

SEP 17 1982

Docket Nos. 50-329/330

MEMORANDUM FOR: Elinor Adensam, Chief
Licensing Branch #4, DL

FROM: George Lear, Chief
Hydrologic & Geotechnical Engineering Branch, DE

SUBJECT: MEETING NOTES OF JULY 27 THROUGH 30, 1982 DESIGN AUDIT

Plant Name: Midland Plant, Units 1 and 2
Licensing Stage: OL
Responsible Branch: LB #4; D. Hood, and R. Hernan, LPM

In response to D. Hood's request, we have marked our comments on the enclosed applicant's advance copy of the meeting notes, covering the July 27-30, 1982 design audit in Ann Arbor, Michigan.

Any questions that you may have on the review comments of the marked enclosure may be referred to J. Kane (28153) of my staff.

Original signed by George Lear
George Lear, Chief
Hydrologic and Geotechnical
Engineering Branch
Division of Engineering

cc w/o encl:
J. Knight
L. Heller

cc w/encl:
D. Hood
H. Singh, COE
S. Poulos, GEI

JDK 9/17/82

DE:HGEB

JKane:jn

DE:HGEB

LHeller

DE:HGEB

GLear

8408020192 840718
PDR FOIA
RICEB4-96

PDR

Bechtel Associates Professional Corporation

777 East Eisenhower Parkway
Ann Arbor, Michigan

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



ADVANCE COPY

BLC-

RS-238-01

7220

Consumers Power Company
1945 West Parnall Road
Jackson, Michigan 49201

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

Subject: Midland Plant Units 1 and 2
Consumers Power Company
Bechtel Job 7220
Meeting Notes No. 1655

Meeting Notes No. 1655 for the NRC audit of the soils remedial activities held July 27 through July 30, 1982, are attached for your information and use.

Very truly yours,

A handwritten signature in cursive script that reads "E.M. Hughes".

E.M. Hughes
Ann Arbor
Project Engineer

for E.M. Hughes

EMH/NS/cs
8/4/1

Attachment: Meeting Notes No. 1655

cc (all w/a):

D.B. Miller
T.J. Sullivan
R.A. Wells

Written Response Requested: No

Enclosure 1

Bechtel Associates Professional Corporation

777 East Eisenhower Parkway
Ann Arbor, Michigan

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



MEETING NOTES NO. 1655

MIDLAND PLANT UNITS 1 AND 2

CONSUMERS POWER COMPANY

BECHTEL JOB 7220

DATE: July 27 through 30, 1982

PLACE: Bechtel Ann Arbor Office

SUBJECT: Nuclear Regulatory Commission Audit of Soils Remedial
Activities

ATTENDEES: Nuclear Regulatory Commission

Consumers Power Company

L. Heller*
D. Hood
J. Kane
J. Knight*
F. Rinaldi

D. Budzik*
W. Cloutier
J. Cook*
J. Meisenheimer
J. Mooney
N. Ramanujam
K. Razdan
J. Schaub*
T. Thiruvengadam

NRC Consultants

W. Chen
G. Harstead
P. Huang*
J. Matra
S. Poulos
R. Samuels
H. Singh*

Bechtel

Bechtel Consultants

E. Burke*
C. Gould*

S. Affifi* D. Reeve*
J.E. Anderson R. Rixford*
T. Dabrowiak* C. Russell*
M. DasGupta* S. Rys*
B. Dhar P. Straube*
D. Griffith* N. Swanberg
M. Henry* R. Tulloch*
B. Klein* G. Tuveson*
J. LeGette* V. Verma*
D. Lewis* L. Young*
L. McElwee* D. Zanese*
M. Rawson*

*Part-time

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- PURPOSES:
- 1) To perform an NRC structural and geotechnical audit of the design and calculations for Midland soils remedial work
 - 2) To provide information necessary to the preparation of the Safety Evaluation Report (SER)
 - 3) To permit release of soils remedial work for construction

PRINCIPAL AGREEMENTS:

- 1) Based on the audit, ^J Knight and D. Hood of the NRC concluded that all technical soils issues were closed by this audit. There are some confirmatory issues which are outstanding. The applicant will provide information on these confirmatory issues as it becomes available. ? Not so.
- 2) Agreements reached regarding specific items are listed below.

General Items

1. NRC staff input for the final Supplemental Safety Evaluation Report (SSER) will include a summary of subsurface investigation

This item was previously resolved with the NRC staff. There was no technical discussion on this item during the audit.
2. Staff input to the final SSER will describe laboratory and field testing

This item was previously resolved with the staff. There was no technical discussion on this item during the audit.
3. Staff input into the final SSER will include staff evaluation of pertinent soil profiles sectional views

This item was previously resolved with the staff. There was no technical discussion on this item during the audit.
4. Summarize the settlement history of Seismic Category I structures other than the auxiliary building (AB) and service water pump structure (SWPS)

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This item was previously resolved with the staff. There was no technical discussion on this item during the audit.

5. Long-term settlement monitoring plans during plant operation for other structures

This is a technical specifications item, ~~with all technical issues resolved~~. The information will be provided to the NRC as part of the final safety analysis report (FSAR) technical specification submittal.

It is premature on the applicant's part to conclude all technical details of a specification are resolved before that specification has been developed and approved.

6. NRC input into the final SSER will cover range of applied bearing pressures' static and dynamic loading

A draft of FSAR Table 2.5-14, with bearing pressure data for the AB included, was provided for NRC use and is included as Attachment 1. The staff reviewed the table and was satisfied with the information presented. This item is technically closed.

7. The applicant was requested to determine that 1.5 x FSAR seismic response spectra analyses are conservative for the AB, SWPS, and borated water storage tank (BWST) in comparison to site-specific response spectra (SSRS).

The NRC staff reviewed calculations verifying that 1.5 x FSAR response spectra envelop the results obtained by using the SSRS and the FSAR response spectra for the AB, SWPS, and BWST. This item is technically closed.

8. The applicant has not provided comparative plots of floor response spectra that were requested by the staff for all buildings (seismic margin review).

Comparative plots of floor response spectra for selected floor elevations in the auxiliary building were shown to the staff for information purposes only. However, it should be noted that the use of the floor response spectra derived from the seismic margin earthquake would be according to the seismic margin review criteria submitted earlier to the staff. The results of the seismic margin review will be submitted to the staff at a later date for the purpose of operating license review.

The Attachment 1 enclosed with these meeting notes is not the same table of bearing pressures which was furnished at the design audit. The applicant should be requested to explain the differences and to indicate which values are correct.

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9. Test data on 9 and 10 Fox-Howlett rebar splices with up to 2% strain

Copies of test data up to 2% strain for 9 and 10 Fox-Howlett rebar splices were sent to the NRC consultant (Science Applications Institute) and were provided to the NRC during the audit.

The NRC found the information acceptable after preliminary review. This item is technically closed.

10. Identification, inspection, and repair procedures for concrete crack repair

Criteria for concrete cracks were agreed upon and are documented in Consumers Power Company letter Serial 18371, 8/2/82. This item is technically closed.

11. Staff input into the final OSER will summarize geotechnical engineering review efforts and SHAKE computer code studies

This item was previously resolved with the staff. There was no technical discussion on this item during the audit.

Auxiliary Building

1. Resolution of allowable vertical differential settlement and strain that will stop underpinning construction and require installation of temporary supports

The NRC staff reviewed the allowable settlement calculations supporting the response to NRC Review Concern 3. Items discussed included assumptions, methodology, and results.

See attachment 2 for review comments and changes
Attachment 2 provides definitions of alert and action levels which were agreed upon for underpinning activities. Attachment 3 provides numerical values which were agreed upon for use during Phases II, III, and IV.

Alert and action settlement levels for Phase III after installation of grillage beams at Piers E and W8 are based on strains recorded by extensometers as indicated in Attachment 3. No other acceptance criteria for strain will be used. This item is technically closed.

2. Compaction control specification for granular fill beneath feedwater isolation valve pits (FIVPs)

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It was agreed that the fill beneath the FIVP will be tested using the procedures outlined in the Seabrook FSAR. A copy of a similar FSAR section was provided by the NRC. The fines portion of the fill will be nonplastic. This will be verified by the resident geotechnical engineer by appropriate testing (hydrometer or Atterberg limits). The backfill will be properly moisture conditioned by soaking immediately prior to compaction. The soaking means will be approved by the resident geotechnical engineer. Compaction acceptance criteria will be 95% modified proctor or 85% relative density based on tests performed prior to placement.

Additional compaction equipment ^(e.g. self propelled double drum compactor) to ~~will~~ be qualified by the test fill method.

3. Methodology for transferring final loads to permanent underpinning wall

Mergentime/Hanson Drawings S-74 and S-74a were reviewed and found acceptable. Analysis of the permanent wall and preliminary design details were reviewed. Items included methodology, rebar stresses in critical areas, and connection to existing structure. This item is technically resolved.

4. Updated scope of construction for Phases III and IV

The construction plan which describes the construction scope (Drawing 7220-SK-C-0101) was reviewed. A discussion was also held regarding construction sequence. This item is technically closed.

Resolution of pier and plate load test details on maximum test load, locations, and time for performing test

The load test will be performed on Pier W-11. The load sequence is to jack the load from 0 to 50% of the bearing pressure allowed for the seismic loading combination, then decreasing the load to 25%, and then increasing the load to 130%. The staff agreed that no additional plate load test is required. This item is technically closed.

6. Long-term settlement monitoring plan during plant operation

This is a technical specifications item, ~~with all technical issues~~ resolved. The information will be provided to the NRC as part of the FSAR technical specification submittal.

7. FSAR documentation on as-built conditions

This is a confirmatory item with all technical issues resolved. The information will be provided to the NRC when it is available ^x for NRC staff review.

Consumers has committed to performing a laboratory compaction or relative density test to establish max. dry density on soil material taken from each field density test location. Bechtel compaction control specification will be revised to allow

(whichever testing standard results in the maximum dry density)

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8. Design modification at freezeway crossing with duct banks
the installed surcharge loading program, monitoring results and Power Company will provide a report addressing backfill techniques. The proposed method for backfilling monitoring pits will be provided prior to accomplishing the work. This is a confirmatory issue. ~~with all technical issues resolved.~~

9. Resolution of required depths of construction dewatering wells

~~The depths of construction dewatering wells are acceptable.~~ When excavating in cohesionless (natural or fill) soils, the groundwater will be maintained 2 feet below the advance of excavation.

In addition, a probing program will be used in selected piers. These piers are E12, W12, E10, W10, E7, W7, E4, W4, CT1, CT6, and CT12. ~~At least one of these additional piers will be in the control tower.~~ The probing will be done ~~in a test hole not to exceed 4 inches in diameter~~ from 5 feet above to 5 feet below the design bearing elevation. If water is encountered while drilling, the stratum will be sufficiently dewatered to provide a stable bearing condition. Interpretation will be done by the resident geotechnical engineer. This item is technically closed.

10. Monitoring matrix showing allowable settlements and strains

An updated copy of the monitoring matrix was provided. Alert and action levels will be added as agreed upon (see AB, Item 1).

The staff agreed that no alert or action level needs to be established for monitoring strain. However, the strain data are considered supplementary to understand the behavior of the building. This item is technically closed.

11. Electrical penetration area (EPA) and cooling tower (CT) relative horizontal movement criteria

The NRC staff reviewed drawings showing the gap detail between the EPA/CT and the turbine building.

No acceptance criteria will be required for horizontal movement during underpinning. Data from the instrumentation measurements will be recorded for information. This item is technically closed.

and strain levels greater than 0.0010 in/in. are a factor to be considered in the raising of the alert and action settlement levels.

Replace with the wording in SSEER pg. 2-48 which is more complete and includes the requirement to grout open test holes which was agreed upon at the design audit.

and used as supplementary information to the differential settlement records in the overall evaluation of structure movement during underpinning work.

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12. Changes in pier configuration

Piers CT4X and CT9X located along Column line K at 5.9 and 7.2 will not be required. Piers will be required at H_C and 5, and at H_X and 8. The NRC staff reviewed Mergentime/Hanson^K drawings showing the details of these piers. This item is technically closed.

13. Details on stiffened bulkhead during drift excavation

The NRC staff agreed with the drift/stiffened bulkhead design. ~~The staff further recommended that the drift portion of construction be eliminated and that the bulkhead be constructed in 2 foot increments with a benched slope on the FIVP side. The applicant agreed to incorporate these comments in the design.~~ This item is technically closed.

14. As-built plan for deep-seated benchmarks

The NRC staff reviewed Drawings 7220-C-1490 and C-1491 showing as-built locations of the AB deep-seated benchmarks. This item is technically closed.

15. Review of Specification 7220-C-200, Emergency Actions

The flowcharts of Specification 7220-C-200 were reviewed in detail. This item is technically closed.

Service Water Pump Structure

1. Complete staff review of sliding and lateral soil pressure calculation under dynamic loading

The NRC staff completed review of the sliding and lateral soil pressure calculation. This item is technically closed.

2. Resolution of pier and plate load test details on maximum test load, locations, and time for performing test

The load test will be performed on Pier 1 (east side). The load sequence is to jack the load from 0 to 50% of the bearing pressure allowed for the seismic loading combination, then decreasing the load to 25%, and then increasing the load to 130%. The staff agreed that no plate load test will be required. This item is technically closed.

The staff agreed to constructing the drift support system in 2-foot increments, with lagging and drift backpadding completed up to the bottom of the EPA foundation slab and with an excavation bench on the FIVP side.

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within 8 ft of the pier foundations as indicated by the continuous sampling in the six perimeter piezometers

3. Resolution of required depths of construction dewatering wells

^{monitoring of}
For construction dewatering at the SWPS, 12 piezometers will be provided. Six will be sealed in the zone from el 570' to el 590'. Soil sampling will be continuous from el 570' to el 585'. The other six will be installed at the subcontractor's discretion.

The water surface will be maintained 2 feet below the ^{bottom of pier} excavations if sand is present. ~~All wells will be lowered to el 570' or exploratory information from the six deep piezometers will be provided to determine the existence of sand layers.~~ If sand layers are identified ^{in the exploratory borings for the} piezometer installation, the wells will be lowered. This item is technically closed.

in borings at the location of the six perimeter piezometers

4. Methodology for transferring loads from jacks to permanent wall and locking off

Drawing 7220-C-2035, with the relevant parts of Specification 7220-C-194 showing final load transfer procedures, were reviewed by the NRC staff. This item is technically closed.

To maintain the 2 foot requirement. The results of the exploratory and the final installation of the piezometers will be provided to the NRC staff.

5. Long-term settlement monitoring plan during plant operation

This is a technical specification issue, ~~with all technical issues resolved.~~ The information will be provided to the NRC as part of the FSAR technical specification submittal.

6. FSAR documentation on as-built conditions

This is a confirmatory item with all technical issues resolved. The information will be provided to the NRC when it is available ^{for NRC staff OL review.}

6a. Strain monitoring to measure acceptable allowable strain

~~The staff concurred with the acceptance criteria for 20-foot extensometers as given in the June 14, 1982, submittal and criteria for 10-foot extensometers as agreed in the meeting of June 25, 1982, (Item 220.10) and documented in the summary of the meeting by D. Hood dated July 19, 1982. This item is technically closed.~~

The NRC staff's evaluation of the applicant's June 14, 1982 submittal indicated the proposed 5/16 inch displacement (extension) criterion over a single 20-foot gage length was not acceptable and the staff recommended that several gages of shorter lengths be installed to permit identification of the more highly stressed sections. In the meeting of June 25, 1982 the applicant committed to using four 5-foot long gages in place of the single 20-foot gage. The acceptance criteria for the 5-foot long gages was not specifically identified at the design audit but it was indicated that the criteria would be based on the yield strain of the reinforcing steel.

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7. Staff input into the final SSER will describe computed earth pressures under both static and dynamic loading and design methods

Review of computed earth pressures was completed. This item is technically closed.

8. The NRC staff is to review and evaluate the applicant's analysis as identified in response to Request 2.8 of Enclosure 8, NRC letter dated 5/25/82 (interaction of circulating water and SWPS wall).

The NRC staff reviewed the drawing showing the gap between the circulating water pumphouse and the SWPS, and compared this gap with the predicted deflections for each structure. The gap is considered acceptable to accommodate the expected movements. This item is technically closed.

9. Check dowels for shear and tension capability

The staff reviewed the design calculations, discussed the design methodology, and determined the shear and tension capability of all connections to be acceptable. This item is technically closed.

Borated Water Storage Tank

1. Long-term settlement monitoring plan during plant operation

This is a technical specification issue, ~~with all technical issues resolved~~. The information will be provided to the NRC as part of the FSAR technical specification submittal.

2. FSAR documentation on as-built conditions

This is a confirmatory item with all technical issues resolved. The information will be provided to the NRC when available, for staff OL review.

3. Staff calculational review for governing loading combinations in structural design

The NRC staff reviewed the calculation for design of the new ring beam foundation for all applicable load combinations. The governing load combination is:

$$V = 1.4D + 1.4T + 1.4F + 1.7L + 1.7H + 1.9E$$

The staff also reviewed the methodology used for design of a typical section considering all forces and moments. This item is technically closed.

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Underground Piping

1. Staff evaluation of previously submitted reports on underground piping not completed

The NRC staff reviewed the calculations for stresses due to seismic and settlement effects. The staff agreed with the assumptions, methodology, and results of the analysis.

The geotechnical branch completed its review of previously submitted reports. The applicant agreed to add ^{live} additional ^{settlement and strain} monitoring stations as requested plus settlement markers at each end of transition zones of replaced/rebedded pipes as shown on Drawing 7220-SK-C-745. The applicant also agreed to change the monitoring frequency to once per month for the first 6 months of plant operation. This will be written into the technical specifications. This item is technically closed.

2. The applicant's proposed reinstallation of 26-inch and 36-inch diameter pipes including review of analysis, properties of backfill, extent of excavation details of transition, and controls during construction

The staff visited the site to review the arrangement of the service water piping in the SWPS.

The design approach for reinstallation of the service water pipe was reviewed and approved. The applicant provided a preliminary stress summary table for the piping to be reinstalled. The final table will be provided by August 20, 1982. Drawing 7220-SK-C-745 was marked up to show the settlement and strain monitoring locations that were agreed upon. A copy of this marked-up drawing is included as Attachment 4.

Properties of the proposed backfill were provided for review. It is presently planned to use a mixture of sand, cement, and fly ash. A proprietary product of this type is "K-Krete".

The next FSAR revision will document the design for the reinstalled piping, properties of the backfill material, and the stress summary table. This item is technically closed.

Attachment 4 is a reduced drawing that is not clear and does not permit checking whether agreed upon locations were added.

The five additional settlement and strain marker locations are station 1+52 and 3+15 for line 26" OHBC-15, station 1+55 for line 26" OHBC-20, station 0+80 for line 26" OHBC-55 and station 3+00 for line 26" OHBC-54.

The frequency of readings will be lengthened to the 90 day interval following the initial six month period if the settlement readings have stabilized (not larger than 0.10 inch, change from the previous reading).

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3. Plant control restricting placement of heavy loads over buried piping and conduits

This is a technical specification item, ~~with all technical issues resolved~~. The information will be provided to the NRC as part of the FSAR technical specification submittal.

4. FSAR documentation on as-built conditions

This is a confirmatory item with all technical issues resolved. The information will be provided to the NRC when it is available.

5. Technical specification proposal by applicant for long-term settlement and strain monitoring plan during plant operation

This is a technical specification item, ~~with all technical issues resolved~~. The information will be provided to the NRC as part of the FSAR technical specification submittal.

Diesel Generator Building Analysis

1. Resolution of assumptions (structural rigidity) and completion of analysis that uses correct settlement values; documentation of these results with comparison to recorded and predicted settlements

The NRC staff reviewed calculations for the diesel generator building which included settlement effects prior to, during, and after surcharge, including predicted values for the life of the plant.

The maximum calculated stress for the period March 28, 1978, to August 18, 1978, is approximately 11 ksi.

Bearing pressures were reviewed and found to be acceptable. This item is technically closed.

2. Long-term settlement monitoring plan during plant operation

This is a technical specification item, ~~with all technical issues resolved~~. The information will be provided to the NRC as part of the FSAR technical specification submittal.

The NRC staff expressed the need to further review the results of calculations on the effects of settlement on the DGB including the method used by the applicant to characterize the shape of the structure resulting from actually recorded settlements and predicted settlement values.

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Permanent Dewatering

1. Resolve availability of 60-day period in view of recharge rate in wells in AB railroad bay area

The applicant reviewed with the NRC staff the events related to the rupture of a construction water pipe which affected the recharge response in the railroad bay area.

~~A detailed discussion was also provided regarding the 8 1/2 day period to initiate shutdown. This period will be documented in the technical specifications. A report will be submitted after system installation to document the water contours developed by the permanent dewatering system. This report will provide final verification of any water source in the railroad bay area. This item is technically closed.~~

2. Requirements of permanent dewatering system during plant operation

This is a technical specification item with all technical issues resolved. The information will be provided to the NRC as part of the FSAR technical specification submittal.

3. Results of typical well fines monitoring

The applicant provided typical results from the July fines monitoring of the AB construction dewatering wells.

<u>Well</u>	<u>5 micron (ppm)</u>	<u>50 micron (ppm)</u>
ME-7	0.5	0.2
ME-8	1.1	0.4
ME-9	0.5	0.3
ME-46	0.6	1.0

This item is technically closed.

Prepared by:

Neal Swanberg

N.W. Swanberg
Assistant Project Engineer

8/4/1

- Attachments:
1. Draft FSAR Table 2.5-14
 2. Definitions of Alert and Action Levels for Underpinning Activities
 3. Numerical Values for Phases II, III, and IV for Underpinning
 4. Markup of Drawing 7220-SK-C-795

Information provided in response to NRC Hydrologic Engineering Section written questions were provided for future review in Echelon and included information on the

MIDLAND 162-FSAR

TABLE 2.5-14

SUMMARY OF CONTACT STRESSES AND ULTIMATE BEARING CAPACITY FOR FOUNDATIONS SUPPORTING SEISMIC CATEGORY I AND OTHER SELECTED STRUCTURES

118
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EARTH
PRESS
WATER
ELEV

Unit	Supporting Soils	Foundation Elevation	Contact Stress Beneath Footing (lb/ft ²)				Factor of Safety			AR	AT	AR	AT
			Gross Dead and Live Load	Net Dead and Live Load	Gross Dead, Live, and Seismic Load	Net Dead, Live, and Seismic Load	Net Ultimate Bearing Capacity (lb/ft ²)	Dead and Live Load	Dead, Live, and Seismic Load				
Category I Structures													
Reactor containment buildings	Very stiff to hard natural cohesive soils	582.5	10,000	3,300	19,500	12,800	45,000	13.6	3.5	P	627		
Auxiliary building area "A"	Very stiff to hard natural cohesive soils	562	LT 7000	LT -200	LT 8200	LT 1000	45,000	LT N.A	LT 45	AR	627	Sub	
Auxiliary building areas B and C ⁽¹⁾	Very stiff to hard natural cohesive soils	579	LT 6600	LT 400	LT 10200	LT 4000	50,000	LT 125	LT 12.5	AR	627	Sub	
Auxiliary building Area D ⁽¹⁾	Very stiff to hard natural cohesive soils	556	LT 15000	LT 8400	LT 20,600	LT 13,000	45,000	LT 6.1	LT 3.5	AR	*		
Auxiliary building Areas E and F ⁽¹⁾	Very stiff to hard natural cohesive soils	571	LT 7,400	LT 700	LT 16,200	LT 9,500	45,000	LT 64.3	LT 4.7	AR	*		
Auxiliary building Area G ⁽¹⁾	Zone 2 ⁽¹⁾	630.5	LT 4400	LT 4000	LT 6400	LT 6000	15,000	LT 3.7	LT 2.6	li	627	Sub	Shic
Auxiliary building Area H ⁽¹⁾	Zone 2 ⁽¹⁾	610	LT 5000	LT 2100	LT 8700	LT 5800	30,000	LT 14.3	LT 5.2	li			
Auxiliary building Areas I and J ⁽¹⁾	Very stiff to hard natural cohesive soils	569	LT 6800	LT 0	LT 9200	LT 2400	50,000	LT N.A	LT 20.8	li			

+ Water varied: $\begin{cases} 635.5 & \text{accident condition} \\ 627 & \text{w earthquake} \\ 595 & \text{Norm case w perm desaturation} \\ 585 & \text{Low case} \end{cases}$

Table 2.5-14 (sheet 1) Revision 44 6/82

ΔE
7-29-82

MIDLAND 1&2-FSAR

TABLE 2.5-14 (continued)

Unit	Supporting Soils	Foundation Elevation	Contact Stress Beneath Footing (lb/ft ²)		Factor of Safety					
			Gross Dead and Live Load	Net Dead and Live Load	Gross Dead, Live, and Seismic Load	Net Dead, Live, and Seismic Load	Net Ultimate Bearing Capacity (lb/ft ²)	Dead and Live Load	Dead, Live, and Seismic Load	
Auxiliary building Areas K and J ⁽¹⁾	Very stiff to hard natural cohesive soils	579	(2)	(2)	(2)	(2)	50,000	(2)	(2)	AK 677- Seismic AK (3) "AK 677- Seismic ① 86ft ② NO 4.7 ABOVE WATER AK :
Feedwater isolation valve pit	Structural sand backfill	601	4,200	(4)	10,100	5,800	25,000	(4)	4.3	
Diesel generator building	Zone 2 ⁽³⁾	628	4,400	3,600	5,700	4,900	14,000	3.9	2.9	
Diesel generator pedestal foundation	Zone 2 ⁽³⁾	628	1,670	900	2,050	1,300	8,000	8.9	6.2	
Borated water storage tank	Zone 2 ⁽³⁾	629	2,000	1,400	4,600	4,000	12,000	8.6	3.0	
Service Water Pump Structure										
Underpinning Walls	Very stiff to hard natural cohesive soils	587	11,220	7,845	23,110	19,735	52,000	6.6	2.6	
Lower mat	Very stiff to hard natural cohesive soils	587	4,920	4,500	13,550	13,100	50,000	11.1	3.8	

① compares to at rest for class
 ② accident case
 677 seismic event case
 ③ see * on first page

KIDLAND 162-FSAR

TABLE 2.5-14 (continued)

Unit	Supporting Soils	Foundation Elevation	Contact Stress Beneath Footing (lb/ft ²)				Factor of Safety		
			Gross Dead and Live Load	Net Dead and Live Load	Gross Dead, Live, and Seismic Load	Net Dead, Live, and Seismic Load	Net Ultimate Bearing Capacity (lb/ft ²)	Dead and Live Load	Dead, Live, and Seismic Load
Circulating water isolation system	Very stiff to hard natural cohesive soils and dense natural sands	596.5	4,030	3,800	4,090	3,900	25,000	6.6	6.4

Note: Factor of safety is defined as the ratio of net ultimate bearing capacity to net contact stress beneath footing.

⁽¹⁾ Refer to Figure 2.5-47 for auxiliary building areas.

~~⁽²⁾ Revised values are to be provided by amendment following reanalysis.~~

⁽³⁾ Refer to Table 2.5-10 for description of Zone 2 soil.

⁽⁴⁾ For these cases, the applied loads are less than or about equal to the depth of embedment times the unit weight of the soil. Therefore, net loads are negative or insignificant and the factor of safety against bearing capacity failure is not applicable.

2. LOAD IS TRANSFERRED TO AREAS D, E & F AS A RESULT OF THE UNDERPINNING OPERATION. (FROM K & L)

5. GROSS SOIL PRESSURE UNDER THE AREAS A THRU L ASSUME THE WATER TABLE IS AT EL. 585'-0.

Alert Level

All values up to the alert level are considered to be within normal working ranges.

Settlement readings should be reviewed by the resident structural engineer daily. In general, for readings below the alert level, attention should be focused on the value of the readings versus the construction progress and any indication of trends that would indicate the alert level will be exceeded.

Once the alert level is exceeded, the site resident engineer must inform engineering in Ann Arbor of the situation. The data including information from the other appropriate data mechanisms should be evaluated in total. Where trends exist that indicate the action level is likely to be reached, plans should be evaluated, ^{and implemented as necessary} to remedy the situation. ^{to prevent the action level from being reached}
(Note: It is recognized that the evaluation may well conclude that no changes are warranted.)

Action Levels*

^{Differential settlement which reach}
Values ^{in excess of} the action level must be reviewed by the resident structural engineer and as soon as possible by engineering in Ann Arbor.

and actions described in Specification C-200
Plans, should be initiated to modify the condition that caused the
settlement reading to ^{reach} ~~exceed~~ the action level. Consumers Power Company
must be informed of the revised plan so that the NRC can be advised of
the situation. The revised plan shall be initiated immediately upon
verbal notification by the resident structural engineer. ~~(Note: It is
recognized that the evaluation may well conclude that no changes are
warranted.)~~ If continuous movement beyond action level occurs, immediate
~~action shall be taken per Specification C-200.~~

If the differential settlements reach 0.50 inch ^(Requality Level), the applicant will start
discussions with NRC for consideration of and concurrence with future
actions before implementing those actions.

* - Cracking levels correspond to these definitions for Alert and Action.

/dj

072801

REMEDIAL SOILS

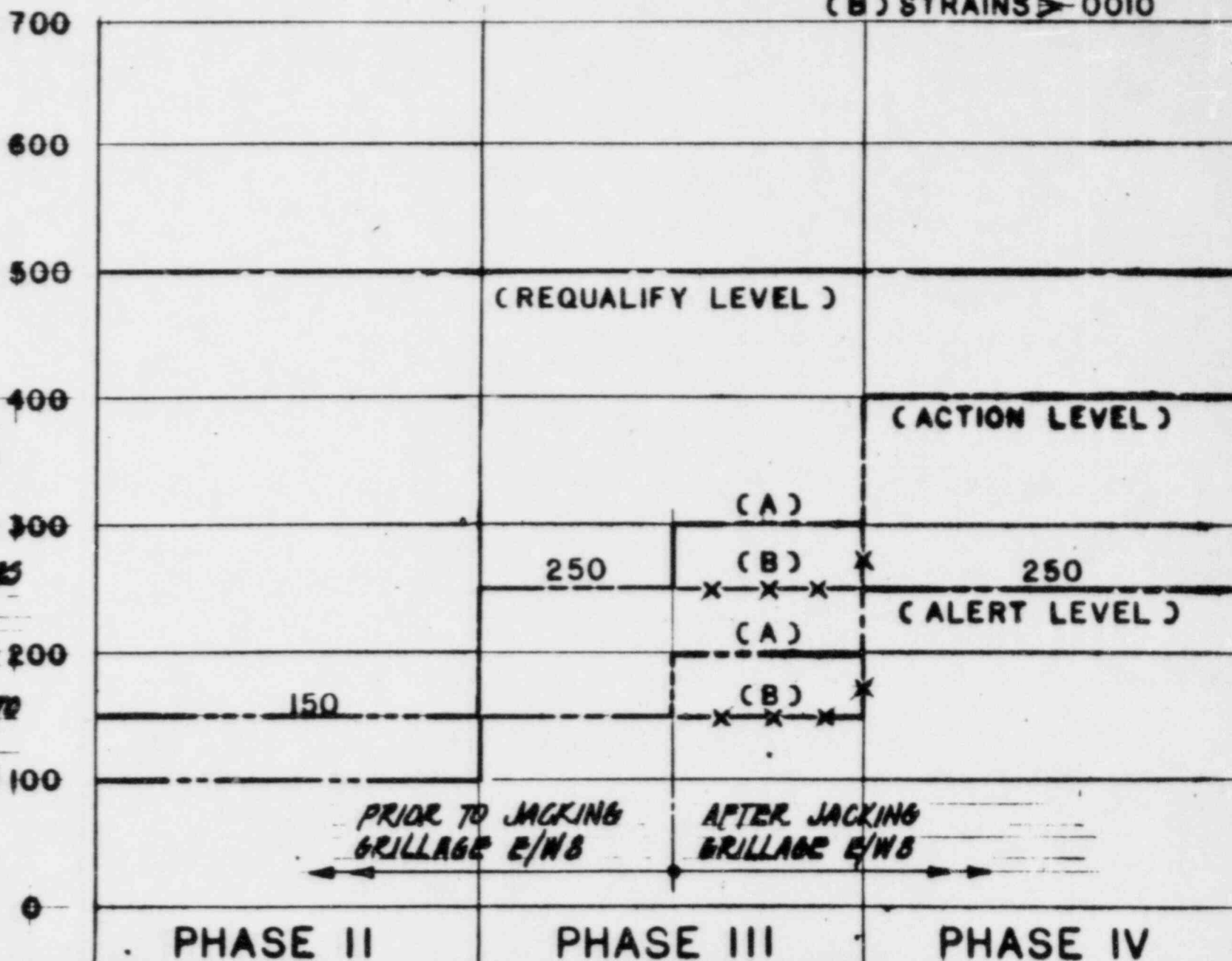
Attachment 3
Sheet 1

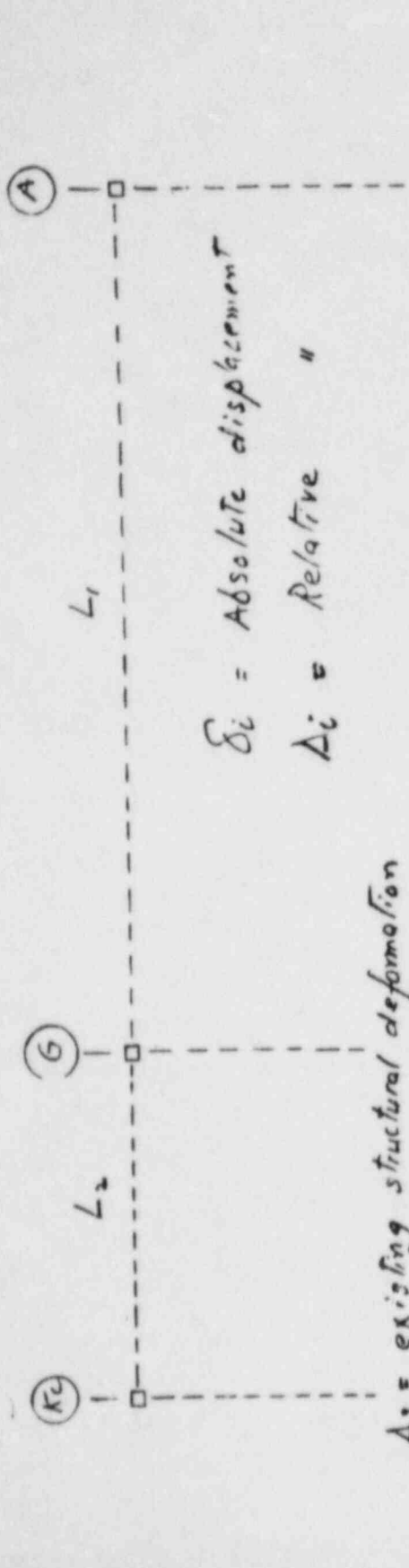
SETTLEMENT MONITORING MATRIX

(A) STRAINS \triangleleft 0010
(B) STRAINS \triangleright 0010

\triangle
RELATIVE
SETTLEMENT
DUE TO BENDING
IN MILS

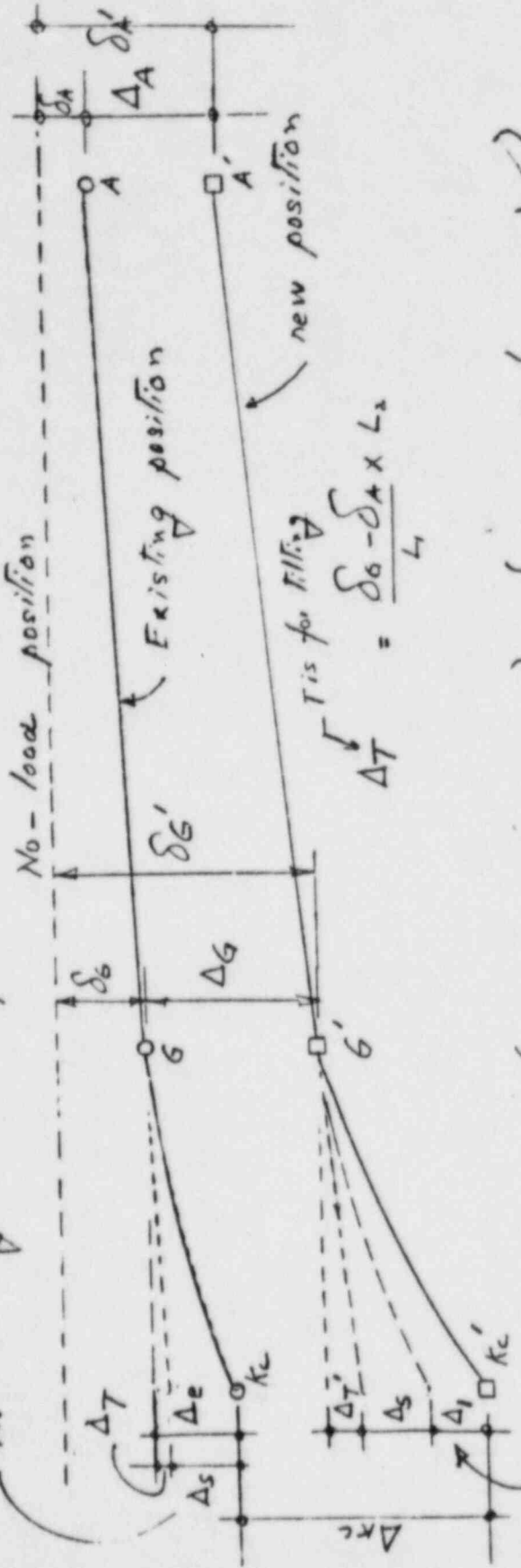
NOTE:
PHASE II ALLOWABLES
APPLY ONLY UNTIL
CONNECTIONS ARE
UPGRADED AS REQ'D
(CONNECTIONS WERE TO
BE VERIFIED PER
JUNE 14 SUBMITTAL)





$\delta_i = \text{Absolute displacement}$
 $\Delta_i = \text{Relative displacement}$

$\Delta_s = \text{existing structural deformation}$

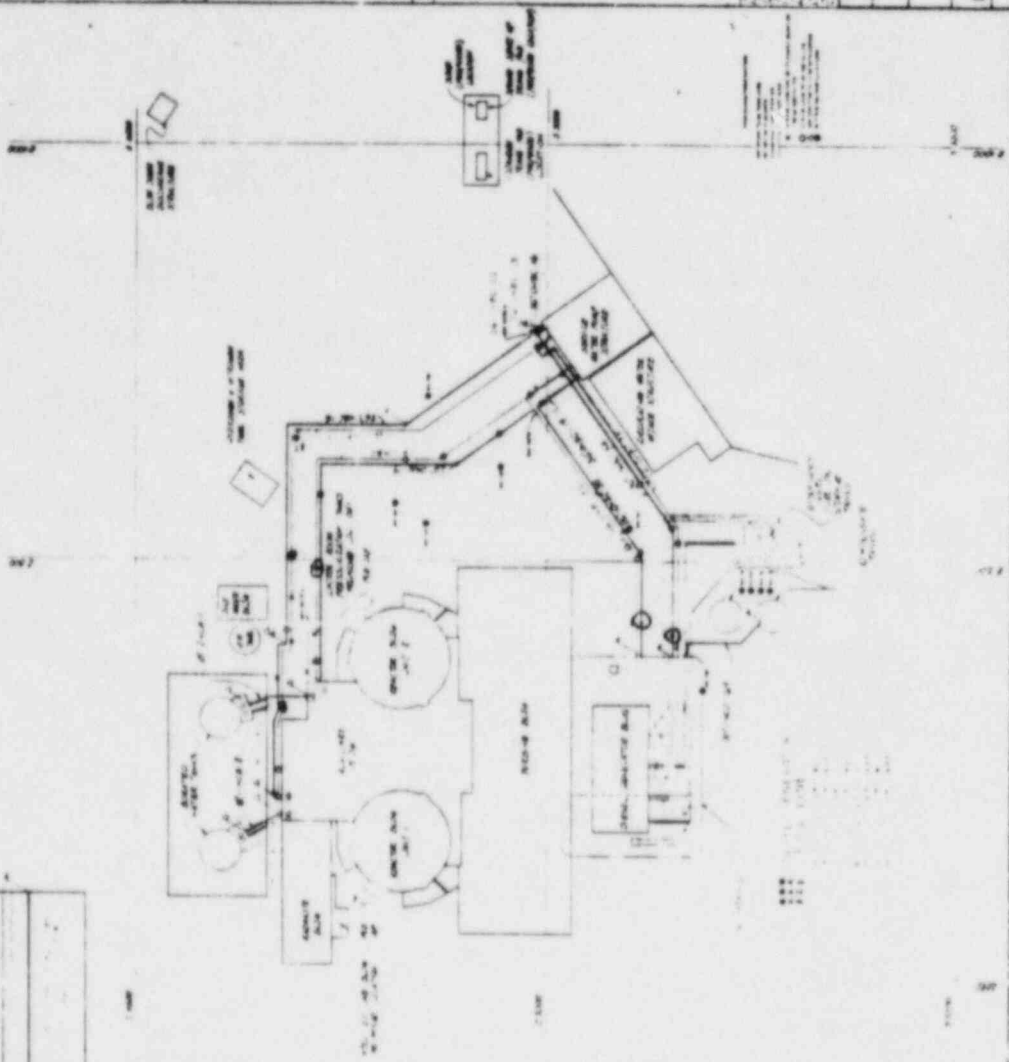
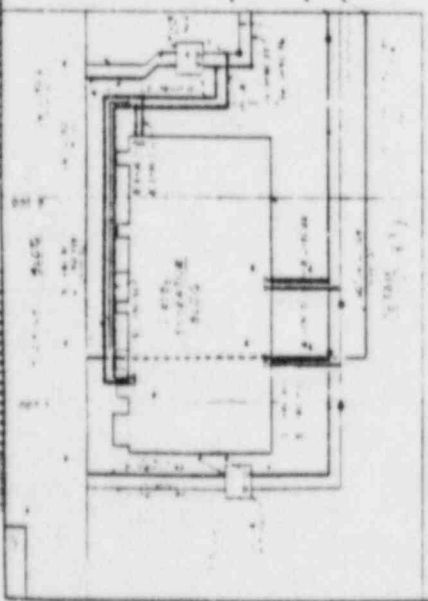


Δ_T is for filling
 $\Delta_T = \frac{\delta_G - \delta_A \times L_2}{L_1}$

$$\Delta_{\text{allowable}} = \left\{ \Delta_{K_c} + \Delta_S + \Delta_T \right\} - \left\{ \Delta_G + \Delta_T' + \Delta_S \right\}$$

$$= \Delta_{K_c} + \Delta_T - \Delta_G - \Delta_T'$$

30X



LEGEND



REFERENCE DIMENSIONS

30 X 100	1.0000	100.0000
30 X 200	2.0000	200.0000
30 X 300	3.0000	300.0000
30 X 400	4.0000	400.0000
30 X 500	5.0000	500.0000
30 X 600	6.0000	600.0000
30 X 700	7.0000	700.0000
30 X 800	8.0000	800.0000
30 X 900	9.0000	900.0000
30 X 1000	10.0000	1000.0000

NOTES

1. ALL DIMENSIONS ARE IN FEET AND INCHES.
2. ALL DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED.
3. ALL DIMENSIONS ARE TO FACE UNLESS OTHERWISE SPECIFIED.
4. ALL DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED.
5. ALL DIMENSIONS ARE TO FACE UNLESS OTHERWISE SPECIFIED.
6. ALL DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED.
7. ALL DIMENSIONS ARE TO FACE UNLESS OTHERWISE SPECIFIED.
8. ALL DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED.
9. ALL DIMENSIONS ARE TO FACE UNLESS OTHERWISE SPECIFIED.
10. ALL DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED.

SECRET

MIDLAND PLANT UNIT B-15
 CONSOLIDATED FERTILIZER COMPANY

PLAN OF BURIED PIPE LOCATION

7220 7-2-75

11 / Box 7

Records in folder labeled

"Midland - Seismic Margin

Review Studies" maintained

by Joseph Kone.

5-PDR