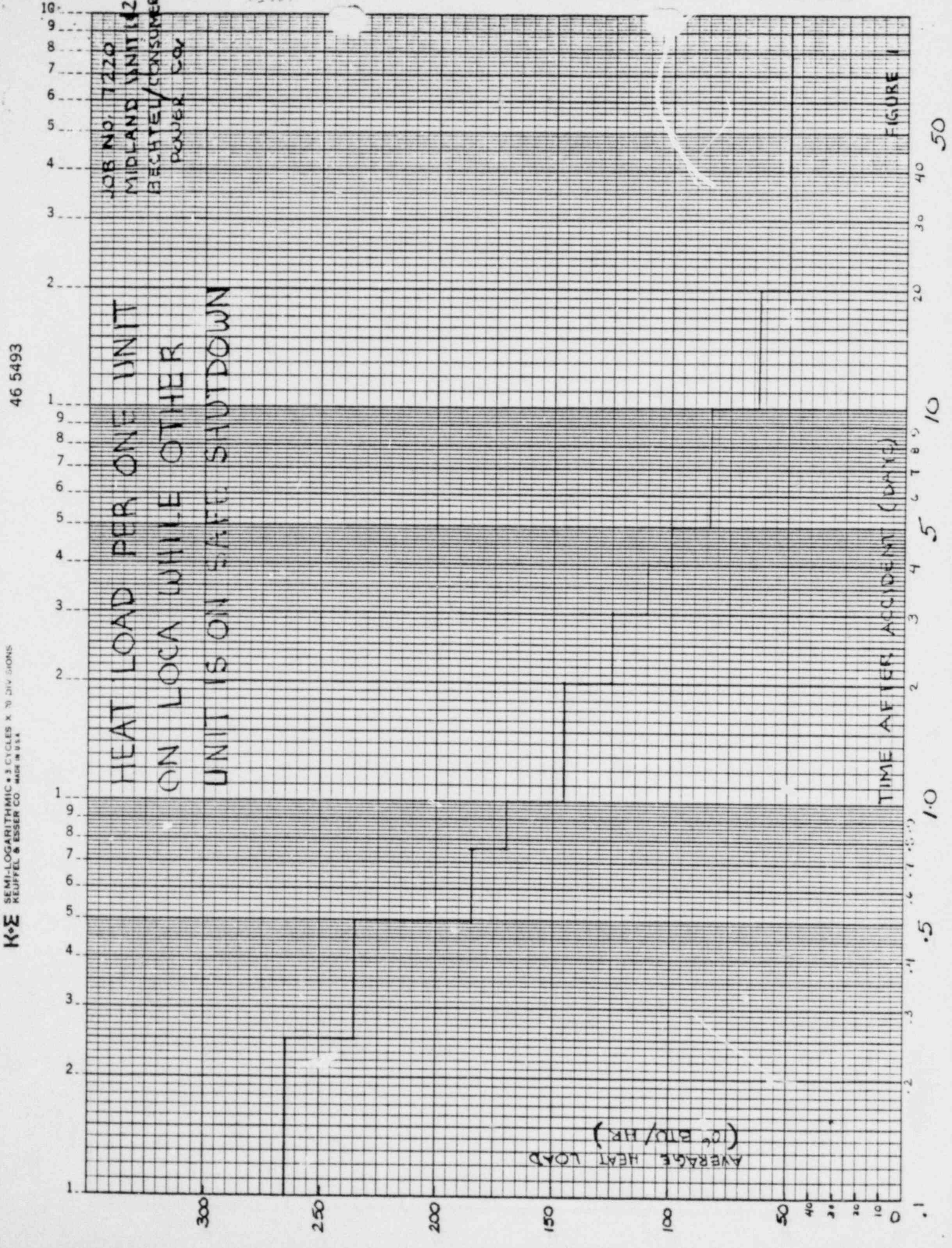

POND OUTLET TEMPERATURE
(DEGREES F)
TIME - TEMPERATURE CURVE
FOR EMERGENCY POND OUTLET
WATER
JOB #7220 MIDLAND UNITS 1 & 2
BECHTEL/CONSUMERS POWER CO.
114
112
110
108
106
104
102
100
98
96
94
92
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
TIME AFTER ACCIDENT (DAYS)

FIGURE 2



JOB NO. 7220
MIDLAND UNIT 1&2
BECHTEL/CONSUMERS POWER CO.
HEAT LOAD PER ONE UNIT ON LOCA WHILE OTHER UNIT IS ON SAFE SHUTDOWN
FIGURE 1
TIME AFTER ACCIDENT (DAYS)
AVERAGE HEAT LOAD (10^6 BTU/HR)
K+E SEMI-LOGARITHMIC 3 CYCLES X 70 DIVISIONS KEUFFEL & ESSER CO. MADE IN U.S.A.
46 5493

TABLE 1

WORST CASE METEOROLOGY FOR POND TEMPERATURE PERFORMANCE

The worst case 1-day period of meteorology for pond temperature was July 29, 1916.

The worst case 30-day period of meteorology for pond temperature performance was July 11 - August 9, 1916.

Date	Wind Speed (mph)	Dry-Bulb Temperature (°F)	Relative Humidity (%)	Solar Radiation (Langleys/day)	Cloud Cover (fraction)
7/29/16	1.7	87	70	680	0
7/11/16-8/9/16	2.4	78.1	73.5	627	.3

TABLE 2

DAILY METEOROLOGICAL DATA
FOR WORST CASE PERIOD FOR POND
THERMAL PERFORMANCE

Date	Dry-Bult Temperature (°F)	Dewpoint Temperature (°F)	Wind Speed (mph)	Solar Radiation (Langley's/day)
7/11/16	76	67	1.5	718
7/12	82	70.5	2.6	643
7/13	75	66	2.3	522
7/14	74	62	3.0	712
7/15	78	68	2.0	669
7/16	80	71.5	2.4	681
7/17	78	70	2.7	706
7/18	78	70	1.8	704
7/19	81	69.5	1.3	698
7/20	78	71	2.6	557
7/21	76	58	3.2	698
7/22	76	64.5	2.5	647
7/23	76	64.5	1.8	693
7/24	78	65.5	1.6	691
7/25	80	66	1.6	689
7/26	80	67.5	1.9	686
7/27	84	67.5	2.3	531
7/28	84	70.5	3.1	577
7/29	87	71	1.7	680
7/30	88	72	2.5	586
7/31	76	64	3.7	666
8/1	68	53.5	3.2	655
8/2	68	58.5	1.7	670
8/3	76	60.5	3.1	428
8/4	78	67.5	2.6	550
8/5	80	71	2.0	561
8/6	83	73	3.0	635
8/7	82	72.5	4.0	456
8/8	74	67	3.0	462
8/9/16	70	61.5	1.8	653

TABLE 3

DIURNAL METEOROLOGY FOR POND TEMPERATURE ANALYSIS

The worst case 1-day period of meteorology for pond temperature performance was July 29, 1916.

Time Period (days)	Wind Speed (mph)	Dry-Bulb Temperature (°F)	Relative Humidity (%)	Solar Radiation (Langleys/day)	Cloud Cover (Fraction)
0-1	1.7	87	70	680	0
0-.25	1.7	87	70	476	0
.25-.5	2.8	72	100	0	0
.5-.75	1.7	87	70	476	0
.75-1.0	.7	102	45	1780	0

TABLE 4

DRY-BULB, DEWPOINT AND RELATIVE HUMIDITY DATA AVAILABLE* FOR JULY 29, 1916

	Dry-Bulb Temperature (°F)	Dewpoint Temperature (°F)	Relative Humidity (%)
7 a.m.	76.8	68	76
2 p.m.	101.0	--	38
7 p.m.	88.4	74	63
max/min	102/72	--	--
mean	87	--	--

* From "Original Monthly Record of Observation" Weather Bureau forms for Lansing, Michigan.

TABLE 5

WORST CASE METEOROLOGY FOR EVAPORATIVE WATER LOSS

The monthly period of highest average dewpoint depression was July, 1946.

The monthly period with the highest average wind speed was March, 1950.

Design Meteorology

Period	Wind Speed (mph)	Dry-Bulb Temperature (^{o}F)	Relative Humidity (%)	Solar Radiation (Langleys/day)	Cloud Cover (fraction)
7/46		70.8	53	670	.3
3/50	17.4				

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PLANT NAME: Midland 1 & 2

ENCLOSURES: Addl Info regarding implementation of Reg. Guides for Midland Plant dealing with structural engineering, the emergency cooling pond & flooding & with attached Drawing SK-C-466....

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