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

October 26, 1983

Docket Nos: 50-329 OM, OL
and 50-330 OM, OL

MEMORANDUM FOR: The Atomic Safety and Licensing Board for the Midland Plant, Units 1 & 2

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

SUBJECT: TRANSMITTAL OF REPORT ON RE-REVIEW OF THE MIDLAND DIESEL GENERATOR BUILDING (BN 83-165)

By earlier Board Notifications 83-109, 83-142 and 83-153, the NRC has described its plan to address the concerns of Dr. Ross Landsman of Region III regarding the structural adequacy of the Midland Diesel Generator Building (DGB). The plan included the preparation of a report on the adequacy of the DGB by a team of NRC structural engineers and consultants. That report, and an accompanying coverletter by the team head, Dr. P. T. Kuo, is enclosed (Enclosure 1) for your information.

Enclosure 2 provides the applicant's results of a modified finite-element analysis of the DGB which was requested by the review team on September 12, 1983, but which was not provided to a schedule consistent with issuance of Enclosure 1. The modified analysis is discussed in Section 2.4.2 to Appendix III of Enclosure 1.

The NRC is currently reviewing Enclosures 1 and 2 to determine its impact, if any, on existing staff positions. The staff plans to prepare a response to Congress relative to the concerns expressed by Dr. Landsman before the Subcommittee on Interior and Insular Affairs on June 16, 1983. The effort is proceeding on a high priority basis. Results will be reported as they become available.

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

Enclosures:
As Stated

cc: See next page

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Docket Nos. 50-329/330

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October 14, 1983

Harold R Denton
Office of Nuclear Reactor Regulation
U S Nuclear Regulatory Commission
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MIDLAND ENERGY CENTER
MIDLAND DOCKET NOS 50-329, 50-330
ADDITIONAL INFORMATION REQUESTED BY NRC STAFF
AT THE TECHNICAL AUDIT OF THE DIESEL GENERATOR BUILDING
FILE: B3.0.3 SERIAL: 25867

This letter transmits to the NRC Staff the information requested at the September 12, 1983 Technical Audit of the Diesel Generator Building (DGB) in Ann Arbor, Michigan. The information provides a comparison of rebar stresses resulting from two analyses in which the forty-year estimated settlements (Settlement Case 2B) were performed on a finite-element model of the DGB. The model and the referenced settlement case were previously discussed by Mr Karl Wiedner at the Atomic Safety and Licensing Board (ASLB) hearing held on December 8 & 9, 1982.

Table 1 gives the stresses for settlements imposed at 10 boundary nodes around the DGB foundation; specifically, 5 nodes on the south wall, and 5 nodes on the north wall. These nodes are located at the intersection of cross walls with north and south walls. This analysis was performed for information purposes only and was carried out during April of 1982.

Table 2 gives stresses for the same settlement case as above, however, this time, settlement values were imposed at 66 boundary nodes around the DGB foundation. The settlement values were obtained by fitting smooth fourth-order polynomial curves through the same settlement values for the 10 node points on the north and south walls stated above. Likewise, this analysis was performed for information purposes only and at the suggestion of the NRC Staff during the aforementioned audit.

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Tabulated rebar stresses for the majority of the elements for both cases are considerably in excess of the allowable value (54 ksi). For the elements with maximum stress values in the the same category the rebar stress values obtained from the second analysis (Table II) are consistently higher than those obtained from the first analysis (Table I).

RJE/MFC/bjw

CC RJCook, Midland Resident Inspector
JGKeppler, Administrator, Region III
DHood, NRC
FRinaldi, NRC
PTKuo, NRC
GLear, NRC
GHarsted, Consultant
JMatra, NSWC
MReich, BNL
CMiller, BNL
CConstancino, BNL
JKane, NRC
RLandsman, Region III

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

Letter Serial 25867 Dated October 14, 1983

At the request of the Commission and pursuant to the Atomic Energy Acts of 1954, and the Energy Reorganization Act of 1974, as amended and the Commission's Rules and Regulations thereunder, Consumers Power Company submits information requested by the NRC during the DGB audit held on September 12, 1983.

CONSUMERS POWER COMPANY

By /s/ R J Erhardt
R J Erhardt
Executive Manager - Midland Project

Sworn and subscribed before me this 17th day of October .

/s/ Alva C Robinson
Notary Public
Jackson County, Michigan

My Commission Expires October 1, 1986.

TABLE 1

129860

DIESEL GENERATOR BUILDING

Displacements imposed at 10 points around the bldg.

TABULATION OF MAX REBAR STRESSES FOR IMPOSING GEOTECH'S 40-YEAR DISPLACEMENTS.

Settlement Case 2B

CATEGORY	ELEMENT	LOAD CASE	DIR'N	AXIAL K/Ft	MOMENT K-Ft/Ft	SHEAR K/Ft	GRAD	REBAR STRESS	CONC STRESS
WEST WALL	43	1	VER	267.573	-19.318	95.990	0	170 *	0.000
INTERIOR WALL	640	1	VER.	136.897	0.529	-66.791	0	115 *	0.000
EAST WALL	895	1	VERT.	141.973	17.367	43.310	0	101.913	0.000
NORTH WALL	102	1	VERT.	186.210	-25.266	-73.447	0	120 *	0.000
SOUTH WALL	689	1	HOR.	276.129	17.615	122.949	0	175 *	0.000
SLAB @ 664'-0"	377	1	E-W	31.358	2.387	-11.755	0	38.629	0.000
ROOF @ 680'-0"	358	1	E-W	65.495	1.268	28.860	0	42.500	0.000
SHIELD WALL NORTH	196	1	HOR.	29.155	8.453	21.334	0	15.859	0.000
SHIELD WALL (S) ABOVE EL 664'-0"	610	1	VER	69.375	6.764	45.297	0	73.379	0.000
SHIELD WALL (S) BELOW EL 664'-0"	631	1	HOR	86.690	78.147	49.568	0	73 *	0.000
INTERNAL SHIELD WALL	398	1	HOR.	0.864	0.190	1.853	0	5.766	0.000
BOX MISSILE SHIELD	739	1	VERT	32.054	0.626	-18.679	0	37.360	0.000

REFERENCE BSAP OUTPUT, CALC NO. DQ-52.1-C1(Q)

REFERENCE OPTCON OUTPUT, CALC NO. DQ-52.1-C2(Q)

* Stresses based on axial load only

TABLE 2

129860

DIESEL GENERATOR BUILDING

Displacements imposed at 66 points around the bldg

Tabulation of Max Rebar Stresses For Enforced 40 yr settlements from 4th order curve.
(Settlement Case 2B)

DGB STRUCTURAL CATEGORY	ELEMENT NO.	LOAD CASE	REBAR DIR'N	AXIAL FORCE (K/FT)	BENDING MOMENT (FT-K/FT)	SHEAR FORCE (K/FT)	TEMP GRAD. (°F)	REBAR STRESS (KSI)	CONC. STRESS (KSI)
WEST WALL	36	1	Vert	201.627	-16.246	-84.206	0	173.036	0
INTERIOR WALL	641	1	Vert	107.829	4.254	-47.798	0	114.301	0
EAST WALL	895	1	Vert	467.989	34.162	88.293	0	244.584	0
NORTH WALL	766	1	Vert	408.619	-34.272	81.767	0	266.747	0
SOUTH WALL	716	1	Vert	416.466	9.614	-37.377	0	258.916	0
SLAB @ 664'-0"	178	1	E-W	60.995	2.283	1.152	0	72.177	0
ROOF @ 680'-0"	791	1	N-S	77.936	4.567	9.503	0	70.442	0
SHIELD WALL NORTH	839	1	Vert	58.894	12.754	-4.308	0	29.617	0
SHIELD WALL SOUTH ABOVE 664'0"	610	1	Vert	92.365	8.273	61.632	0	108.295	0
SHIELD WALL SOUTH BELOW 664'0"	631	1	Horiz.	119.811	95.726	70.239	0	230.620	0
INTERNAL SHIELD WALL	398	1	Horiz	6.888	.255	4.905	0	8.147	0
BOX MISSILE SHIELD	739	1	Vert	47.516	1.782	-16.187	0	56.657	0

Reference BSAP output DQ-52.12-C1 (Q), Rev 0
Reference OPTCON output DQ-52.12-C2 (Q), Rev 0

~~Central~~ ② File

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

OCT 21 1983

MEMORANDUM FOR: P. T. Kuo, Section Leader
Structural Engineering Section B
Structural and Geotechnical Engineering Branch
Division of Engineering

FROM: Frank Rinaldi, Structural Engineer
Structural Engineering Section B
Structural and Geotechnical Engineering Branch
Division of Engineering

SUBJECT: R. LANDSMAN'S CONCERNS ON INTEGRITY OF DIESEL GENERATOR BUILDING AT MIDLAND SITE

Enclosed please find the initial response to R. Landsman's concerns on the integrity of the Diesel Generator Building at the Midland site, as prepared during a working meeting on July 28, 1983, by myself and our consultants, John Matra and Gunnar Harstead.

Frank Rinaldi

Frank Rinaldi, Structural Engineer
Structural Engineering Section B
Structural and Geotechnical
Engineering Branch
Division of Engineering

Enclosure: As stated

cc: H. Denton
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J. Matra
G. Harstead
F. Rinaldi

OCT 26 1983

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REPLY TO R. B. LANDSMAN'S CONCERNS ON THE STRUCTURAL INTEGRITY OF THE DIESEL GENERATOR BUILDING FOR MIDLAND NUCLEAR POWER PLANT

INTRODUCTION:

The structural engineering staff and their consultants have reviewed and evaluated the structural adequacy of the Diesel Generator Building (DGB) to determine the functionality of the DGB and compliance of the design to the structural engineering requirements of NRC for the licensing of a nuclear power plant.

The Midland Nuclear Power Plant (NPP) has had a number of technical reviewers throughout the licensing period, Construction Permit (CP) and Operating License (OL) stages.

This report concentrates on the period following the determination by Consumer Power Co. (CPCo) that the fill material under the DGB did not meet the design specifications and that remedial actions were necessary. The applicant, under advice of their consultants, surcharged the structure with approximately 30 feet of sand and implemented a permanent dewatering program to correct the poor soil conditions under the DGB. In addition, electrical ducts were discovered to be supported by a competent foundation and were structurally connected to the base of the DGB. This condition imposed new loads on the structure in addition to all other design loads (Dead Loads, Live Loads, Tornado Loads, Earthquake Loads, Temperature Loads), and the abnormal differential settlement loads. Considerable cracks developed as a result of these additional loads. In order to eliminate this condition, the duct banks were released, therby removing one of the abnormal loads.

The DGB is a reinforced concrete structure with three crosswalls that divide the structure into four cells. Each cell contains a 6 ft.-6 inch-thick concrete pedestal to support a diesel generator unit. The building is supported on continuous footings that are founded at el. 628 ft. and rest on backfill that extends down to approximately el. 603 ft. This rectangular boxlike structure covers an area of approximately 70 ft. by 155 ft. The exterior walls are 30 in. thick, and the interior walls are 18 in. thick. The foundations of the exterior and interior walls of the DGB consist of continuous reinforced concrete footings, 10 ft. wide and 2 ft. 6 inch thick, with their base at el. 628 ft. The walls rise from an elevation of 628 ft. (bottom of footing) to el. 690 ft. (top of roof slab).

Sections 3.8.3.4 and 3.8.3.5 of Supplement No. 2 to the Midland NPP Safety Evaluation Report summarize the NRC structural staff and consultants evaluation of the DGB. This document was modified during the (ASLB) hearing of December 10, 1982, by the additional written testimony of Frank Rinaldi, Franz Schauer, John Matra, and Gunnar Harstead and all oral correction introduced by the same witnesses. The adequacy of the DGB is based upon many analyses, reviews, and monitoring requirements which address normal loads, settlement loads and postulated environmental loads. Due to the fact that available measured and predicted settlement data is not sufficiently refined to calculate structural component's stress by the use of a finite element analyses, the following quotations summarize the structural staff position for acceptance of the DGB:

(a) The NRC Staff believes the actual measured settlement values are the best characterization of settlement at the Midland site.

(b) The NRC Staff has not fully relied on these settlement values in any analyses to ascertain the acceptability of the DGB to withstand its design load over the lifetime of the plant. Instead, the Staff has looked at the current condition of the structure to estimate stresses due to settlement. To these it added stresses due to other design loads which are not presently on the structure but which have to be considered. The staff relied on Applicant's finite element analysis only for the latter stresses.

(c) The NRC Staff finds the DGB to be structurally acceptable.

(d) The NRC Staff is requiring a program of surveillance of the structure and for its foundation to ensure the continued safety of the structure.

(e) The NRC Staff takes no postion with respect to the acceptability of Applicant's finite element analysis of the DGB (as applicable to settlement effects).

(f) The NRC Staff's acceptance of the DGB is subject to the outcome of Seismic Margin Review.

Summary of Landsman's Concerns:

The concerns documented by R. Landsman regarding the DGB by his memorandum to R. F. Warnick, Director, Office of Special Cases, Region III, dated July 19, 1983, transmitted to D. G. Eisenhut, Director, Division of Licensing, NRR, by memorandum dated July 21, 1983, were received by the undersigned on July 27, 1983. This memorandum identifies, in general, concerns previously discussed by the staff during internal meetings and at the ASLB December 1982 hearings related to the DGB. The undersigned fail to understand why R. Landsman has not chosen to participate more fully during these meetings, or why he had not documented his concerns during the review process. The concerns identified in his July 19, 1983 memorandum in some cases are not clear, do not give specific reference to transcripts and other official documents, and in some cases, references to various statements are not fully correct. We will first summarize our understanding of his concerns and then address them in the following order:

FIRST CONCERN: Claim of inadequacy of the Finite Element (FE) Analysis performed by the applicant for the DGB as applies to the following:

(a) Effect of cracks on stiffness of DGB
(b) Validity of straight line settlement data
(c) Time dependency effects of settlements
(d) Corley statement on cracks and time dependency effects of settlement
(e) Staff's official position on FE analyses as stated by F. Schauer.

SECOND CONCERN:

(a) Claim that the analyses performed by NRC staff consultant (NSWC) is not properly documented in the SSER #2 based on their testimony at ASLB hearing.

(b) Claim that different analyses (Plastic) should have been used.

(c) Claim that F. Rinaldi stated that the staff cannot rely on the results of the NSWC analyses using actual settlement values.

THIRD CONCERN: Claim that the crack evaluation used to determine the stress in the reinforcing steel is not an adequate practical engineering approach.

FOURTH CONCERN: Claim that the crack monitoring program accepted by the staff to evaluate the rebar stresses during the service life of the building is not adequate.

SUMMARY: Recommendation for new remedial structural fixes required to ensure structural integrity and provide adequate margins of safety.

<u>Reply to Landsman's Concern:</u>

FIRST CONCERN

Part (a) In the design of reinforced concrete structures, the composite of concrete and rebars is modelled as homogeneous material with the concrete expected to crack under tensile loads. It is acceptable to assume concrete sections as uncracked for calculational purposes. The assumption of uncracked concrete neglects both the expected cracks and the stiffness of reinforcing bars which are compensating effects in the calculation of stiffness. Also, a reduced stiffness would reduce moments and forces due to settlement, therefore, reducing some conservatism from the structural analyses.

In conclusion, we find the design practice of neglecting the cracks in an analysis of the reinforced concrete structure is acceptable. Note that extensive crack evaluation efforts have been carried out by the applicant and their consultants and by the staff and our consultants, to determine the effects of cracks on the structure.

Part (b) The direct use of settlement data can give results which can be used to develop indications of the state of stress in the structure. The applicant used what they considered the best practical approach to determine the effects of the measured displacements on the structure, based on the available number of measured points and on the accuracy of the measurements.

The DGB is a stiff structure. The characterization of the boundary conditions used in the analyses should be consistent with that of a stiff structure; namely, linear. Also, settlement data has an inaccuracy inherent in the readings. The applicant's engineers claimed to have an accuracy no better than 1/8". Bending moments are proportional to the second derivative of displacement with respect to length and shear is proportional to the third derivative of displacement with respect to length. A mathematical error analysis shows that the accuracy diminishes with subsequent differentiation. Therefore, the accuracy of the moments and shears will be unreliable if the raw settlement data is used. Structural engineering judgment must be exercised in the formulation of the models and in the evaluation of the results.

The applicant performed many of the analyses to represent various stages of construction, including a completed model, a 40-year life-model and a model using no soil support in an area where we could not rely on the competence of the soil.

Attempts to directly use the raw settlement data resulted in anomalies such as tension in the soil and moments and forces in the structure that cannot be justified by prudent engineering judgment, analyses, and observations of the structure.

In conclusion we state that the use of the straight line or other representation using the available settlement data cannot produce credible results.Therefore, the staff did develop a conservative estimate of the state of stress of the structure based on the crack-evaluation and added these results to the stress levels for the environmental loads as per code requirements. However, we like to point out that several loads (DL, LL, T) were added twice. Also, the controlling load combination is the one with the tornado load. The applicant did not account for venting of the structure in their analysis, but the drawings and site visits indicated that considerable venting is provided. We like to point out that these two factors add a great deal of conservatism to the results. In addition, the effects of future settlement was considered in the applicant analysis, but the staff will rely on the monitoring program.

Part (c) The fact that settlement took place over a period of time was accounted for in the applicant's and in NSWC's analyses. Settlements that took place prior to the completion of construction has less effect on the final stresses in the structure, for the following reasons:

a. The partially constructed structure is less stiff and, therefore, moments and forces were minimized

b. reinforced concrete that had not yet been installed could not be subjected to stresses resulting from previous settlement. We, therefore, find that the time dependent effect was used to our satisfaction.

Part (d) We recommend contacting W. G. Corley and request his direct comments to R. Landsman's in First Concern Part (d).

Part (e) F. Schauer did make the statement identified by R. Landsman during the ASLB hearing of December 10, 1982 (p. 11149). However, we suggest that R. Landsman read the cross-examination by the ASLB on page 11150 of the December 10, 1983 hearing to fully understand the staff position as stated by F. Schauer.

The answers provided on that page of the transcripts states that one cannot fully rely on all of the analyses, and that engineering judgment needs to be exercized.

Second Concern

Part (a) The summary report of the NSWC analyses was entered into evidence at the ASLB, December 10, 1982, hearing. It was discussed in detail by J. Matra and commented on by F. Rinaldi, G. Harstead, and F. Schauer. In summary, that report stated the following points:

1. The behavior of this structure as shown by the results of the analyses is inconsistent with respect to the actual observations in the structure as far as crack locations. (Not for duct bank impingement consideration).

2. Analyses of the partial structure, including duct impingement, resulted in very high stresses in the walls at the duct banks. With these stresses over twenty times yield, a great possibility of cracks in these areas existed. A comparison between the crack mapping survey at this time of construction (3/78 to 1/79) and the analyses are in good agreement as far as the location of structural cracks in the area of the duct banks are concerned. However, the analyses show that other areas of the DGB walls still have high stresses and in probability should also be cracked. But no cracks were observed in these areas.

3. In all cases where the duct banks have been released, the measured or predicted settlement values imposed on the analytical models resulted in very high stresses in areas where no cracks now exist. Thus, indicating that these settlement values as such were not seen by this structure.

4. Imposing the measured settlement values on a partially completed model, and then considering these values as part of the total settlement values for the completed structure, without considering the following effects:

   (a) redistribution of loads once yield is reached,

   (b) the relaxation effects,

   (c) the accuracy of the measured data, and

   (d) the location of the measured settlement value relative to the footings where the actual displaced values were input are discussed, but not actually input into the analysis,

   can and does lead to large errors. Thus, this structure will never undergo the differential settlements as predicted nor the patterns of settlement indicated in the measured and or predicted settlements.

Also, as indicated in the reply to First Concern Part (b), the results indicate tension in the soil and moments and forces in the structure that cannot be accounted for using sound engineering practice.

The analyses indicated that the direct use of the limited number of actual measured settlement data in the engineering analyses cannot be used without proper structural engineering judgment. The analyses were used in selecting a crack monitoring point for the service life of the DGB (a location of high stress as per these analyses, but having no major cracks was selected).

Part (b) The elastic analyses performed by the applicant give correct and conservative indications of stress for non-settlement loads. This is concluded after having reviewed the structural model, the analyses and the results. If an elastic analysis shows a region of high bending moment such that reinforcing bar stresses exceed their yield stress, the section may then be considered plastic; i.e., increasing rotation will not increase moments or stresses. However, there is no indication of yielding rebars or spalling of concrete which would indicate that a portion of the structure has become plastic. In fact, the formation of plastic sections in a structure mitigates the secondary stress effects of conditions such as differential settlement. To state that "supposed areas of high stress, where cracks are not located, may not exist due to redistribution of loads," is inconsistent with the mechanism of redistribution of stresses.

Part (c) The claim that F. Rinaldi stated, "that the actual settlement values could not be relied upon to determine if the DGB meets the regulatory requirements" is not complete. The additional testimony clearly states that the applicant's analyses using linear settlement data were not fully relied upon in our evaluation. This is stated on pages 11084 - 11087 of the ASLB hearing transcripts, dated December 10, 1982. The staff performed an additional crack evaluation as stated in our written testimony presented on the pages following page 11086 of the above mentioned ASLB hearings. All stress levels were below code allowable. Therefore, we found the concrete cracking levels in the DGB, as reported by the applicant, acceptable. The proposed crack monitoring will provide controls over potential future crack-patterns.

Third Concern

The evaluation of cracks as performed by the Staff is not a structural analysis, but rather a method of estimating upper bound stresses in the rebars of an existing reinforced concrete structure. These values were used as conservative values for stress due to differential settlement, shrinkage and other secondary effects. These stresses were conservatively added to total stresses developed by the applicant.

The structural analyses of the DGB were performed by the applicant considering all load combinations as documented in their report, "Structural Stresses Induced by Differential Settlement of the DGB."

The results are documented in the additional written testimony. See transcripts for the ASLB hearing of December 10, 1982.

The DGB is not a complex structure, instead, it is a simple box-like structure. Also, all reinforced concrete structures have cracks and we disagree with the statement that "there is no practical method available today to analyze a complex structure with cracks in it." Note that the applicant's structural consultants and our structural staff and their consultants have performed several evaluations of the DGB without finding any unresolved concerns.

Fourth Concern

The DGB was not accepted by the staff soley by relying on a crack monitoring program. On the contrary, the acceptance was based upon reviews of the analyses and designs prepared by the applicant as well as independent calculations. Furthermore, the stresses caused by settlements are secondary stresses. Secondary stresses are defined as those stresses which can exist in a structural material which do not impair that capability of the structural material to carry primary stresses, provided the secondary stresses do not cause rupture or gross distortions of the structural material. From a variety of evaluations, the indications are that the stresses in the reinforcing bars are well below yield and far from rupture. The compressive stresses in the concrete are very low. There are no indications of gross distortions of the structure. Therefore, the cracks that have occurred merely indicate that the reinforcing bars will carry imposed tensile forces while imposed compressive forces will cause the cracks to close. While there are no expectations of rupture or gross distortions in the future, a crack monitoring program has been established to provide engineers with information to assess the condition of the structure, as a prudent measure.

The criteria for the monitoring program is identified as ASLB exhibit #29. It contains specific requirements for Alert and Action levels for the monitoring of single and collective crack widths.

Reply to Summary:

It is surprising that, with all of the data and information available on the subject of DGB there still exists such a misunderstanding. Beyond this response we would respectfully direct R. Landsman to evaluate all of the information currently available in the field of structural analysis and specifically to that available in the docket of the Midland project.

It is our conclusion that all analyses, designs, crack mapping and evaluations and the monitoring program are adequate to establish the structural integrity of the DGB. Only unexpected results during the monitoring program would necessitate a reassessment of the DGB.

Gunnar Harstead

Gunnar Harstead, Consultant
Structural & Geotechnical
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General Offices: 1945 West Parnall Road, Jackson, MI 49201 • (517) 788-0550

October 14, 1983

Harold R Denton
Office of Nuclear Reactor Regulation
U S Nuclear Regulatory Commission
Washington, DC 20555

MIDLAND ENERGY CENTER
MIDLAND DOCKET NOS 50-329, 50-330
ADDITIONAL INFORMATION REQUESTED BY NRC STAFF
AT THE TECHNICAL AUDIT OF THE DIESEL GENERATOR BUILDING
FILE: B3.0.3 SERIAL: 25867

This letter transmits to the NRC Staff the information requested at the September 12, 1983 Technical Audit of the Diesel Generator Building (DGB) in Ann Arbor, Michigan. The information provides a comparison of rebar stresses resulting from two analyses in which the forty-year estimated settlements (Settlement Case 2B) were performed on a finite-element model of the DGB. The model and the referenced settlement case were previously discussed by Mr Karl Wiedner at the Atomic Safety and Licensing Board (ASLB) hearing held on December 8 & 9, 1982.

Table 1 gives the stresses for settlements imposed at 10 boundary nodes around the DGB foundation; specifically, 5 nodes on the south wall, and 5 nodes on the north wall. These nodes are located at the intersection of cross walls with north and south walls. This analysis was performed for information purposes only and was carried out during April of 1982.

Table 2 gives stresses for the same settlement case as above, however, this time, settlement values were imposed at 66 boundary nodes around the DGB foundation. The settlement values were obtained by fitting smooth fourth-order polynomial curves through the same settlement values for the 10 node points on the north and south walls stated above. Likewise, this analysis was performed for information purposes only and at the suggestion of the NRC Staff during the aforementioned audit.

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OC1083-0055A-MP04

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Tabulated rebar stresses for the majority of the elements for both cases are considerably in excess of the allowable value (54 ksi). For the elements with maximum stress values in the the same category the rebar stress values obtained from the second analysis (Table II) are consistently higher than those obtained from the first analysis (Table I).

RJE/MFC/bjw

CC RJCook, Midland Resident Inspector
JGKeppler, Administrator, Region III
DHood, NRC
FRinaldi, NRC
PTKuo, NRC
GLear, NRC
GHarsted, Consultant
JMatra, NSWC
MReich, BNL
CMiller, BNL
CConstancino, BNL
JKane, NRC
RLandsman, Region III

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

Letter Serial 25867 Dated October 14, 1983

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 information requested by the NRC during the DGB audit held on September 12, 1983.

CONSUMERS POWER COMPANY

By R J Erhardt
R J Erhardt
Executive Manager - Midland Project

Sworn and subscribed before me this 17th day of October.

Alva C. Robinson
Notary Public

My Commission Expires Oct 1, 1986

0C1083-0055A-MP04

129860

TABLE 1

DIESEL GENERATOR BUILDING

Displacements imposed at 10 points around the bldg.

TABULATION OF MAX REBAR STRESSES FOR IMPOSING GEOTECHS 40-YEAR DISPLACEMENTS.

Settlement Case 2B

CATEGORY	ELEMENT	LOAD CASE	DIR'N	AXIAL K/Ft	MOMENT K-Ft/Ft	SHEAR K/Ft	GRAD	REBAR STRESS	CONC STRESS
WEST WALL	43	1	VER	267.573	-19.318	95.990	0	170*	0.000
INTERIOR WALL	640	1	VER	136.897	0.529	-66.791	0	115*	0.000
EAST WALL	895	1	VERT	161.973	17.367	43.310	0	101.943	0.000
NORTH WALL	102	1	VERT	186.210	-25.266	-73.447	0	120*	0.000
SOUTH WALL	689	1	HOR	276.129	17.415	122.949	0	175*	0.000
SLAB @ 664'-0"	377	1	E-W	31.358	2.387	-11.755	0	38.629	0.000
ROOF @ 680'-0"	358	1	E-W	65.495	1.268	28.860	0	42.500	0.000
SHIELD WALL NORTH	196	1	HOR.	29.155	8.453	21.334	0	15.859	0.000
SHIELD WALL (3) ABOVE EL 664'-0"	610	1	VER	69.375	6.764	45.297	0	73.379	0.000
SHIELD WALL (3) BELOW EL 664'-0"	631	1	HOR	86.690	78.147	49.568	0	73*	0.000
INTERNAL SHIELD WALL	398	1	HOR.	0.864	0.190	1.853	0	5.766	0.000
BOV MISSILE SHIELD	739	1	VERT	32.054	0.626	-18.679	0	37.360	0.000

REFERENCE BSAP OUTPUT, CALC NO. DQ-52.1-C1(Q)

REFERENCE OPTCON OUTPUT, CALC. NO. DQ-521-C2(Q)

* Stresses based on axial load only

TABLE 2

129860

DIESEL GENERATOR BUILDING

Displacements imposed at 66 points around the bldg

Tabulation of Max Rebar Stresses for Enforced 40 yr settlements from 4th order curve.
(Settlement Case 2B)

DGB STRUCTURAL CATEGORY	ELEMENT NO.	LOAD CASE	REBAR DIR'N	AXIAL FORCE (K/FT)	BENDING MOMENT (FT-K/FT)	SHEAR FORCE (K/FT)	TEMP GRAD. (°F)	REBAR STRESS (KSI)	CONC. STRESS (KSI)
WEST WALL	36	1	Vert	201.627	-16.246	-84.206	0	173.036	0
INTERIOR WALL	641	1	Vert	107.829	4.254	-47.798	0	114.301	0
EAST WALL	895	1	Vert	467.989	34.162	88.293	0	244.564	0
NORTH WALL	766	1	Vert	408.619	-34.272	81.767	0	266.747	0
SOUTH WALL	716	1	Vert	416.466	9.614	-37.377	0	258.916	0
SLAB @ 664'-0"	178	1	E-W	60.995	2.283	1.152	0	72.177	0
ROOF @ 680'-0"	791	1	N-S	77.936	4.567	9.503	0	70.442	0
SHIELD WALL NORTH	839	1	Vert	58.894	12.754	-4.30[illegible]	0	[illegible]	0
SHIELD WALL SOUTH ABOVE 664'0"	610	1	Vert	92.365	[illegible].273	[illegible].632	0	108.295	0
SHIELD WALL SOUTH BELOW 664'0"	631	1	Horiz.	[illegible]	[illegible]5.726	70.239	0	230.620	0
INTERNAL SHIELD WALL	398	1	Ho[illegible]	[illegible].888	.255	4.90[illegible]	0	8.147	0
BOX MISSILE SHIELD	739	1	[illegible]	47.516	1.782	-16.187	0	56.657	0

Reference BSAP Ou[illegible]ut DQ-52.12-C1(Q), Rev 0
Reference [illegible]PTCON [illegible]tput DQ-52.12-C2(Q), Rev 0

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

October 12, 1983

PRINCIPAL STAFF			
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D/RA		DE	
A/RA		[illegible]	
RC		[illegible]	
PAO		SCS	
SGA		[illegible]	
ENF		File	

Docket Nos: 50-329 OM, OL
and 50-330 OM, OL

Applicant: Consumers Power Company

Facility: Midland Plant, Units 1 and 2

Subject: Summary of September 12 and 13, 1983, Meeting on Structural Adequacy of the Diesel Generator Building

On September 12 and 13, 1983, a task force comprised of NRC structural engineers and NRC consultants from Brookhaven National Laboratory met at the Bechtel Offices in Ann Arbor, Michigan to discuss and audit structural design calculations of the Diesel Generator Building for Midland Plant, Units 1 and 2. The meeting is part of the re-evaluation described by Board Notification BN 83-109 dated July 27, 1983 (and subsequently by BN-142 dated September 22, 1983). Attachment 1 is a summary of the meeting and audit. Attachment 2 is an executive summary of the design of the Diesel Generator Building provided as a meeting handout. Attachments 3 and 4 provide a best fit polynomial matching the known settlement data which, at the request of the audit team, is to be used as input for a finite-element analysis by Bechtel. Results of the analysis are to be provided to Brookhaven.

A report by the task force will be issued in October 1983.

Darl S. Hood, Project Manager
Licensing Branch No. 4
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Attachments:
As stated

cc: See next page

OCT 17 1983

MIDLAND

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Supplemental page to the Midland OM, OL Service List

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ATTACHMENT 1

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

SEP 29 1983

Docket Nos.: 50-329/330

MEMORANDUM FOR: George E. Lear, Chief
Structural and Geotechnical Engineering Branch
Division of Engineering

THRU: Pao-Tsin Kuo, Section Leader
Structural Engineering Section B
Structural and Geotechnical Engineering Branch
Division of Engineering

FROM: Norman D. Romney, Structural Engineer
Structural Engineering Section B
Structural and Geotechnical Engineering Branch
Division of Engineering

Chen P. Tan, Structural Engineer
Structural Engineering Section B
Structural and Geotechnical Engineering Branch
Division of Engineering

SUBJECT: TRIP REPORT - MIDLAND DGB STRUCTURAL DESIGN AUDIT

As part of the NRC task group review of the Landsman's concerns regarding the Midland Diesel Generator Building (DGB), N. D. Romney and C. P. Tan of the SGEB staff visited the Bechtel, Ann Arbor, Michigan offices on September 12 and 13, 1983. The purpose of the visit was to conduct an audit of the structural design calculations of the Midland DGB. Mr. Romney and Dr. Tan were assisted by NRC consultants from Brookhaven National Lab, represented by Drs. A. J. Philippacopoulos, C. Miller, and C. Costantino.

On Monday, September 12, 1983, the NRC task group reviewed the following DGB calculations:

- concrete/rebar stresses using settlement data by Karl Wiedner;
- straight line (rigid body) settlement by Karl Wiedner;
- concrete/rebar stresses assuming the DGB is supported at four points;
- stress totals from all load combinations;
- finite element modal for DGB.

On Tuesday, September 13, 1983, the NRC task group reviewed calculations

CONTACT: N. D. Romney, SGEB
X 28987

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by Mete Sozen on rebar stresses estimated from concrete crack widths. In addition, the task group reviewed concrete pour data (sequence and date of pours) and settlement surveying procedures used on the DGB. The afternoon of September 13, 1983 was devoted to an interview of Mr. Ross Landsman of Region III by the NRC task group. The purpose of the interview was to gain a thorough understanding of Mr. Landsman's concerns regarding the DGB.

Enclosure 1 is a list of attendees for both days of the audit. Enclosure 2 was provided by Bechtel at the audit and is a chronological list of events before and after issuance of the NRC staff order modifying the construction permits.

Norman D. Romney
Structural and Geotechnical
Engineering Branch
Division of Engineering

Chen P. Tan
Structural and Geotechnical
Engineering Branch
Division of Engineering

Enclosures: As stated

cc: J. Knight
E. Adensam
D. Hood
P. Kuo

ENCLOSURE 1

ATTENDEES

DIESEL GENERATOR BUILDING AUDIT
SEPTEMBER 12, 1983

N. Swanberg	Bechtel
J. A. Mooney	CPCO
N. D. Romney	NRC/DE/SGEB
Darl Hood	NRC/NRR/DL/LB4
Chen P. Tan	NRC/NRR/DE/SGEB
Carl J. Costantino	BNL
Charles A. Miller	BNL
A. J. Philippacopoulos	BNL
P. Shunmugavel	Bechtel
B. Dhar	Bechtel
F. Villalta	CPCO
Ernie Koerke	CPCO
John Schaub	CPCO
Karl Wiedner	Bechtel-SF
K. Razdan	CPCO
A. Boos	Bechtel
G. Tuyeson	Bechtel
D. Reeves	Bechtel
D. Zanese	Bechtel
T. Kumbier	Bechtel
S. Afifi	Bechtel
T. R. Thirivengadam	CPCO

NRC AUDIT OF DIESEL GENERATOR BUILDINGS (DGB) MIDLAND
SEPTEMBER 13, 1983

NAME	COMPANY
J. A. Mooney	CPCO
T. R. Thirivengadam	CPCO
P. Shunmugavel	Bechtel
N. Ramanujam	CPCO
S. S. Afifi	Bechtel
John Schaub	CPCO
B. Dhar	Bechtel
K. L Brorohn	CPCO
G. A. Zanese	Bechtel
Chen P. Tan	NRC/SGEB —
Norman D. Romney	NRC/SGEB
A. J. Philippacopoulos	BNL
Charles A. Miller	BNL
Mete Sozen	Bechtel Consultant
Carl J. Costantino	BNL
Karl Wiedner	Bechtel
Darl Hood	NRC/NRR/DL
Fernando Villalta	CPCO
J. N. Leech	CPCO
N. Swanberg	Bechtel
C. Wilson	Bechtel

Enclosure 2

RONOLOGICAL LIST OF EVENT BEFORE AND AFTER ISSUANCE OF NCR STAFF ORDER MODIFYING CONSTRUCTION PERMITS .

Date	Activity	Reference
1975-1977	Fill material is placed in vicinity of diesel generator building (DGB)	BLC-11412 (Final Report of MCAR 24)
1977		
October 5	Begin pouring the DGB foundations to el 630'-6" (see January 28, 1978)	SK-C-628
October 5	Poured foundation to el 630'-6" on south wall of bay 4, and south half of east wall of bay 4 (56 yards)	Pour DG (630.50)A
October 25	Poured foundation to el 630'-6" on north wall of bay 4, and north half of east wall of bay 4 (66 yards)	Pour DG (630.50)B
October 28	Poured foundation to el 630'-6" on south wall of bay 3, and south half of each wall of bay 3 (55 yards)	Pour DG (630.60)C
November 8	Poured foundation to el 630'-6" on north wall of bay 3, and north half of each wall of bay 3 (61 yards)	Pour DG (630.50)D
November 23	Poured sump base slab to el 627'-6" at southeast corner of bay 2 and southwest corner of bay 3 (33 yards)	Pour DG (627.50)A
December 13	Begin pouring the DGB walls to el 635'-0" (see February 20, 1978)	SK-C-628
December 13	Poured walls to el 634'-0" on north wall of bay 4, and north half of each wall of bay 4 (36 yards)	Pour DG (634.00)A'
December 16	Poured foundation to el 630'-6" on south face of bay 2, and south wall of each wall of bay 2 (60 yards)	Pour DG (630.50)F
December 20	Poured foundation to el 630'-6" on north wall of bay 1, and north half of west wall of bay 1 (56 yards)	Pour DG (630.50)G
December 22	Poured foundation to el 630'-6" on north wall of bay 2, and north half of each wall of bay 2 (61 yards)	Pour DG (630.50)E

Date	Activity	Reference
December 28	Poured foundation to el 630'-6" on south wall of bay 1, and south half of west wall of Bay 1 (47 yards)	Pour DG (630.50)H
December 30	Poured sump base slab to el 627'-6" at south east corner of bay 1 and southwest corner of bay 2 (24 yards)	Pour DG (627.50)
December 30	Poured walls to el 635'-0" on south wall of bay 4, and south half of east wall of bay 4 (29 yards)	Pour DG (635.00)A'
1978		
January 4	Poured sump base slab to el 627'-6" at northeast corner of bay 1 and northwest corner of bay 2 (36 yards)	Pour DG (627.50)B
January 6	DG pedestal foundation in bay 4 is poured (190 yards)	Pour DG (637.53)A
January 16	Poured foundation to el 630'-6" in south half of east wall of bay 2 (61 yards)	Pour DG (630.50)I
January 19	Poured walls to el 634'-6" in north wall of bay 3 and north half of of east wall of bay 3 (27 yards)	Pour DG (634.50)B'
January 25	Poured foundation to el 630'-6" in north half of each wall of bay 2 (45 yards)	Pour DG (630.50)J
January 25	Completed pouring the DGB foundations to el 630'-6" (see October 5, 1977)	SK-C-628
February 2	Poured walls to el 635'-0" in south wall of bay 3, and south half of east wall of bay 3 (46 yards)	Pour DG (635.00)B'
February 10	Poured walls to el 635'-0" in south wall of bay 1, and south half of west wall of bay 1 and south half of east wall of bay 1 (46 yards)	Pour DG (635.00)C'
February 14	DG pedestal foundation in bay 3 is poured (190 yards)	Pour DG (634.53)B
February 14	Poured walls to el 634'-6" in north wall of bay 2 and north half of east wall of bay 2 (29 yards)	Pour DG (634.5)C'

Chronological List of Events (Continued)

Date	Activity	Reference
February 20	Poured walls to el 635'-0" in south wall of bay 2 and south half of east wall of bay 2 (28 yards)	Pour DG (635.00)D'
February 20	Poured wall to el 634'-6" in north wall of bay 1 and north half of west wall of bay 1 and north half of east wall of bay 1 (41 yards)	Pour DG (634.50)D'
February 20	Completed pouring DGB walls to el 634'-6" or 635'-0" (see December 13, 1978)	SK-C-628
March 8	DG pedestal foundation in bay 2 is poured (193 yards)	Pour DG (631.53)C
March 14	Began pouring second lift on walls to el 650'-0" or 654'-0" (see April 28, 1978)	SK-C-628
March 14	Poured wall to el 650'-0" on north wall of bay 4 and north half of east wall of bay 4 (89 yards)	Pour DG (650.00)A'
March 17	Poured wall to el 654'-0" on south wall of bay 4 and south half of east wall of bay 4 (92 yards)	Pour DG (654.00)A'
March 23	DG pedestal foundation in bay 1 is poured (192 yards)	Pour DG (637.53)D
March 28	First scribe mark is installed on DGB	File C-2645
March 29	Poured wall to el 650'-0" in north wall of bay 3 and north half of east wall of bay 3 (81 yards)	Pour DG (650.00)B'
April 4	Poured wall to el 654'-0" in south wall of bay 3 and south half of of east wall of bay 3 (94 yards)	Pour DG (654.00)B'
April 11	Poured wall to el 650'-0" in north wall of bay 2 and north half of east wall of bay 2 (85 yards)	Pour DG (650.00)C'
April 14	Poured wall to el 654'-0" in south wall of bay 2 and south half of east wall of bay 2 (81 yards)	Pour DG (654.00)C'
April 24	Poured wall to el 650'-0" in north wall of bay 1, north half of east wall of bay 1, and north half of west wall of bay 1 (139 yards)	Pour DG (650.00)D

Date	Activity	Reference
April 28	Poured wall to el 654'-0" in south wall of bay 1, south half of east wall of bay 1, and south half of west wall of bay 1 (156 yards)	Pour DG (654.00)D'
April 28	Completed pouring walls to el 654'-0" (see March 14, 1978)	SK-C-628
May 9	First settlement marker is installed on DGB	C/S File C-2645
May 12	Last scribe mark is placed on DGB	C/S File C-2645
July 7	First survey record taken on scribe marks	C/S file C-2645
July 10	Begin Pouring HVAC chamber slab (see August 22, 1978)	SK-C-628
July 10	Poured walls to el 656'-6" in south wall of bay 4 (26 yards)	Pour DG (656.50)A
July 10	Poured wall to el 651'-9" in north wall of bay 3 and bay 4 (22 yards)	Pour DG (651.75)A
July 17	Poured walls to el 656'-6" in north wall and south wall of bay 3 (42 yards)	Pour DG (656.50)B
July 21	Poured wall to el 662'-0" in north wall of bay 4, north half of west wall of bay 4, and north half of east wall of bay 4 (129 yards)	Pour DG (662.0)A'
July 26	Poured wall to el 656'-6" in north wall of bay 2 (23 yards)	Pour DG (656.50)C
July 27	Poured wall to el 656'-6" in south wall of bay 2 (23 yards)	Pour DG (656.50)D
August 3	Poured wall to el 656'-6" in north wall of bay 1 and south wall of bay 1 (45 yards)	Pour DG (656.50)E
August 7	Poured wall to el 662'-0" in north wall of bay 3 and north half of west wall of bay 3 (84 yards)	Pour DG (662.00)B'
August 8	Poured wall to el 662'-0" in north wall of bay 1, north half of east wall of bay 1, and north half of west wall of bay 1 (125 yards)	Pour DG (662.00)C'

Date	Activity	Reference
August 15	Poured wall to el 662'-0" in south wall of bay 4, south half of east wall of bay 4, south half of west wall of bay 4, and east half of south wall of by 3 (100 yards)	Pour DG (662.00)D'
August 18	Poured wall to el 662'-0" in east half of south wall in bay 2, west half of south wall in bay 3,, and south half of east wall of bay 2 (61 yards)	Pour DG (662.00)F'
August 18	Poured wall to el 662'-0" in north wall of bay 2 (57 yards)	Pour DG (662.00)E'
August 18	Finished pouring HVAC chamber slab (see July 10, 1978)	
August 21	NCR 1482 (on soils issue) is generated	MCAR 24 Report 1
August 22	NRC inspector at Midland jobsite is informed of unusual DGB settlement	
August 23	DGB construction voluntarily halted	BEBC-2427
August 25	Soil boring program initiated	MCAR 24, Interim Report 1
September 7	NRC Region III is verbally informed of abnormal settlement of diesel generator building	NUREG-0793 (Appendix A)
September 7	MCAR 24 is issued (see September 1, 1981)	
September 27	Poured wall to el 662'-0" in south wall of bay 4, south half of west wall of bay 4, south half of east wall of bay 4, and west half of south wall of bay 3	
September 29	Interim Report 1 to MCAR 24 is forwarded to the NRC	Howe-183-78 (ref. BLC-6578)
November 7	Interim Report 2 to MCAR 24 is forwarded to the NRC	Howe-230-78
November 16	Construction activities resume on the DGB	BEBC-2547
November 16	Isolate electrical duct bank from the DGB in bay 3	SK-C-628

Chronological List of Events (Continued)

Date	Activity	Reference
November 18	Isolate electrical duct bank from the DGB in bay 1	SK-C-628
November 21	Isolate electrical duct bank from the DGB in bay 4	SK-C-628
November 24	Isolate electrical duct bank from the DGB in bay 2	SK-C-628
December 4	Meeting held with NRC, CPCo, and Bechtel to inform NRC of current status of DGB settlement	MCAR Interim Report 3
December 12	Placed mezzanine floor to el 664'-0" in bay 4 (171 yards)	SK-C-628 Pour DG (664.00)A
December 19	Placed mezzanine floor to el 664'-0" in bay 3 (152 yards)	SK-C-628 Pour DG (664.00)B
December 20	Placed mezzanine floor to el 664'-0" in bay 1 (166 yards)	SK-C-628 Pour DG (664.00)C
December 21	NRC is informed of decision to preload DGB	Howe 267-78
December 28	Placed mezzanine floor to el 664'-0" in bay 2 (154 yards)	SK-C-628 Pour DG (664.00)D
1979		
January 5	Interim Report 3 to MCAR 24 is forwarded to the NRC	Howe-1-79
January 5	Poured wall to el 681'-6" in north wall of bay 4 and north half of east wall of bay 4 (131 yards)	Pour DG (681.50)A'
January 10	Poured wall to el 680'-0" in north wall of bay 1 and north half of west wall of bay 1 (126 yards)	Pour DG (680.00)A'
January 12	End of pond fill	MCAR Interim Report 2
January 16	First crack mapping of DGB completed	Memo from McConnel to Dhar

Chronological List of Events (Continued)

Date	Activity	Reference
January 18	Poured wall to el 678'-3" in north wall of bay 3, north half of west wall of bay 3, and north half of east of bay 3 (143 yards)	Pour DG (678.25)A'
January 24	Poured wall to el 678'-3" in north wall of bay 2, and north half of west wall of bay 2 (98 yards)	Pour DG (678.25)B'
January 26	Beginning of surcharging (completed on April 6, 1979) in accordance with Specification 7220-C-81	
January 31	Condensate lines 20"-1HCD-169, 6"-1HCD-513, and 6"-2HCD-513 were cut loose on the south side of the turbine building. Horizontal movement of 3 to 4 inches to the west was observed.	Field Engineers Report 1/31/79
February 1	Condensate line 20"-2HCD-169 was cut loose on the south side of the turbine building.	Field Engineers Report 2/1/79
February 10	Last settlement marker is installed on DGB (see March 28, 1978)	IOM, C. Dirnbau to S. Rao, 2/10/81
February 15	Preparatory work for installation of strain gage monitors in the turbine building wall started today. Strain gages are being installed in accordance with Specification 7220-C-83.	Field Engineers Report 2/15/79 by J. Wasylewsk
February 20	Poured wall to el 678'-3" in south wall of bays 1, 2, 3, and 4; poured south half of all north-south walls (476 yards)	Pour DG (678.25)C'
February 20	Completed pouring walls to el 678'-3" (started on January 5, 1979)	SK-C-628
February 23	Installation of strain gage monitors for Q line wall of turbine building is completed. Installation is in accordance with Specification 7220-C-83 (see February 15, 1979)	Field Engineers Report 2/23/79 by J. Wasylewsk
February 23	Interim Report 4 to MCAR 24 is forwarded to the NRC	Howe-58-79

Date	Activity	Reference
March 5	All surcharge activities through Step III of Table I on Drawing 7220-C-1141(Q) have been completed. Surcharge placement is suspended until March 22, 1979, to observe effect of surcharge placed to date (surcharge approximate elevation is 644'-0")	Field Engineer Report 3/5/79 by J. Wasylews
March 6	NRC visits jobsite to observe preloading program for consolidation of backfill under DGB	NUREG-0793 (Appendix A)
March 8	Commence placing roof and parapet to el 681'-6" (completed on March 22, 1979) (401 yards)	SK-C-628
March 21	NRC initiates 10 CFR 50.54(f) Requests Regarding Plant Fill	Telecopy from Denton to Howe[illegible]
March 22	Temporary settlement markers were installed	IOM, C. Dirnba[illegible] to S. Rao, 2/10/81
March 22	Placing of surcharge resumes in accordance with Step V of Drawing 7220-C-1141(Q) (see March 5, 1979). Roof and parapet completed, i.e., last of DG has been poured (see March 8, 1979)	BEBC-2806
April 7	Placement of surcharge is completed (began on January 26, 1979)	Field Engineers Report 4/7/79 by J. Wasylewsk
April 24	Applicant submits response to Requests Regarding Plant Fill, 10 CFR 50.54(f)	
April 30	Interim Report 5 to MCAR 24 is forwarded to the NRC	Howe-132-79
May 9	All pedestal markers are installed	IOM, C. Dirnbau to S. Rao, 2/10/81
May 31	Applicant submits Revision 1 of Responses to NRC Requests Regarding Plant Fill, 10 CFR 50.54(f)	
June 25	Interim Report 6 to MCAR 24 is forwarded to the NRC	Howe-174-79

Date	Activity	Reference
July 9	Applicant submits Revision 2 of Responses to Requests Regarding Plant Fill, 10 CFR 50.54(f)	
August 15	Removal of surcharge commences	
August 22	Construction activities resume on the DGB	
August 31	Removal of surcharge is complete	
September 5	Interim Report 7 to MCAR 24 is forwarded to the NRC	Howe-233-79
September 12	Survey readings are taken on both temporary and permanent markers and permanent markers and conversion	IOM, C. Dirnb to S. Rao, 2/10/81
September 13	Revision 3 of Responses to NRC Requests Regarding Plant Fill, 10 CFR 50.54(f), is forwarded to NRC	
September 19	Poured topping slab at 664 (25 yards) in bay 3	Pour DG (663.75)A
September 21	Poured topping slab at 664 (20 yards) in bay 4	Pour DG (663.67)B
September 28	Poured topping slab at 664 (24 yards) in bay 2	Pour DG (663.83)A
October 2	Poured topping slab at 664 (23 yards) in bay 1	Pour DG (663.83)B
October 8	Poured curbs for removable roof plugs - all bays (18 yards)	Pour DG (680.58)A
October 16	Poured east-west ductbank in bay 1	Pour DG (632.58)A
October 22	Ann Arbor office allows field to reweld the condensate lines at the turbine building (see January 31 and February 1, 1979)	BEBC-3344
October 24	Poured east-west ductbank in bay 2	Pour DG (632.33)A
November 2	Interim Report 8 to MCAR 24 is forwarded to the NRC	Howe 284-79
November 13	Revision 4 of Responses to Requests Regarding Plant Fill, 10 CFR 50.54(f), is forwarded to NRC	

Date	Activity	Reference
November 14	Initial site visit by Corps of Engineers	NUREG-0793 (Appendix A)
December 6	NRC staff issues order modifying the construction permits	
December	Crack mapping of DGB is again performed	
December 4	Poured removable roof plug in bay 1 (23 yards)	Pour DG (682.1)A
December 6	Poured removable roof plug in bay 2 (23 yards)	Pour DG (682.1)B
December 10	Poured removable roof plugs in bays 3 and 4 (44 yards)	Pour DG (682.1)C
1980		
February 13	Poured base mats for stair towers (14 yards)	Pour DG (634.33)A
February 15	Meeting with NRC to discuss soils preloading and dewatering program for fill under diesel generator building	NUREG-0793 (Appendix A)
February 29	Revision 5 of Responses to Requests Regarding Plant Fill, 10 CFR 50.54(f), is forwarded to NRC	
April 1	Revision 6 of Responses to Requests Regarding Plant Fill, 10 CFR 50.54(f), is forwarded to NRC	
May 5	Revision 7 of Responses to Requests Regarding Plant Fill, 10 CFR 50.54(f), is forwarded to NRC	
July 24 and 31	Poured mudmat for bay 2 base slab (30 yards)	Pour DB (633.08)A and DG(633.08)B
August 1	North half of el 634'-0" slab is poured in bay 2 (26 yards)	Pour DG (634.08)A
August 5	Poured mudmat for bay 1 base slab (33 yards)	Pour DG (633.08)C
August 12	South half of el 634'-0" slab is poured in bay 2 (39 yards)	Pour DG(634.08)E

Date	Activity	Reference
August 15	Revision 8 of Responses to Requests Regarding Plant Fill, 10 CFR 50.54(f), is forwarded to NRC	
August 15	North half of el 634'-0" slab is poured in bay 1 (26 yards)	Pour DG(634.08
August 22	South half of el 634'-0" slab is poured in bay 1 (38 yards)	Pour DG(634.08
August 28	NRC and their consultants tour site	NUREG-0793 (Appendix A)
August 29	Begin grouting the gap between the DGB footing and the mud mat (see September 11, 1980)	REM C-2817
August 29	Grouting of the east footing of bay 3 begins; completed on August 29, 1980	Field Engineer Report 9/17/80 by J. Wasylews
September 2	Grouting of the north footing of bay 3 begins; completed on September 5, 1980	Field Engineer Report 9/17/80 by J. Wasylews
September 8	Grouting of the east footing of bay 4 begins; completed on September 11, 1980	Field Engineer Report 9/17/80 by J. Wasylews
September 9	Poured east-west ductbank in bay 4 (10 yards)	Pour DB(632.0)
September 11	Completed grouting of gap between building footing and mud mat (see August 29, 1980)	REM C-2817
September 11	Poured part of east-west ductbank in in bay 3 (10 yards)	Pour DG(630.0)
September 14	Revision 9 of Responses to Requests Regarding Plant Fill, 10 CFR 50.54(f), is forwarded to NRC	
September 19	Completed pouring east-west ductbank in bay 3 (16 yards)	Pour DG (632.0)B
September 24	Poured east side of bay 4 mudmat for base slab	Pour DG (632.92)A
September 29	Poured remainder of bay 4 mud mat for base slab	Pour DG (632.92)B
October 2	Poured mudmat for bay 3 base slab (28 yards)	Pour DG (633.92)A

Chronological List of Events (Continued)

Date	Activity	Reference
October 7 to February 20	Oral depositions of NRC staff, CPCo BPC, and consultants (of NRC) during discovery for soils hearing	NUREG-0793 (Appendix A)
October 8	North half of el 634'-0" slab is poured in bay 4 (26 yards)	Pour DG(633.02)C
October 14	South half of el 634'-0" slab is poured in bay 4 (40 yards)	Pour DG(633.02)B
October 16	North half of el 634'-0" slab is poured in bay 3 (28 yards)	Pour DG(634.0)B
October 23	South half of el 634'-0" slab is poured in bay 3 (39 yards)	Pour DG(634.0)C
October 31	Diesel generator has been installed in bay 1	Geotechnical Trip Report (Com 037095)
November 13	Diesel generator has been installed in bay 2	Geotechnical Trip Report (Com 037095)
November 21	Revision 10 of Responses to Requests Regarding Plant Fill, 10 CFR 50.54(f), is submitted to NRC	
December 15	DG has been installed in bay 3	Geotechnical Trip Report (Com 037095)
1981		
February 5	DG has been installed in bay 4	Geotechnical Trip Report (Com 037095)
March 16	Revision 11 of Responses to Requests Regarding Plant Fill, 10 CFR 50.54(f), is submitted to NRC	CPCo letter Serial 11632
April 18	Calculation DQ-14(Q) is signed off at Revision 0. Calculation supports results presented in NRC Technical Audit of April 20 through 24	
April 20 to April 24	NRC performs structural technical audit of Midland Nuclear Power Plant	
April 16	Crack mapping of DGB is again performed	IOM, J.L. Hoekwater to B. Dhar (Com 028197)

Date	Activity	Reference
July 7	Sent nodal forces to D. Green of Earthquake Engineering Services for input to ADINA analysis	IOM, L.H. Curtis to D. Green (Com ______)
July 13	Crack mapping results of DGB are forwarded to Ann Arbor office	IOM, J.L. Hockwater to B. Dhar (Com 036143)
July 17	Sent nodal forces to D. Green of EES for input to ADINA analysis	IOM, L.H. Curtis to D. Green (Com ______)
August 19	Preliminary Report on ADINA analysis is submitted to Bechtel by CYGNA (formerly EES)	IOM, D. Green to L.H. Curtis (Com 039796)
August 31	Authorization is sought to retain M. Sozen as consultant	IOM, T.E. Johnson to E.A. Rumbaugh (Com 048581)
September 1	Final Report on MCAR 24 is submitted to CPCo	BLC-11412
September 10	Final Report on ADINA analysis is submitted to Bechtel by CYGNA (formerly EES)	IOM, D. Green to L.H. Curtis (Com 041955)
September 30	Meeting with NRC staff to discuss study of stresses in vicinity of crack in wall of DGB	IOM, F. Villalta to A.J. Boos (Com ______)
October 6 and 7	Meeting with NRC on underground pipes and DGB settlement measurements	NUREG-0793 (Appendix A)
October 16	Letter to NRC forwarding final reports on NRC structural audit open items	NUREG-0793 (Appendix A)
October 21	Technical Report, "Structural Stresses Induced by the Differential Settlement of the Diesel Generator Building" is submitted to the NRC	CPCo letter Serial 14316
October 26	Revision 12 of Response to NRC Requests Regarding Plant Fill is transmitted to NRC	CPCo letter Serial 14333
December 10	Meeting with NRC to discuss existing concrete cracks (N. Swanberg, T.E. Johnson, and M. Sozen present for Bechtel)	IOM, R.C. Bauman to A.J. Boos (Com 055320)

Date	Activity	Reference
1982		
January 11	Meeting in Bethesda between NRC and consultants, CPCo, Bechtel, and its consultants to discuss cracks	
January 28	Calculation DQ-23(Q) is signed off at Revision 0. Calculation DQ-23(Q) supports first drafts of Karl Wiedner's Public Hearing testimony (Settlement which was previously contained in FSAR load combinations is removed.)	
February 12	Report of Construction Technology Laboratories' (CTL) "Evaluation of Cracking in DGB at Midland Plant" is forwarded by CTL to CPCo	(Com 059271)
February 16	Report entitled Evaluation of the Effect on Structural Strength of Cracks in the Walls of the DGB by Mete A Sozen is forwarded to the NRC BPC, Com 059799)	J. Mooney to H. Denton (CPCo Serial 15978
February 23 to February 25	CPCo and Bechtel meet with NRC in Bethesda to discuss soils remedial actions	
February 25	NRC staff receives advance copy of K. Wiedner's draft testimony (January 8, 1982) on structural reanalysis of the DGB, excluding Appendix C	NUREG-0793 (Appendix A)
March 5	Crack survey of DGB east wall is completed	IOM, J.L. Hoekwater to B. Dhar (Com 061512)
April 19	ACRS Report is submitted to NRC	CPCo letter Serial 16629
May 11	Safety Evaluation Report (SER) is issued by the NRC	NUREG-0793 (Appendix A)
June 2	Technical report revision (required as a result of meetings with NRC in Bethesda during February 23 and 25, 1982) is sent to CPCo	BLC-14356
June	Supplement 1 to SER is issued by the NRC	NUREG-0793

Date	Activity	Reference
June 25	Revision 13 of Responses to NRC Requests Regarding Plant Fill is transmitted to NRC	CPCo letter Serial 17916
June 28	FSAR Revision 44 is transmitted to NRC (Revision 44 is first revision of FSAR which physically includes four settlement equations of Response to Question 15 of the NRC Requests Regarding Plant Fill).	CPCo letter to NRC (J.W. Cook to H.R. Denton) Serial 17897
July 29 and July 30	NRC visits Ann Arbor office to discuss comments on NRC's draft Safety Evaluation Report	
September 2	Meeting held in Alburquerque, New Mexico to discuss the fifth draft of Dr. Peck's testimony (S. Affifi, K. Wiedner, J. Brenner, M. Miller, D.A. Zanese)	
September 23	Public Hearing Testimony of K. Wiedner is transmitted to lawyers (Isham, Lincoln & Beale) for distribution.	BPC letter to Isham, Lincoln & Beale
October	Supplement 2 to SER is issued by the NRC	NUREG-0793
December	Public Hearing in Midland Courthouse on Diesel Generator Building	
December 17	Revision 14 of Responses to NRC Requests Regarding Plant Fill is transmitted to NRC	CPCo letter Serial 20390
1983		
January 4	Dead load, live load, and settlement load stresses distributions are forwarded to R.P. Kennedy of Structural Mechanic Associates (SMA)	BPC letter to SMA (Com 100053)
January 21	Additional stress distributions are submitted to SMA (node coordinates and connectivity)	BPC letter to SMA (Com 102278)

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ATTACHMENT 2

August 24, 1983

MIDLAND PLANT UNITS 1 AND 2

DIESEL GENERATOR BUILDING

EXECUTIVE SUMMARY

With September 12, 1983 Addendum

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MIDLAND PLANT UNITS 1 AND 2

DIESEL GENERATOR BUILDING

EXECUTIVE SUMMARY

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MIDLAND PLANT UNITS 1 AND 2
DIESEL GENERATOR BUILDING
EXECUTIVE SUMMARY

I. BACKGROUND

A. GENERAL

A construction permit for Midland Plant Units 1 and 2 was issued by the Atomic Energy Commission on December 15, 1972. Soils-related problems were first identified in July 1978 when the settlement monitoring program detected excessive settlement of the diesel generator building (DGB). The DGB has a shallow foundation and is located at the southern end of the main power block as shown in the site plan (Figure ES-1). The building had settled more than was predicted for this stage of construction. Shortly thereafter, the applicant verbally reported the matter to the NRC site inspector and formally reported it under 10 CFR 50.55(e) in September 1978.

B. LAYOUT

The DGB is a two-story, reinforced-concrete structure with three crosswalls that divide the structure into four cells; each cell contains a diesel generator unit. The building is supported on continuous footings that are founded at el 628' and rests on fill that extends down to approximately el 603'. Plan dimensions of the DGB are approximately 155' x 70' with a total internal height of approximately 44 feet as shown in Figure ES-2. Each diesel generator rests on a 6'-6"-thick, reinforced-concrete pedestal that is not structurally connected to the building foundation.

C. ORIGINAL DESIGN

1. Philosophies

The DGB is a Seismic Category I, safety-related structure designed to protect the diesel generators and associated equipment and to protect this equipment from extreme environmental conditions such as seismic events and tornado and wind loads. As a result of these requirements, a box-type, reinforced-concrete structure with thick walls and roof was chosen. The building is supported by strip or continuous footings. The diesel generators, supported on separate foundations, isolate the building from any potential vibration problem.

2. Structural Systems

In general, conventional and standard calculations were used to analyze and design the various components of the structural system. Computer analysis using the finite-element method was used in some cases such as the floating slab at grade and north walls with complex openings. A lumped-mass computer model supported by soil springs was used to generate seismic response spectra. The seismic forces used in the static analysis and design of the structural components were based on the appropriate acceleration values selected from the response spectra.

All walls were designed as shear walls to resist seismic forces. The exterior walls and roof were also designed to resist impact loads due to tornado-generated missiles as well as pressure loads caused by tornado depressurization. Interior concrete floors are supported by steel beams that carry the vertical loads. The concrete floors and roof were also designed to act as diaphragms to distribute the horizontal loads imposed on the structure. The continuous wall footings (strip foundation) were designed to transmit the building loads to the soil foundation. The floor slabs at grade are independent from the structure and the diesel generator foundations and were designed as floating slabs supported by compacted backfill. The diesel generator foundations are large, reinforced-concrete blocks independent of the structure and are designed to carry the various loads transmitted by the diesel generators.

3. <u>Conservatisms</u>

The DGB is a two-story box structure with a configuration that is inherently strong to resist the applied loads. In addition, the exterior walls and roof are very thick in order to prevent local penetration from postulated tornado-generated missiles. Thus, the structure has a great deal of reserve strength to resist stresses caused by a seismic event and extreme wind loads.

II. DIESEL GENERATOR BUILDING CONSTRUCTION HISTORY

The DGB has a shallow foundation and was constructed in an area of the plant where approximately 25 feet of compacted backfill was placed under the foundation over the natural material at the site. In this area, the majority of the fill was placed between 1975 and 1977. The actual foundation construction of the DGB began in October 1977 and was completed in January 1978. The building walls were constructed up to grade (el 635') between December 1977 and February 1978. The next 19-foot-high section of walls was built between March and April 1978. The diesel generator pedestal foundations were constructed between January and March 1978. The installation of the construction scribe marks to aid construction activities began in March 1978 and was completed in May 1978, and the settlement markers were installed between May and November 1978. In early July 1978, survey settlement records using the scribe marks were begun. During July 1978, when the building was approximately 60% complete, the settlement monitoring program detected settlements of 3.5 inches at the point of greatest settlement, compared to the design predictions of 3 inches for the 40 years of expected plant operation. It appeared that the building was settling due to the consolidation of the underlying fill and was being partially supported along the north portion by four electrical duct banks acting as vertical piers resting on the natural soil below the fill. Shortly thereafter, the applicant verbally reported the matter to the NRC site inspector, and formally reported it under 10 CFR 50.55(e) in September 1978.

Construction of the DGB was voluntarily stopped in August 1978 and a soil boring program was initiated to determine the quality of the backfill under the foundation. Drs. R.B. Peck and A.J. Hendron, Jr. were retained as consultants to advise on the selection and the execution of any remedial action.

The exploration program confirmed that the fill did not meet the specified compaction requirements and that it consisted of both cohesive soil and granular soil. Lean concrete was also used locally as backfill. The fill ranged from very soft to very stiff for cohesive soil and from very loose to dense for granular soil. At the time of the exploration, the groundwater level ranged from el 616' to el 622', and the cooling pond, located about 275 feet south of the building, had a water level at approximately el 622'.

On the basis of the consultants' recommendations and after a review of various alternatives, it was decided to surcharge the DGB and the surrounding area to accelerate settlement and consolidate the fill material. During November 1978, the duct banks (see Figure ES-2A) entering the DGB were isolated from the building so additional settlement due to surcharging and the additional deadweight of the structure to be constructed would not overstress these areas. Construction of the building was also resumed in November 1978 with the remainder of the concrete work on the building being essentially completed by the end of March 1979. Before the surcharge program began in January 1979, the utilities entering the DGB were isolated from the DGB so that settlement during surcharging would not overstress these areas. The utilities were reconnected after the surcharge program was completed in August 1979.

III. REMEDIAL PROGRAM

A. SURCHARGE PROGRAM

The purpose of the surcharge was to accelerate the settlement so that future settlement under the operating loads would be within tolerable limits. Furthermore, this procedure would permit a reliable estimate of the future settlement. Before the surcharge was placed, soil instrumentation was installed (see Table ES-1). The instrumentation was directed at monitoring settlement and pore water pressure in the fill.

Surcharging consisted of placing 20 feet of sand above grade (el 634') with the geometry shown in Figure ES-3. The surcharge was added in two principal increments as shown by the idealized load history in Figure ES-4. Surcharging was effectively begun on January 26, 1979. Approximately 94% of the structure dead load had been applied by the time the surcharge reached maximum level. During this time, the cooling pond level was raised to el 627'. Removal of the surcharge started August 15, 1979, when it had been determined by the applicant and its consultants that primary consolidation of the soil had been achieved and that future settlement could be reliably predicted.

B. PERMANENT DEWATERING SYSTEM

The results of the exploration showed some loose sands were present under the DGB. The surcharge was not expected to improve the sand densities sufficiently to preclude liquefaction during seismic events. Therefore, a permanent dewatering system was designed to maintain water level below el 610' in the area of the DGB. Elevation 610' was selected in accordance with a liquefaction evaluation based on the method published by Seed (see Reference 1). Standard penetration values and relative density data obtained from various investigations were used in this analysis. The study employed a conservative upper-bound acceleration value of 0.19 g, which is larger than the 0.12 g Midland SSE.

C. SETTLEMENT PREDICTIONS

1. <u>Settlement Predictions Based on Surcharge Program</u>

Figure ES-4 contains a typical plot of settlement versus time for a point on the DGB, along with piezometer elevations, cooling pond elevations, and the idealized surcharge load history. The settlement data points for the period before surcharge removal have been replotted as settlement versus the logarithm of time as shown in Figure ES-5. The data after surcharge removal are shown on the semi-log plot of Figure ES-6. Figure ES-5 shows the typical consolidation behavior with primary consolidation completed and the secondary consolidation, with a typical straight line settlement versus log time relation beginning approximately 100 days from the start of surcharge placement. This behavior permitted extrapolations to be made to forecast the building settlement during its service life under the conservative assumption that the surcharge remains in place for 40 years. Results of this extrapolation are shown in Figure ES-7.

Upon surcharge removal, the building showed a rebound of about 0.2 inch. Following the rebound in August 1979 and until the start of dewatering in September 1980, the building showed a maximum settlement of about 0.1 inch. This is less than the range of 0.2 to 0.5 inch, which was predicted on the basis of the previously mentioned straight-line extrapolation.

Following the start of dewatering activities in September 1980 up to December 31, 1981, the building settled 0.4 to 0.5 inch (see Figure ES-8) primarily due to lowering the groundwater table from approximately el 620' to el 595'. Between December 31, 1981, and June 1983, the building settled an additional 0.3 inch primarily due to further lowering of the groundwater table to approximately el 587'. As shown in Figure ES-6, these settlements display relatively steep slopes on the settlement-versus-log-time plot. However, when these data are compared with the observed settlements of the two Borros anchors BA-8 and BA-53 (see Figure ES-9) embedded in the natural soil below the structures, it is seen that most of the observed settlement of the building was due to deep settlement of the underlying natural soil caused by dewatering. When the uniform, deep-seated settlement of the natural soil (below el 603') due to dewatering is subtracted from the total building settlement, the resulting backfill settlement-versus-log-time plot (see Figure ES-10) displays a slope less than the one used for secondary consolidation settlement prediction. Therefore, the predictions of secondary consolidation settlement given in Figure ES-7 are conservative. Furthermore, any future dewatering settlements should be small because future drawdown would exceed the present magnitude by only small amounts.

Concern about liquefaction of the loose sand portions of the backfill is eliminated by permanent groundwater lowering. The settlement of the unsaturated sand because of ground shaking caused by earthquakes (shakedown settlement) was calculated on the basis of the approach described by Silver and Seed (Reference 2) and the recommendations on multidirectional shaking by Pyke, Seed, and Chan (Reference 3). The estimated shakedown settlement is approximately 1/4 to 1/2 inch for ground acceleration up to 0.19 g. The north side of the building will settle the maximum of 1/4 to 1/2 inch during the 0.19 g earthquake, whereas the south side will settle a negligible amount because there is a smaller thickness of sand under the south side of the DGB. Thus, the building will tend to rotate slightly toward the north during seismic shaking. To date, it has tended to rotate south during static settlement under the surcharge load due to the higher percentage of clay under the south side of the building.

2. Settlement Predictions Based on Laboratory Data

At the request of the NRC, 11 soil borings were drilled in the DGB area during April and May 1981 as a part of additional soil investigation. Details of this investigation program were coordinated with the NRC staff and its consultants, the Army Corps of Engineers.

One-dimensional consolidation tests were performed on the samples obtained after removal of surcharge to provide an estimate of maximum past consolidation pressure. The maximum past consolidation pressures interpreted from the laboratory tests showed a scatter predictable for consolidation laboratory tests on heterogeneous fill. The data showed some of the interpreted maximum past consolidation pressures to be lower than would have been expected after surcharging; a greater number were higher. On the basis of this information, a settlement analysis was made to estimate future primary consolidation under the DGB loading. On the basis of a review of the results of this analysis and the measured and predicted settlements, the applicant and the NRC agreed that it is sufficiently conservative to represent future settlement in the structural analysis by the sums of the values in Figures ES-7 and ES-8.

D. FOUNDATION MATERIAL PROPERTIES

1. Bearing Capacity

The results of the strength tests on cohesive soils obtained after surcharging provided shear strength parameters required for evaluation of the factors of safety against bearing capacity failure under static and seismic conditions. The factor of safety against a static bearing capacity failure is greater than 5, compared to the minimum acceptable value of 3. The factor of safety against a bearing capacity failure for combined static and earthquake loads consistent with a safe shutdown earthquake (SSE) of 0.12 g is greater than 2.6. The factor of safety was shown to be equal to 2.4 for an SSE whose dynamic forces are based on a 0.12 g earthquake increased by 50%. The minimum acceptable factor of safety is 2.0 for combined static and earthquake loading.

2. Dynamic Properties of Backfill

Seismic cross-hole testing was performed at two locations within the DGB during November and December 1979 to determine the shear wave velocity of the fill for seismic analysis. The measured shear wave velocities are given in Figure ES-11. The data showed the shear wave velocity can be represented by a value of 500 ft/sec from ground surface to el 615' and by a value of 850 ft/sec from el 615' to el 600'. These numbers were used to determine the shear wave velocity value used in the seismic analysis of the DGB.

E. SURCHARGE EFFECTIVENESS

Figure ES-12 presents a comparison between the pressures that existed during surcharge and those expected during the operating life of the structure. This comparison shows that at all depths in the fill, the pressures that existed during surcharge exceeded those that are expected while the structure is operational. Furthermore, all settlement-versus-log-time plots show that secondary consolidation has been reached. Therefore, the settlements predicted on the assumption that the surcharge remains in place for 40 years (see Figure ES-7) are conservative based on the fact that all loads added after surcharge removal, including those due to permanent dewatering, will be less than the surcharge loading at all depths.

F. SETTLEMENT MONITORING

The settlement of the diesel generator building will be monitored during plant operation. Survey measurements will be taken at least every 90 days during the first year of plant operation. Survey frequency for subsequent years will be established after evaluating measurements taken during the first year. Allowable total settlements, which are based on the predicted values, have been established for each of the settlement markers on the structure and pedestals. If 80% of the allowable settlement (settlement action limit) is reached, survey frequency will be increased to at least once every 60 days and an engineering evaluation will be performed. If the allowable settlements are exceeded, the plant will be shut down until the structure's safety can be established.

IV. <u>STRUCTURAL REANALYSIS</u>

A structural reanalysis was performed on the DGB to determine the settlement and surcharging effects on the building.

A. DESIGN CRITERIA

The DGB is predominately made from 4,000 psi concrete (except the roof slab, which is 5,000 psi concrete) reinforced with Grade 60 steel bars. The building was originally designed for the ACI code allowables.

The load combinations employed for the original analysis and design of the DGB are provided in FSAR Subsection 3.8.6.3. The original FSAR load combinations did not contain a settlement effects term (T). Four additional load combinations were established and committed to be considered. These additional combinations consider the effects of differential settlement in combination with long-term operating conditions and with either wind load or OBE. Table ES-2 provides the load combinations listed in FSAR Subsection 3.8.6.3 and the four additional load combinations.

The following loads are considered in the reanalysis:

1. Dead loads (D)
2. Effects of settlement combined with creep, shrinkage, and temperature (T)
3. Live Loads (L)
4. Wind loads (W)
5. Tornado loads (W')
6. OBE loads (E)
7. SSE loads (E')
8. Thermal effects (T_o)

B. ANALYSIS

1. Models

The structural reanalysis uses two different mathematical models of the DGB: a dynamic lumped-mass model, and a static finite-element model.

The dynamic lumped-mass model is a one-dimensional, stick-type, lumped-mass model using beam elements to represent the structural stiffness, and spring and damper elements to represent the impedance functions for the foundation medium. The model was used to determine the overall seismic behavior of the DGB. The impedance functions were based on the dynamic soil properties. To account for the uncertainties in the foundation soil properties, impedance functions were varied considerably and the resulting seismic responses were enveloped.

The finite-element model is a mathematical model that reduces the DGB to an interrelated system of finite elements. The building is defined by a set of 853 nodal points and 1,294 elements. Of these elements, 901 are plate elements representing walls and slabs, 141 are beam elements representing the footings, and 252 are boundary elements representing the foundation soil. Horizontal and vertical translational springs are used to simulate the boundary condition. Figure ES-13 illustrates an isometric view of the finite-element model.

2. Load Representation

The dead load is represented in the finite-element model by the acceleration due to gravity. The live load is represented by pressures applied to plate elements modeling the floors. Wind loads are represented by pressures on plate elements and concentrated nodal loads. Seismic loads are represented by accelerations and settlement effects are represented by the soil springs explained below.

3. Soils Springs

a) Short-Term Load Analysis

The overall translational soil impedances from the dynamic model are used to calculate soil springs in the finite-element analysis for short-term loads (i.e., wind, tornado, and seismic).

b) Analysis Without Settlement Effects

The analytical model for dead load and live load case without settlement effects was constructed by using large values for the soil springs.

c) Analysis for Settlement Effects

For long-term loadings with settlement effects, the structural reanalysis addresses four distinct time periods. A unique set of measured or estimated settlement values that corresponds to each of the following periods are used:

1) March 28, 1978, to August 15, 1978

The first scribe mark was placed on the structure on March 28, 1978. August 15, 1978, represents the closest survey date before halting DGB construction. The structure was partially completed to 26 feet (el 656'-6") above the top of the foundation. A long-hand analysis was used for calculating stresses.

2) August 15, 1978, to January 5, 1979

The duct banks were separated from the structure, and DGB construction activities resumed during this period. January 5, 1979, is the last survey date before the start of surcharge activities.

The structure was constructed to el 662'-0" and was analyzed using finite-element methods.

3) January 5, 1979, to August 3, 1979

Surcharge activities occurred within and around the structure during this period. August 3, 1979, is the last survey date available before the start of surcharge removal. During this period, the structure was completed and analyzed using finite-element methods.

4) Forty-year settlement

This period is composed of the following:

a. Actual measured settlements from September 1979 to December 1981 - These settlements are small when compared with the predicted settlements and are mainly due to dewatering.

b. Predicted secondary consolidation from December 1981 to December 2025 - These values, based on the conservative assumption that the surcharge remains in place over the life of the plant, exceed the settlement that will actually occur.

To determine forces resulting from settlement, an analysis was performed separately for each of the above four cases. The analysis was iterative in nature to produce a deflection profile of the spread footing foundation that best approximates the settlement profile for the time period being considered.

Figure ES-14 summarizes the actual and estimated settlements employed in the settlement analysis. Figures ES-15, ES-16, and ES-17 give individual isometric presentations of measured and predicted settlements and also show settlement values resulting from the finite-element analysis of the DGB model for periods 2, 3, and 4. The comparison shows good correlation between values resulting from the finite-element model and the measured/predicted settlement values. Because of the high stiffness of the structure compared to the underlying soil, the building will mainly undergo rigid body motion. Differences between calculated and measured/predicted settlements are small and within the accuracy of the survey. The accuracy of the surveys and of the predictions of future settlements are presented as an error band on Figures ES-15, ES-16, and ES-17. It can be seen that practically all the differences between the calculated and the measured/predicted settlements lie within these error bands.

4. Analysis of Survey Data

An analysis of the survey data reveals that the data are not accurate enough to reflect the exact changes in the structural shape due to the settlement.

The results of a review of this survey data can be summarized as follows:

a) The difference between consecutive measurements at a building location reveals both positive and negative values. The negative values indicate that the structure moved up or a potential inaccuracy in measurement existed. Because the structure cannot easily move up against its own weight, it is likely that a negative value indicates an inaccuracy in measurement.

b) Review of relative displacements of the north and south walls show that the data vary irregularly. It cannot be concluded from these data that the structure developed differential settlement in the period considered.

c) Angle Variation Analysis

During the settlement period considered, random changes in algebraic sign exists for the vertical angle formed by three markers along the south wall of the DGB. Therefore, it can be concluded that the settlement of the structure during this period was mainly rigid body motion.

d) Warpage Analysis

The warpage across the structure was found to vary with time between positive and negative values. It can be concluded that the survey data are not sufficiently accurate to prove that the structure has developed differential settlement (warpage) across the corners.

Summarizing, the survey data analysis concludes that the existing data were not accurate enough for direct use in structural analysis and need to be modified, error bands were established to be between 0.125 inch and 0.225 inch for the four settlement periods. By smoothing the settlement vs time curves to compensate for the survey inaccuracies, the data reflect that the structure was experiencing mainly rigid body motion in the period during which settlement was measured.

C. STRUCTURAL EVALUATIONS AND RESULTS

The concrete walls and slabs were evaluated using the OPTCON program. This program calculated the stresses in the concrete and reinforcement of a given section that is subjected to axial load, bending moment, and thermal gradient. The shear stresses in various parts of the building (walls, slabs, and footing) were evaluated using hand calculations from the Bechtel Structural Analysis Program (BSAP) results. The DGB was found to meet the structural design criteria as defined earlier.

The critical load combinations are those that include either the tornado load case (W'), the OBE load case (E), or the settlement effect (T), specifically:

$1.0D + 1.0L + 1.0W' + 1.0T_o$

$1.0D + 1.0T + 1.0L + 1.0E$

$1.4D + 1.4T$

In a majority of the locations in the DGB, the tornado load combinations produce the highest stress levels.

D. ADDITIONAL STRUCTURAL ANALYSES

For comparison only, an additional analysis of the DGB was evaluated for the more stringent load combinations of ACI 349 as supplemented by Regulatory Guide 1.142 (Table ES-3) and found to be adequate.

Another informational finite-element analysis of the DGB has been performed. In this analysis, the 40-year settlement values were imposed onto the structure directly, rather than adjusting the soil springs to an approximate settlement profile as explained earlier. Because the settlement profile is not a smooth curve, the results of the finite-element analysis indicate that the allowable stress levels would be exceeded by a large margin in a vast portion of the structure. Furthermore, the analysis illustrates that additional forces beyond the structural dead load are required to deflect the structure into this shape. In other words, either the soil must be capable of developing tension to pull the structure down or dead load in excess of the existing building dead load must be supplied at the appropriate points to deform the structure to comply with the settlement profile. This analysis therefore demonstrates that the settlement profile cannot realistically be applied directly to the structure.

An analysis was also performed to investigate the structure's ability to span any soft soil condition. This analysis consisted of employing a soil spring value of zero at the junction of the south wall and the interior wall separating bays 3 and 4. Soil spring values were then linearly varied in the north as well as the east-west directions so that they returned to their original 40-year value within a distance of approximately 15 feet from the zero spring. It can be concluded from this analysis that the DGB can successfully span the assumed soft soil spot introduced without significantly increasing the stress levels.

E. EFFECTS OF CONCRETE CRACKS

A set of electrical duct banks located beneath the building foundation initially acted to restrain the even movement of the structure during fill settlement. A systematic crack pattern was observed in walls resting on the duct banks. Cracks in walls that do not rest on duct banks are attributable to the effect of restrained volume changes during curing and drying of the concrete. Cracks were first mapped after the duct banks were separated from the DGB and prior to surcharge placement. Another crack mapping of the DGB was performed after surcharge removal to acertain the effect of surcharge.

The concrete cracks within the DGB were formally addressed in the response to Question 29 of the NRC Requests Regarding Plant Fill. In this response, the cause and significance of the concrete cracks in all structures were presented. Subsequently, during the NRC structural technical audit of April 1981, further discussion was held concerning the effects of the cracks and the additional stresses resulting from the concrete cracks. To evaluate the additional stresses associated with the concrete cracking, a number of analytical approaches have been used and the results forwarded to the NRC in the response to Question 40 of the NRC Requests Regarding Plant Fill. These results indicated that because these stresses are strain-induced secondary stresses, they do not affect the ultimate strength capacity of the cracked member.

In response to an NRC request for a nonlinear, finite-element analysis to evaluate the effects of cracks on the integrity of the DGB, an additional computer analysis of the DGB was performed. This analysis was performed using a finite-element program, Automated Dynamic Incremental Nonlinear Analysis (ADINA), which is a three-dimensional, nonlinear program capable of considering concrete crushing, cracking, crack widening, and reinforcement yielding. The east wall of the DGB was selected for the ADINA analysis. A crack was modeled into the east wall, and the ADINA analysis was performed for two governing load combinations. The analysis indicated that the effect of concrete cracks was localized and minor in nature. The results of this ADINA analysis were submitted to the NRC, followed by meetings with the NRC staff to discuss these results.

To address additional staff concerns, further evaluation of the existing concrete cracks was performed by two consultants, Dr. Mete Sozen of the University of Illinois and Dr. W. Gene Corley of Portland Cement Association. The consultants agree that the DGB is capable of withstanding the loads it was initially designed for, despite the existence of concrete cracks. A report addressing the evaluation of cracks by the consultants has been presented to the NRC staff; three meetings have subsequently been held to discuss the report on cracks.

Also, reports on a crack repair program by Portland Cement Association for all cracks in all structures have been submitted to the NRC. Based on these reports, all exterior cracks 20 mils and larger in width and accessible interior cracks 20 mils and larger will be repaired such that the extent (length) of repair will be limited to a crack width of 10 mils or larger. Also, a monitoring program will be implemented which will consist of monitoring DGB cracks once every year during the first 5 years of plant operation and at 5-year intervals thereafter. Specific acceptance criteria (i.e., alert limits and action limits) on crack width and crack width increases are also specified.

F. SEISMIC MARGIN REVIEW

As part of the seismic margin review (SMR) conducted for Midland, the DGB's ability to withstand seismic excitation was investigated. The evaluation was conducted using new seismic response loads developed for the seismic margin earthquake (SME) together with normal operating design loads. The seismic loads were developed using a site-specific earthquake for Midland as well as new soil-structure interaction parameters which reflect the site layering characteristics. Margins against code-allowable values were calculated for selected elements throughout the structure.

The seismic excitation of the structure was specified in terms of site-specific response spectra developed for the top-of-fill location. These spectra have a peak ground acceleration of approximately 0.15 g. The vertical component was specified as two-thirds of horizontal.

A seismic analysis was performed using the lumped-mass model explained earlier.

Overall seismic loads determined by the response spectrum analyses were distributed to the resisting structural elements by the rigid diaphragm approximation. This method is appropriate for the concrete shear wall and diaphragm system of the DGB. Seismic shears and overturning moments were distributed to the individual walls in proportion to their relative rigidities. Seismic loads acting on the diaphragms were determined using information available from the load distributions to the individual walls. The shear walls and diaphragms were evaluated for seismic loads combined with loads due to normal operating conditions predicted by static analyses.

Capacities for the shear walls were developed in accordance with the ultimate strength design provisions contained in ACI 349-80. Shear walls were checked for their ability to resist in-plane shears and overturning moments. Margin factors were determined for the selected walls based on comparisons of the loads due to seismic and normal operating conditions and the code ultimate strength capacities. The selected walls were found to be governed by overturning moment. The lowest code margin calculated was found to be 1.8. The SME must be increased by at least a factor of 2.2 before the code margin for any wall would be exceeded.

Diaphragm capacities were determined using ACI 349-80 criteria developed for shear walls. The diaphragms evaluated were found to be governed by shear. The lowest code margin for the diaphragms was found to be 2.0. For any diaphragm to reach code capacity, the SME must be increased by a factor of 2.1.

Code margins for the selected structural elements were all conservatively based on minimum specified material strengths and maximum seismic load cases. Reductions in loads to account for inelastic energy dissipation were not used for the DGB. All code margins were determined to be greater than unity. Before code capacity is reached for any DGB element investigated, the SME must be increased by 2.1. It can, therefore, be concluded that the DGB has more than sufficient structural capacity to resist the SME based on code criteria and significantly higher capacity before failure is expected.

V. CONCLUSIONS

The original design of the DGB, based on its overall geometry and layout, produced a structure with a great deal of reserve strength. The settlements during early stages of construction and during the surcharge program did not cause any unusual distress or significant loss of structural strength. The remedial program of surcharging the area with 20 feet of sand has caused the fill to now be under secondary consolidation. Future settlement can be conservatively predicted and will not be excessive. It has been shown through the soil exploration program that the fill material under the DGB does have sufficient reserve in bearing capacity to resist all the imposed loads with the proper safety factor. This area of the site is being permanently dewatered to eliminate any potential for liquefaction that could occur in the sand backfill below the DGB during a seismic event.

The DGB has been structurally reanalyzed for the various phases of construction and the 40-year life of the plant considering the critical load combinations using finite-element computer methods. This analysis includes soil-structure interaction and takes into account the settlement history and the predicted settlement of the structure. On the basis of this analysis, the structure has been shown to meet the design criteria with a significant reserve in strength. In addition, a settlement monitoring program will be maintained on the structure and in the event the actual settlement is greater than 80% of the allowable values, the structure will be reevaluated.

There has been some minor structure cracking during construction and surcharge loading of the area. It has been shown through analysis and evaluation by the consultants that the cracking has not impaired the ultimate strength of the structure. A crack monitoring program will be maintained and in the event that cracks should approach the allowable crack width limits, the structure will be reevaluated.

The SMR of the DGB has revealed that the building has more than sufficient structural capacity to resist the SME.

Thus, it can be concluded that the DGB has the reserve strength to resist all the imposed loading combinations, including settlement, has sufficient margin to resist a larger earthquake, and has sufficient monitoring to ensure that the structure will continue to safely perform its function.

REFERENCES

1. H.B. Seed, "Soil Liquefaction and Cyclic Mobility Evaluation for Level Ground During Earthquakes," Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 105, No. GT2 (February 1979), Pages 201 through 255

2. M.L. Silver and H.B. Seed, The Behavior of Sands Under Seismic Loading Conditions, Earthquake Engineering Research Center, College of Engineering, University of California, Berkeley, California, December 1969

3. R. Pyke, B. Seed, and K.C. Chan, "Settlements of Sands under Multidirectional Shaking," Journal of Geotechnical Engineering Division, GT4, April 1975, Pages 379 through 397

TABLE ES-1

DIESEL GENERATOR BUILDING INSTRUMENTATION

Type	Number
Building Settlement Markers	28
Settlement Plates	52
Borros Anchors	60
Deep Borros Anchors	4
Sondex Gages	5
Piezometers	48

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TABLE ES-2

LOADS AND LOAD COMBINATIONS FOR CONCRETE STRUCTURES OTHER THAN THE CONTAINMENT BUILDING FROM THE FSAR AND QUESTION 15 OF RESPONSES TO NRC REQUESTS REGARDING PLANT FILL

Responses to NRC Requests Regarding Plant Fill, Question 15

a. Service Load Condition

$U = 1.05D + 1.28L + 1.05T$ (1)

$U = 1.4D + 1.4T$ (2)

b. Severe Environmental Condition

$U = 1.0D + 1.0L + 1.0W + 1.0T$ (3)

$U = 1.0D + 1.0L + 1.0E + 1.0T$ (4)

FSAR Subsection 3.8.6.3

a. Normal Load Condition

$U = 1.4D + 1.7L$ (5)

b. Severe Environmental Condition

$U = 1.25 (D + L + H_O + E) + 1.0T_O$ (6)

$U = 1.25 (D + L + H_O + W) + 1.0T_O$ (7)

$U = 0.9D + 1.25 (H_O + E) + 1.0T_O$ (8)

$U = 0.9D + 1.25 (H_O + W) + 1.0T_O$ (9)

c. Shear Walls and Moment Resisting Frames

$U = 1.4 (D + L + E) + 1.0T_O + 1.25H_O$ (10)

$U = 0.9D + 1.25E + 1.0T_O + 1.25H_O$ (11)

d. Structural Elements Carrying Mainly Earthquake Forces, Such as Equipment Supports

$U = 1.0D + 1.0L + 1.8E + 1.0T_O + 1.25H_O$ (12)

Table ES-2 (continued)

e. Extreme Environmental and Accident Conditions

$$U = 1.05D + 1.05L + 1.25E + 1.0T_A + 1.0H_A + 1.0R \quad (13)$$

$$U = 0.95D + 1.25E + 1.0T_A + 1.0HA_A + 1.0R \quad (14)$$

$$U = 1.0D + 1.0L + 1.0E' + 1.0T_O + 1.25H_O + 1.0R \quad (15)$$

$$U = 1.0D + 1.0L + 1.0E' + 1.0T_A + 1.0H_A + 1.0R \quad (16)$$

$$U = 1.0D + 1.0L + 1.0B + 1.0T_O + 1.25H_O \quad (17)$$

$$U = 1.0D + 1.0L + 1.0T_O + 1.25H_O + 1.0W' \quad (18)$$

where

B = hydrostatic forces due to the probable maximum flood (PMF)

D = dead loads of structures and equipment and other permanent, load-contributing stress

E = operating basis earthquake (OBE)

E' = safe shutdown earthquake load (SSE)

H_O = force on structure caused by thermal expansion of pipes under operating conditions

H_A = force on structure caused by thermal expansion of pipes under accident conditions

L = conventional floor and roof live loads (includes moveable equipment loads or other loads which vary in intensity)

R = local force, pressure on structure, or penetration caused by rupture of pipe

T = effects of differential settlement, creep, shrinkage, and temperature

T_O = thermal effects during normal operating conditions

T_A = total thermal effects which may occur during a design accident

U = required strength to resist design loads or their related internal moments and forces

W = design wind load

W' = tornado wind loads, excluding missile effects, if applicable (refer to Subsection 2.2.3.5)

TABLE ES-3

LOADS AND LOAD COMBINATIONS FOR
COMPARISON ANALYSIS REQUESTED IN
QUESTION 26 OF NRC REQUESTS
REGARDING PLANT FILL

ACI 349 as Supplemented by Regulatory Guide 1.142

a. Normal Load Condition

$U = 1.4 (D + T) + 1.7L + 1.7R_O$

$U = 0.75 [1.4 (D + T) + 1.7L + 1.7T_O + 1.7R_O]$

b. Severe Environmental Condition

$U = 1.4 (D + T) + 1.4F + 1.7L + 1.7H + 1.9E_O + 1.7R_O$

$U = 1.4 (D + T) + 1.4F + 1.7L + 1.7H + 1.7W + 1.7R_O$

$U = 0.75 [1.4 (D + T) + 1.4F + 1.7L + 1.7H + 1.9E_O + 1.7T_O + 1.7R_O]$

$U = 0.75 [1.4 (D + T) + 1.4F + 1.7L + 1.7H + 1.7W + 1.7T_O + 1.7R_O]$

c. Extreme Environmental Conditions

$U = (D + T) + F + L + H + T_O + R_O + W_T$

$U = (D + T) + F + L + H + T_O + R_O + E_{SS}$

d. Abnormal Load Conditions

$U = (D + T) + F + L + H + T_A + R_A + 1.5P_A$

$U = (D + T) + F + L + H + T_A + R_A + 1.25P_A + 1.0(Y_R + Y_J + Y_M) + 1.25E_O$

$U = (D + T) + F + L + H + T_A + R_A + 1.0P_A + 1.0(Y_R + Y_J + Y_M) + 1.0E_{SS}$

where

Normal loads are those loads encountered during normal plant operation and shutdown, and include:

T = settlement loads

Table ES-3 (continued)

D = dead loads or their related internal moments and forces

L = applicable live loads or their related internal moments and forces

F = lateral and vertical pressure of liquids or their related internal moments and forces

H = lateral earth pressure or its related internal moments and forces

T_O = thermal effects and loads during normal operating or shutdown conditions, based on the most critical transient or steady-state condition

R_O = maximum pipe and equipment reactions if not included in the above loads

Severe environmental loads are those loads that could infrequently be encountered during the plant life and include:

E_O = loads generated by the operating basis earthquake (OBE)

W = loads generated by the operating basis wind (OBW) specified for the plant

Extreme environmental loads are those loads which are credible but highly improbable, and include:

E_{SS} = loads generated by the safe shutdown earthquake (SSE)

W_T = loads generated by the design tornado specified for the plant

Abnormal loads are those loads generated by a postulated high-energy pipe break accident and include:

P_A = maximum differential pressure load generated by a postulated break

T_A = thermal loads under accident conditions generated by a postulated break and including T_O

R_A = pipe and equipment reactions under accident conditions generated by a postulated break and including R_O

U = required strength to resist design loads or their related internal moments and forces

Y_R = loads on the structure generated by the reaction on the broken high-energy pipe during a postulated break

Table ES-3 (continued)

Y_J = jet impingement load on a structure generated by a postulated break

Y_M = missile impact load on a structure generated by or during a postulated break, such as pipe whipping

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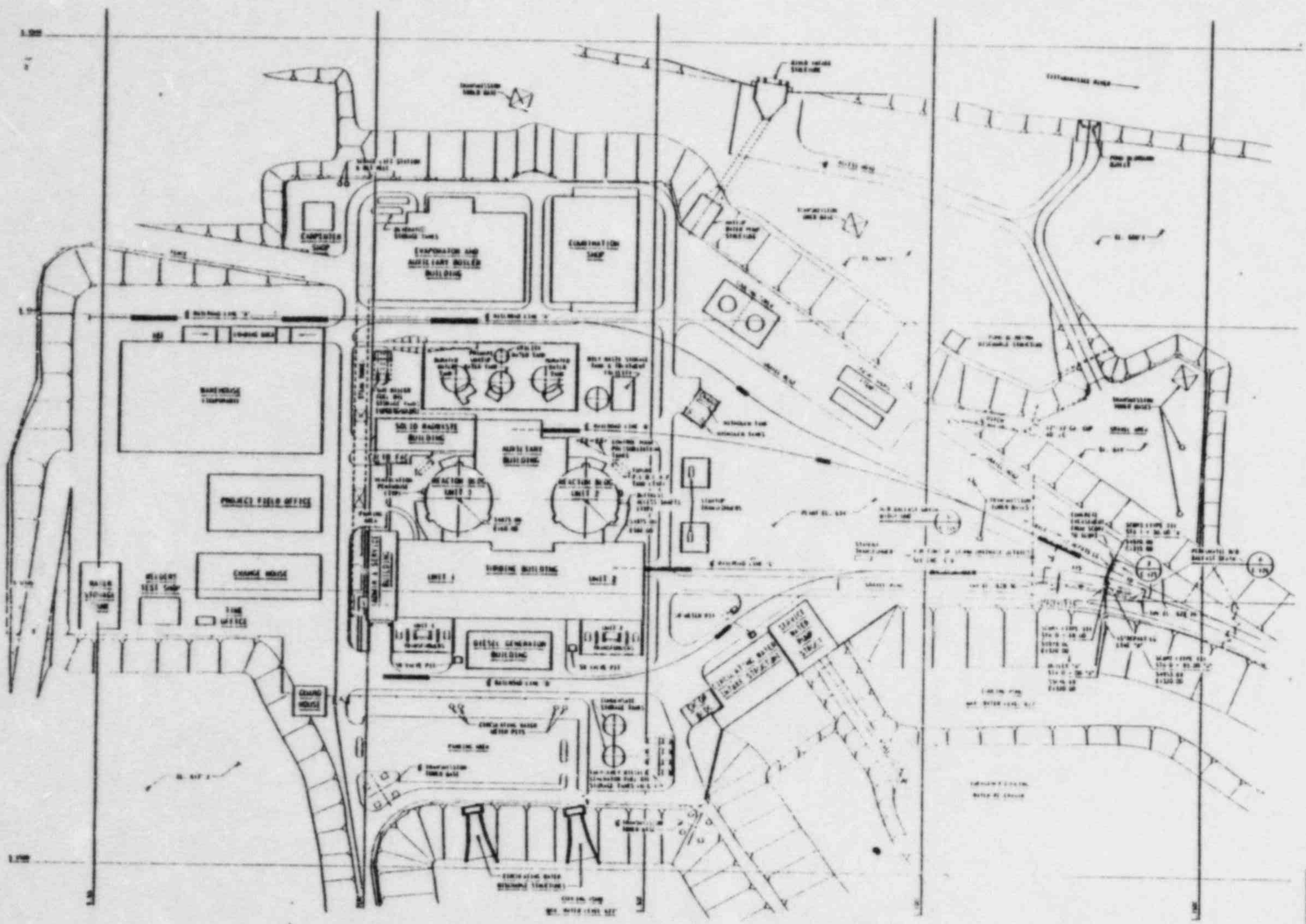
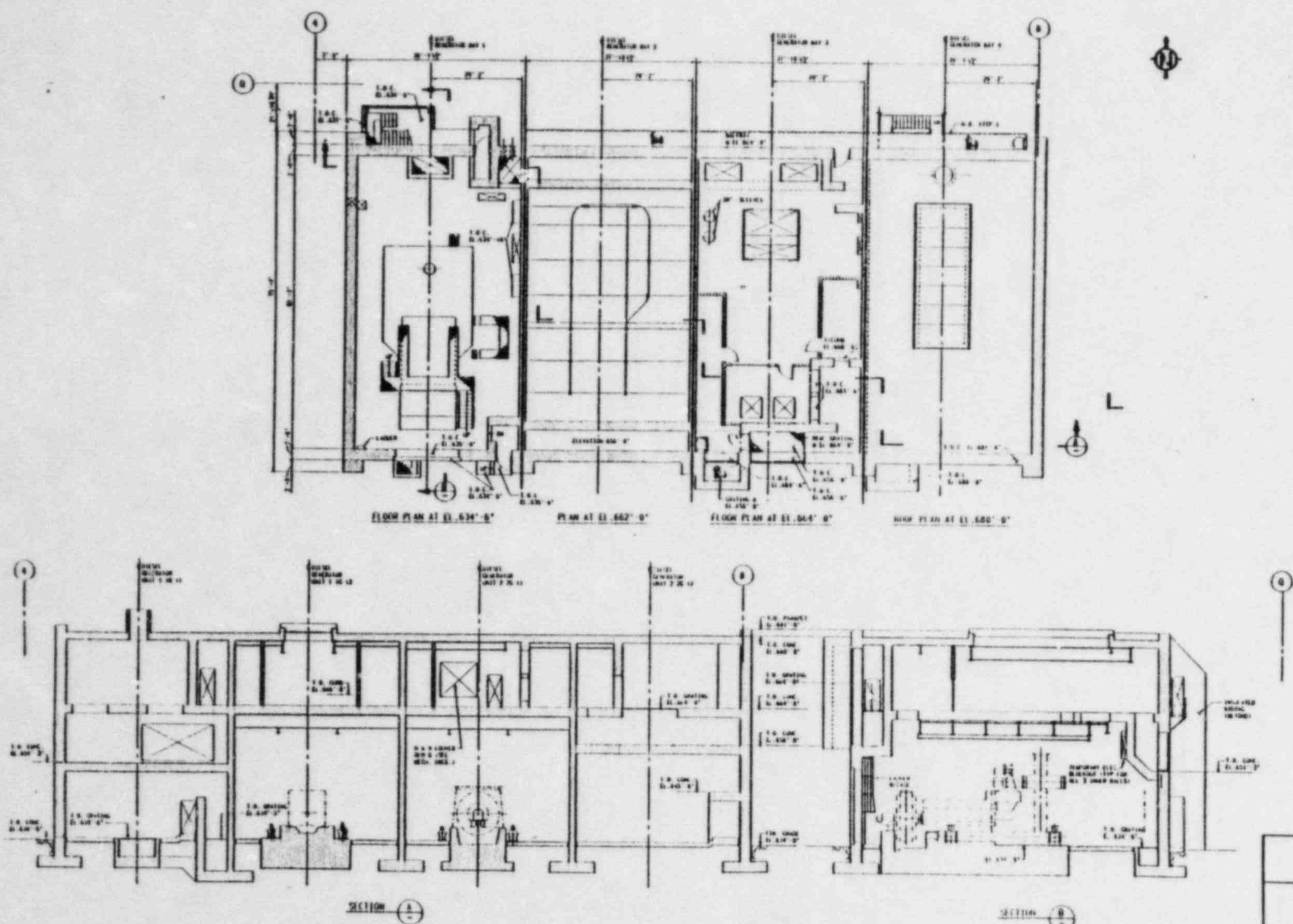


DIESEL GENERATOR BUILDING
EXECUTIVE SUMMARY

SITE PLAN OF MIDLAND
UNITS 1 AND 2 POWER PLANT

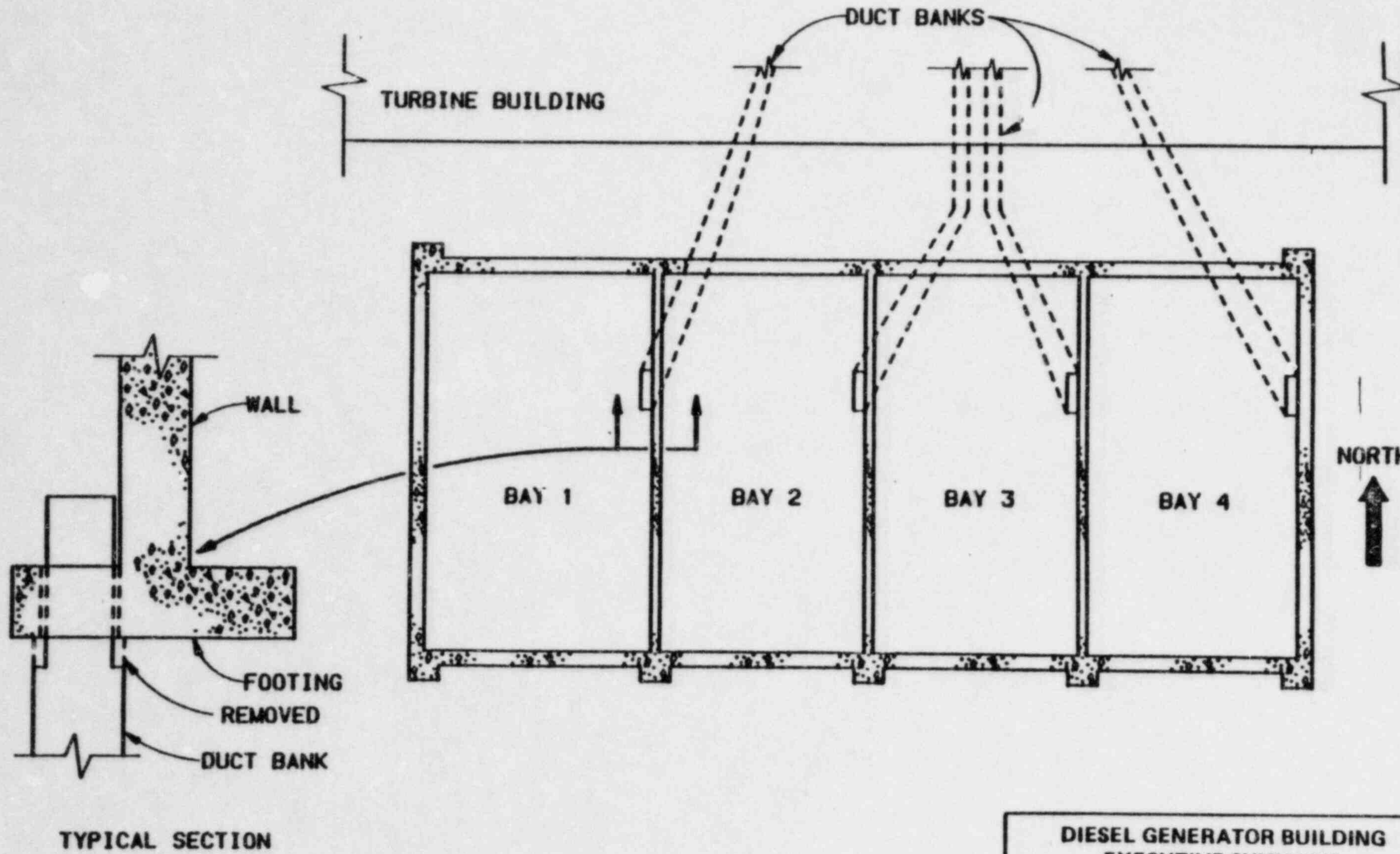
FIGURE ES-1



DIESEL GENERATOR BUILDING
EXECUTIVE SUMMARY

PLAN VIEW AND SECTIONS

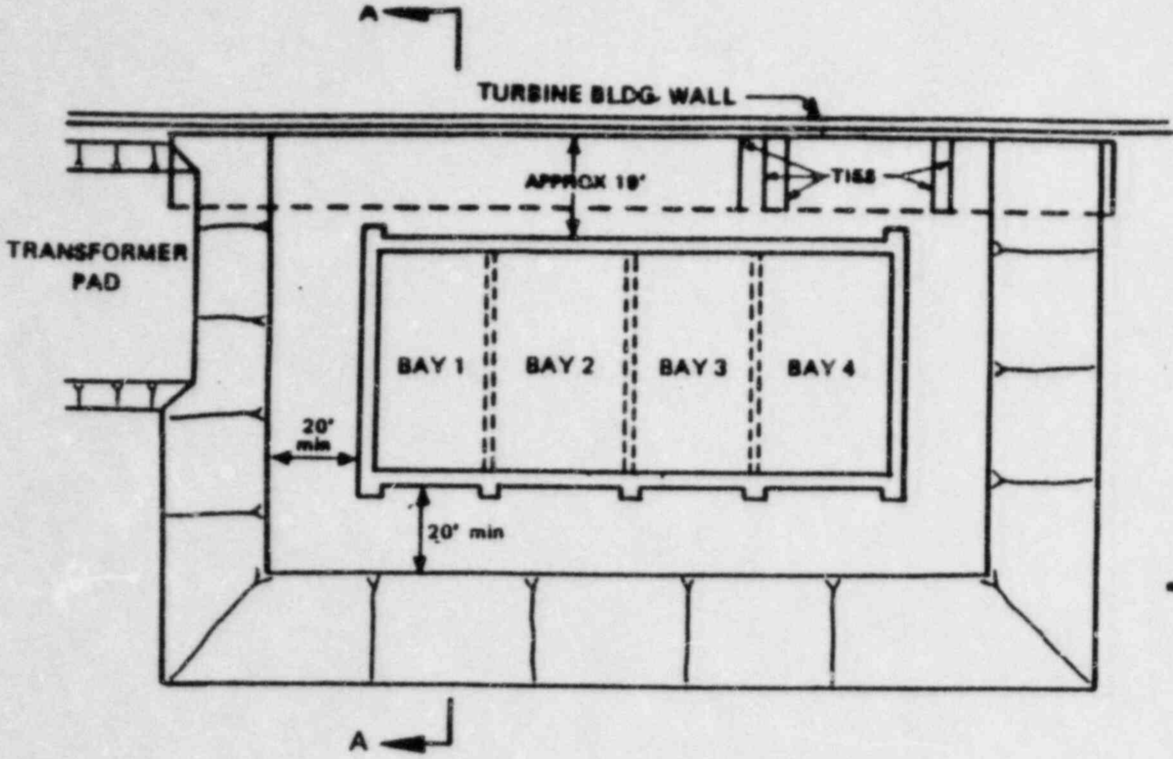
FIGURE ES-2



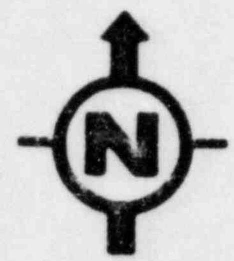
DIESEL GENERATOR BUILDING
EXECUTIVE SUMMARY

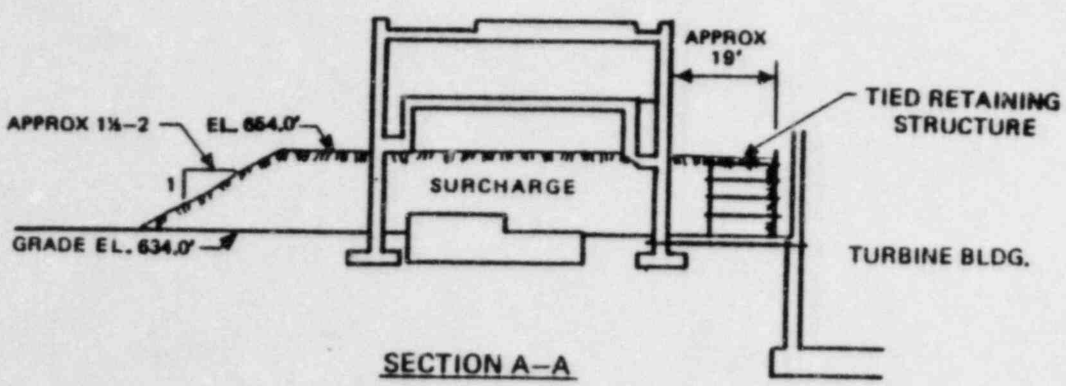
DUCT BANK LAYOUT

FIGURE ES-2A

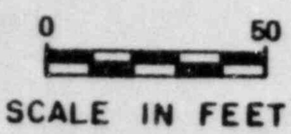


PLAN





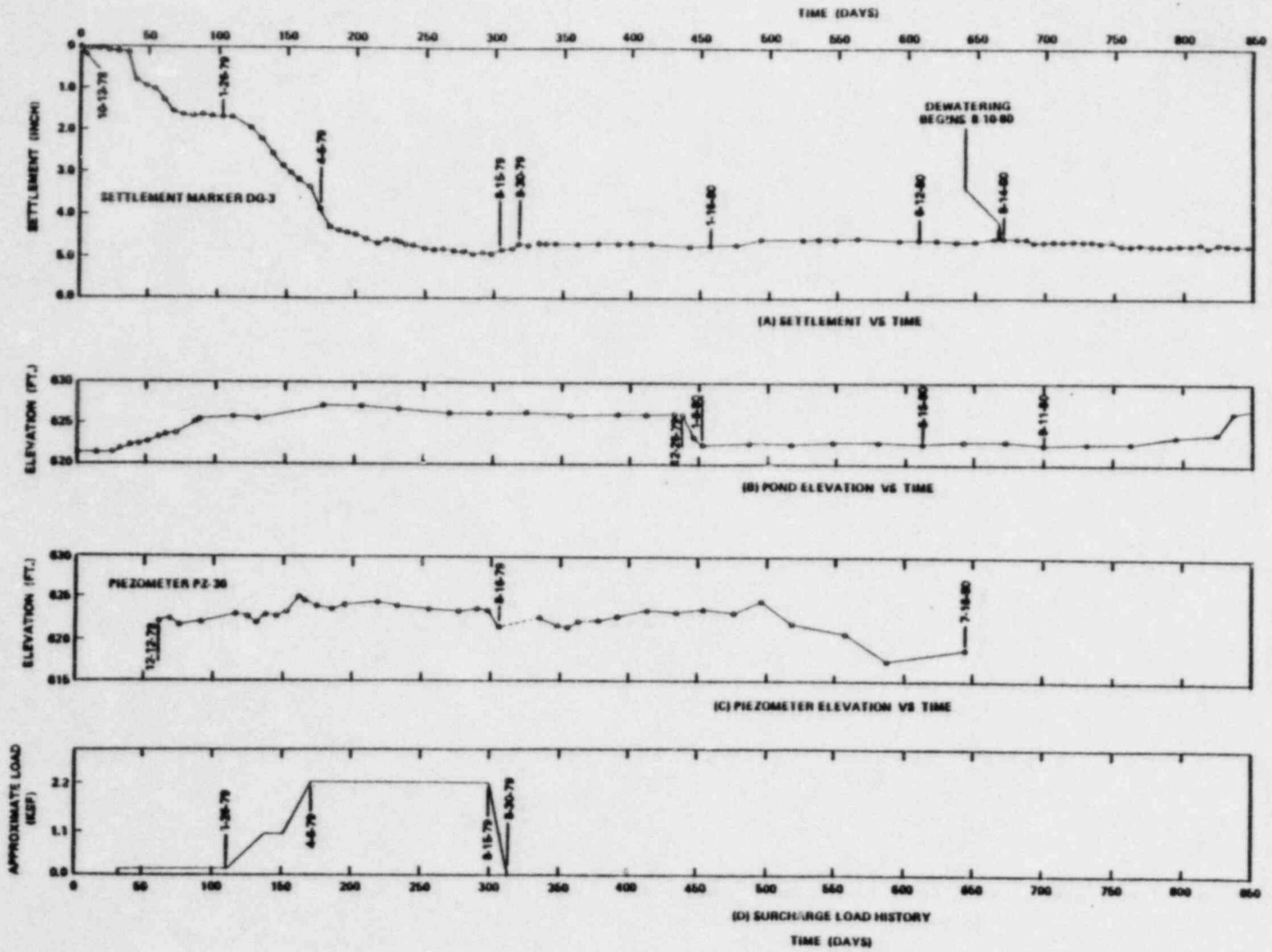
SECTION A–A



DIESEL GENERATOR BUILDING
EXECUTIVE SUMMARY

GENERAL LAYOUT OF
SURCHARGE LOAD

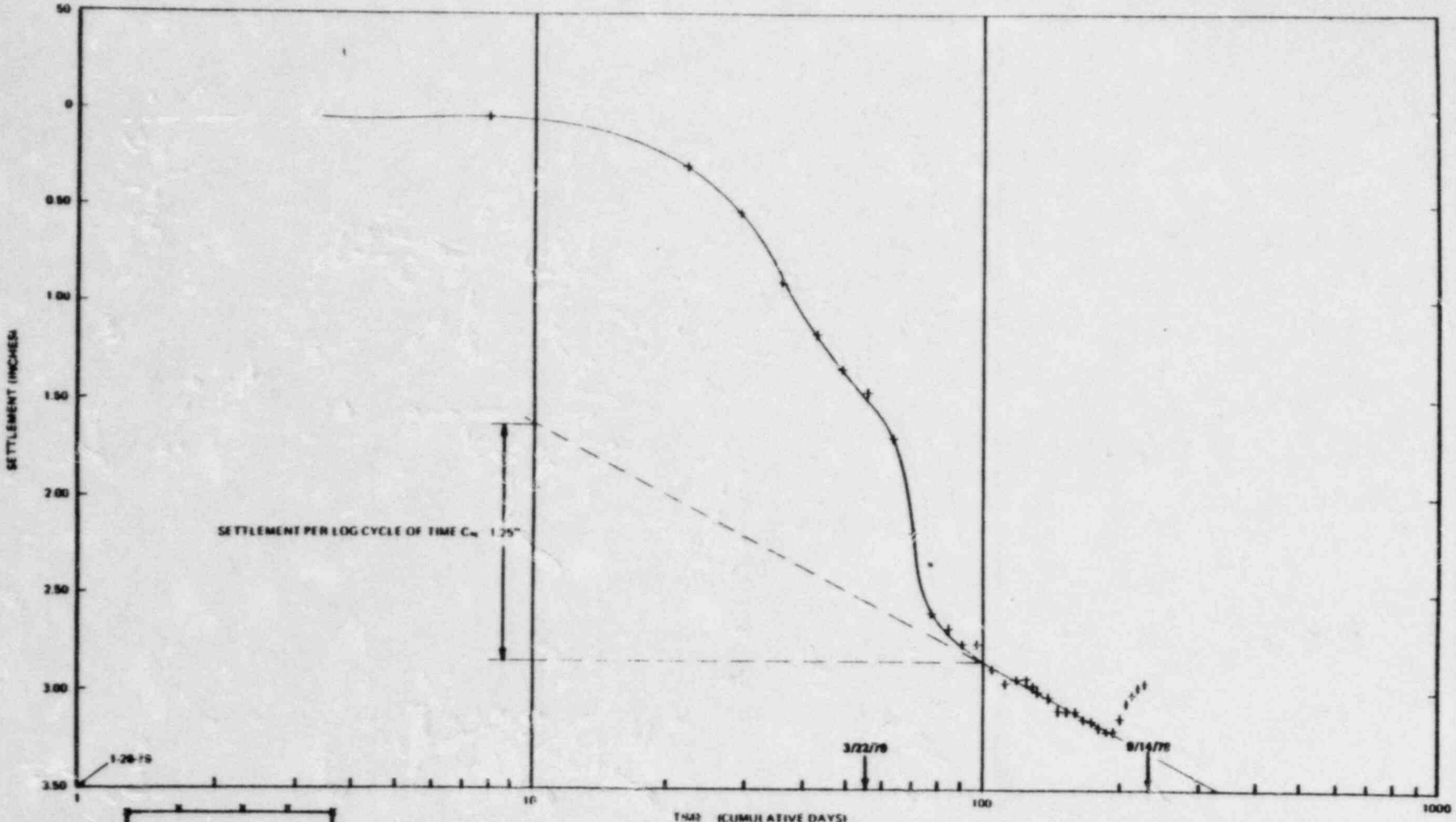
FIGURE ES-3

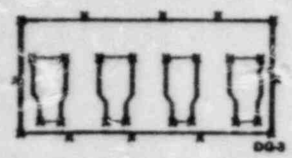


DIESEL GENERATOR BUILDING
EXECUTIVE SUMMARY

TYPICAL SETTLEMENT, COOLING POND LEVEL, PIEZOMETER LEVEL AND SURCHARGE LOAD HISTORY

FIGURE ES-4

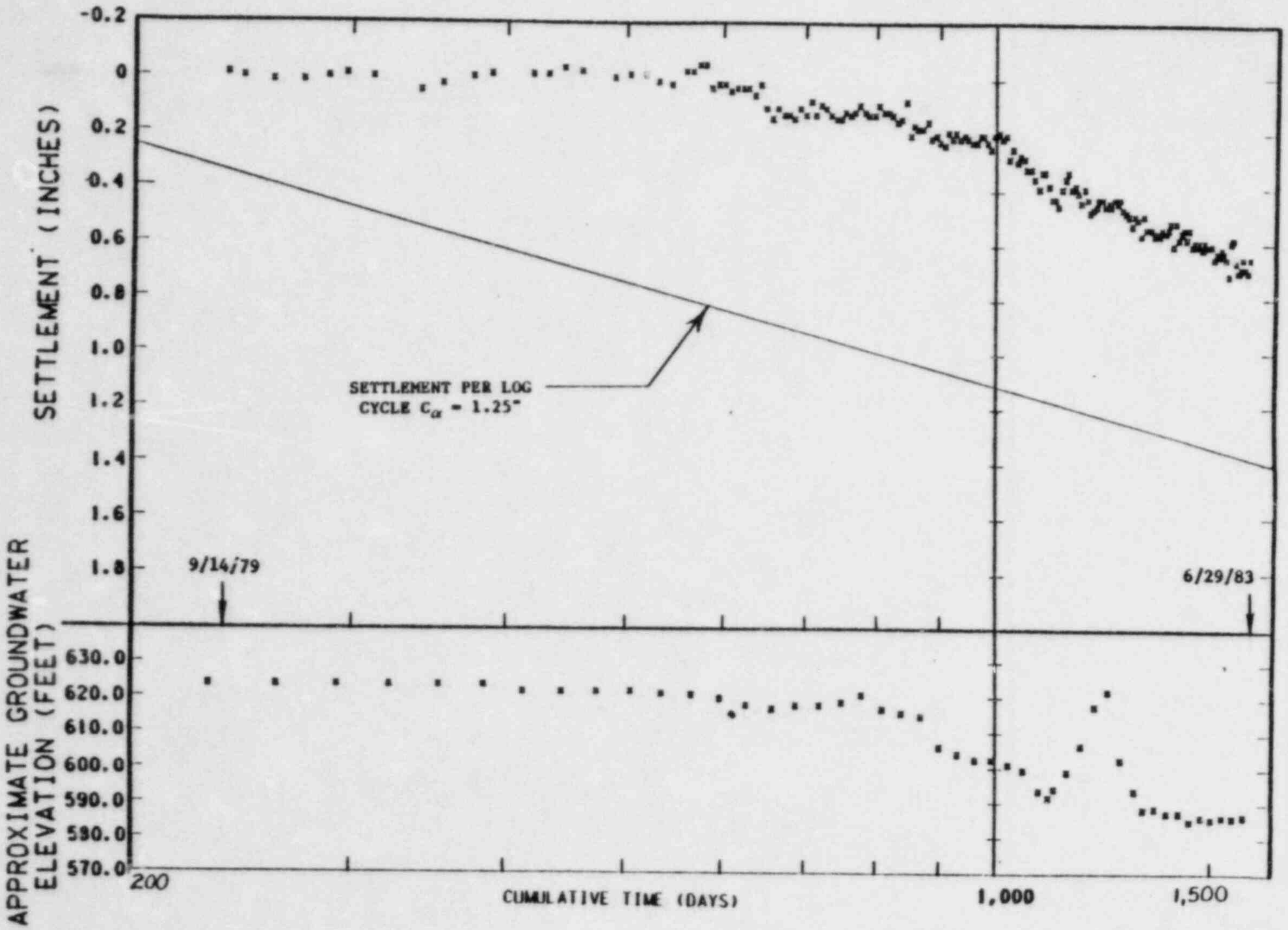




SETTLEMENT MARKER LOCATION PLAN
DIESEL GENERATOR BUILDING
(NOT TO SCALE)

NOTE:
The permanent marker could not be monitored from 3-22-79 to 9-14-79 due to surcharge. Temporary markers at elevation 664'-0" ± were used during this period to estimate the settlement of the permanent marker. On 9-14-79 the settlement was again based directly upon the permanent marker.

DIESEL GENERATOR BUILDING EXECUTIVE SUMMARY
SETTLEMENT VS. LOGARITHM OF TIME FROM 1/26/79 TO 9/14/79 MARKER DG-3
FIGURE ES-5

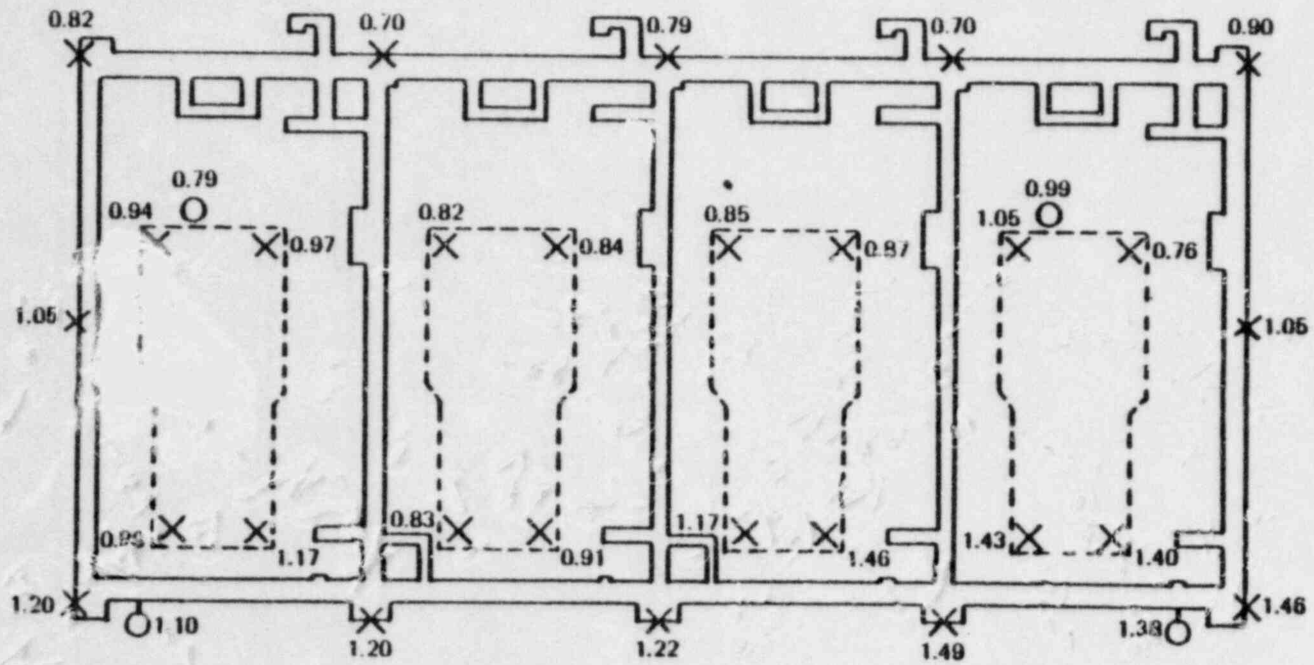


DIESEL GENERATOR BUILDING
EXECUTIVE SUMMARY

SETTLEMENT VS. LOGARITHM OF
TIME SINCE 9/14/79
MARKER DG-3

FIGURE ES-6

DIESEL GENERATOR BUILDING



LEGEND

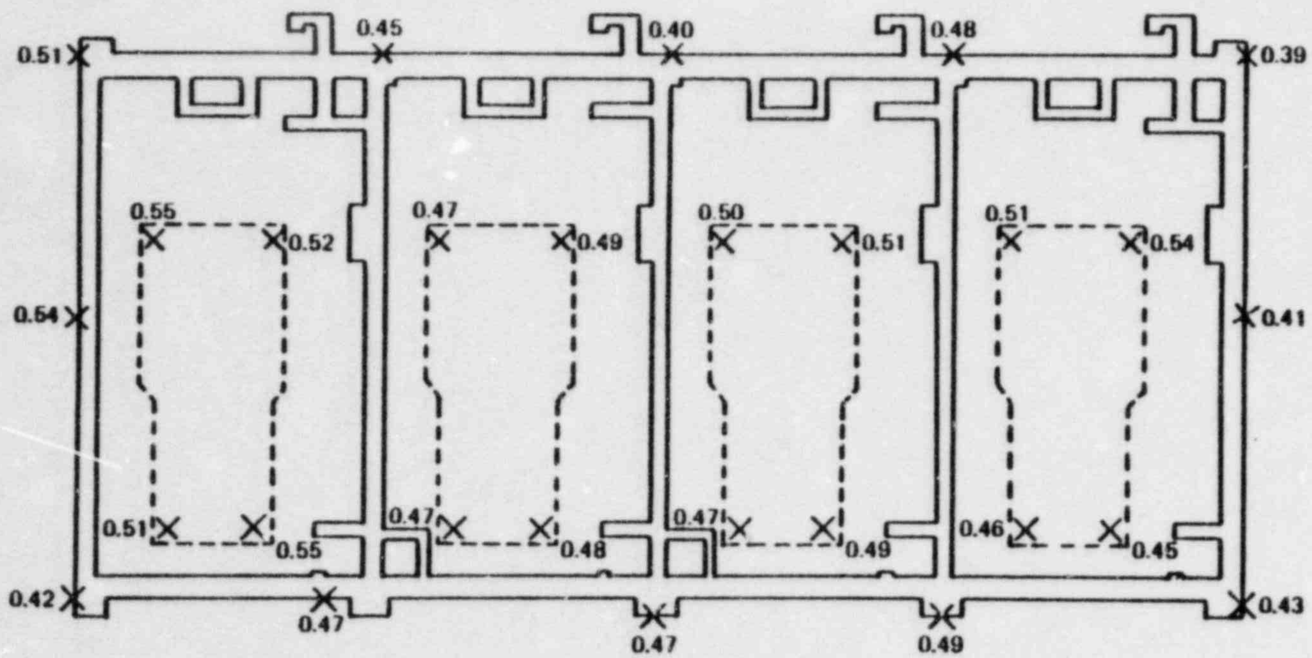
O —— DEEP BORROS ANCHOR

X —— BUILDING / PEDESTAL SETTLEMENT MARKER

1.20 —— SETTLEMENT IN INCHES

DIESEL GENERATOR BUILDING EXECUTIVE SUMMARY
ESTIMATED SECONDARY COMPRESSION SETTLEMENTS FROM 12/31/81 TO 12/31/2025 ASSUMING SURCHARGE REMAINS
FIGURE ES-7

DIESEL GENERATOR BUILDING

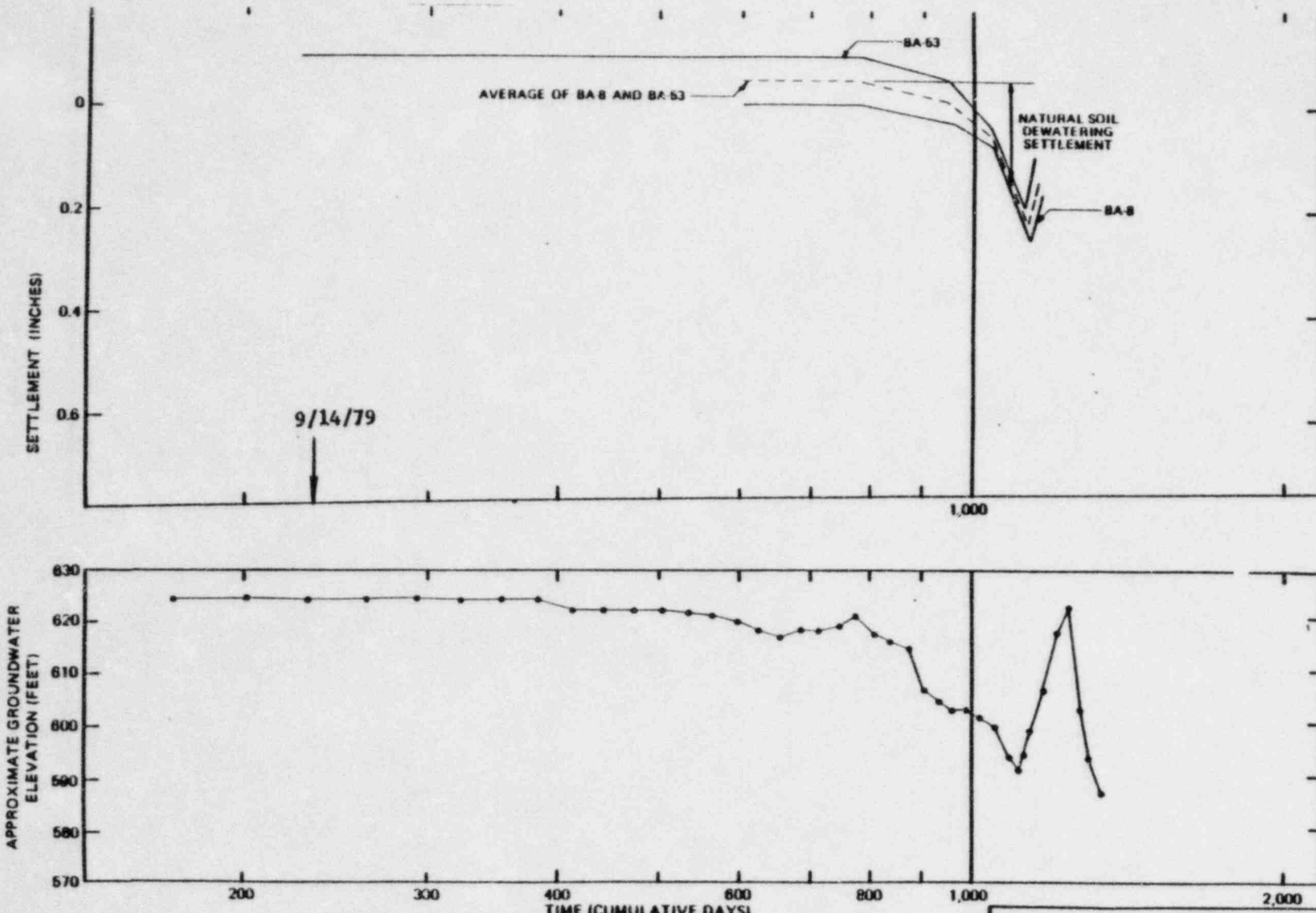


LEGEND

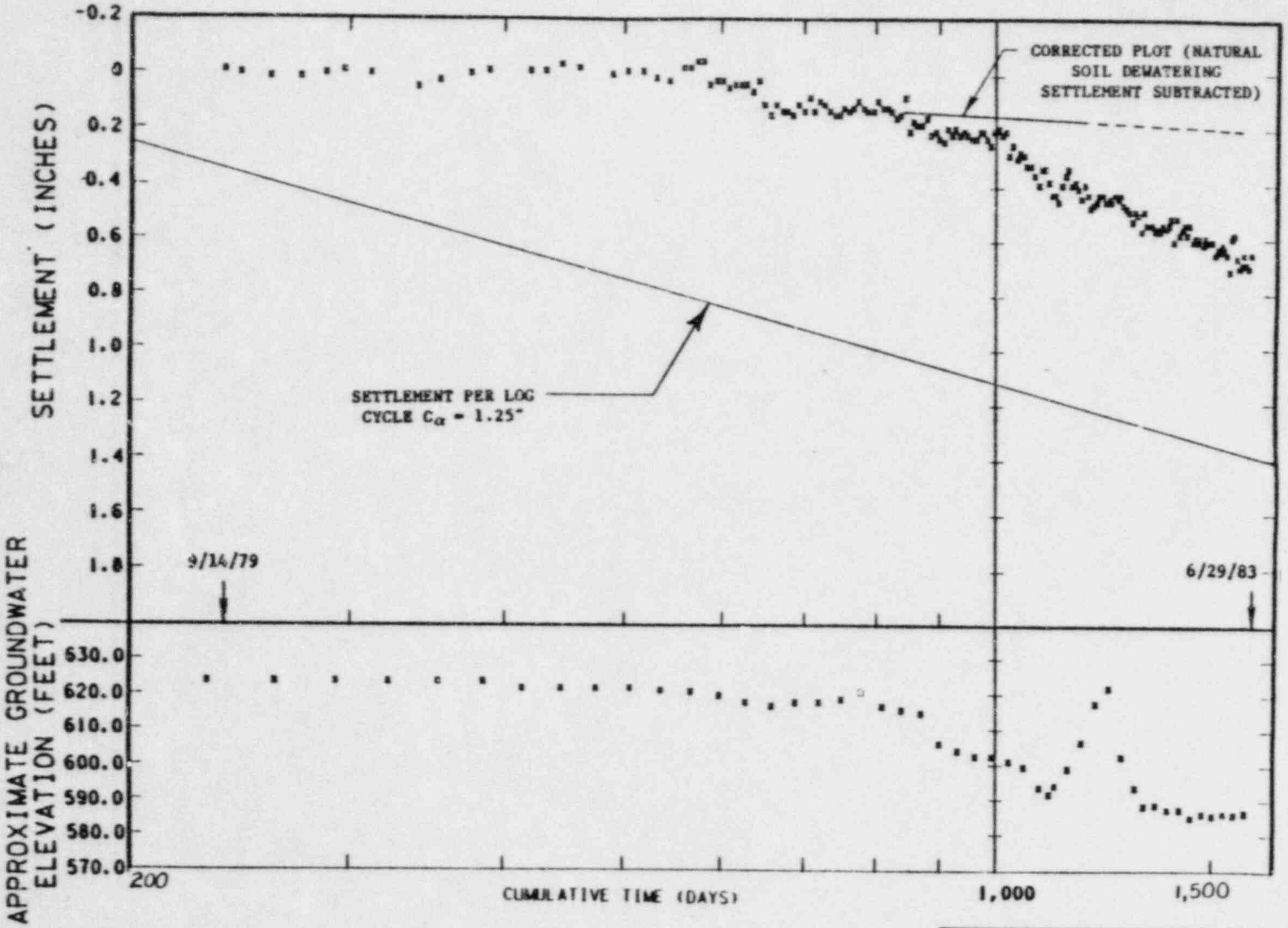
X —— BUILDING / PEDESTAL SETTLEMENT MARKER

0.42 —— MEASURED SETTLEMENT BETWEEN 9/14/79 AND 12/31/81.

DIESEL GENERATOR BUILDING EXECUTIVE SUMMARY
MEASURED SETTLEMENT FROM 9/14/79 TO 12/31/81
FIGURE ES-8



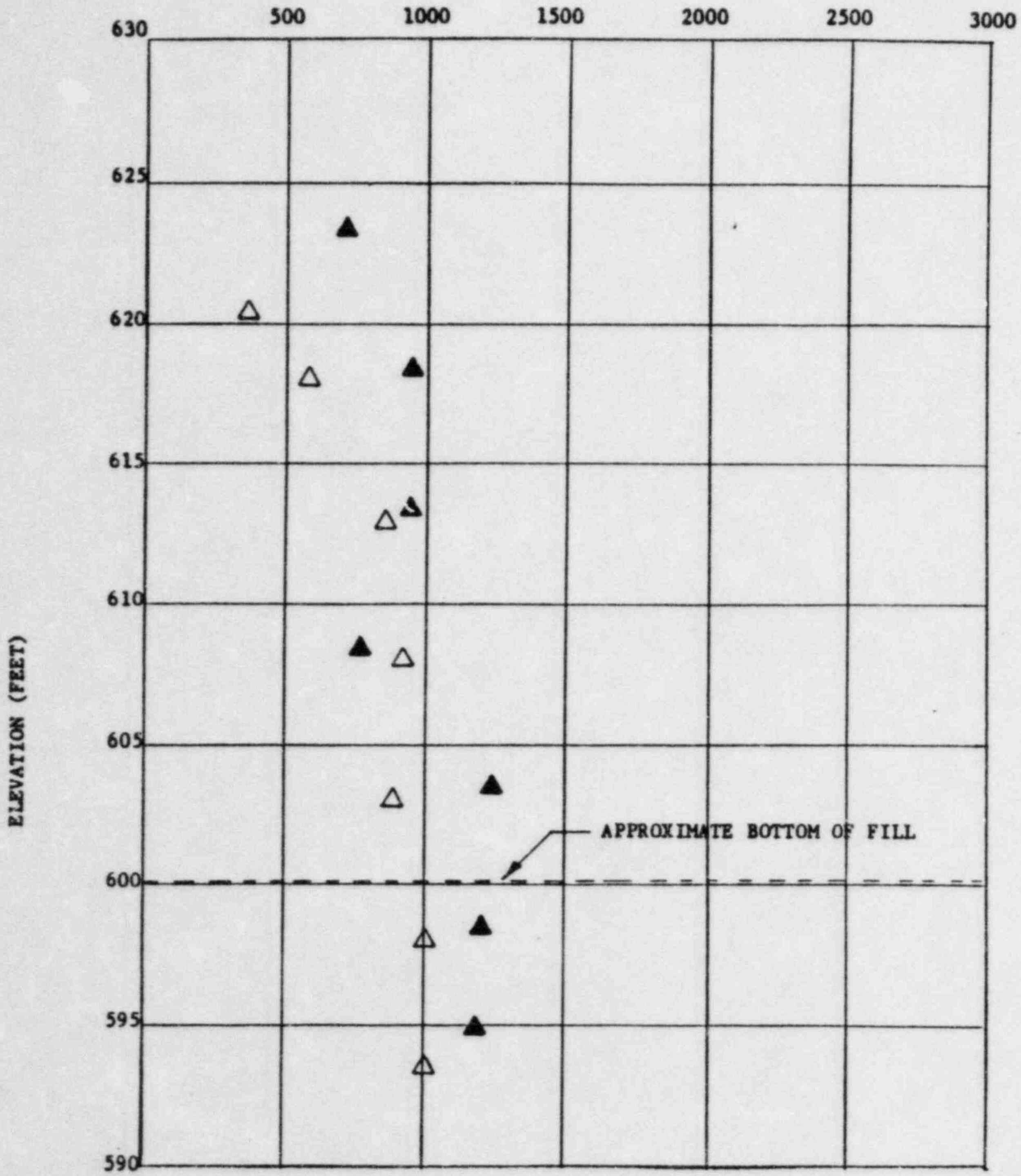
DIESEL GENERATOR BUILDING EXECUTIVE SUMMARY
AVERAGE SETTLEMENT AFTER SURCHARGE REMOVAL BA-8 AND BA-53
FIGURE ES-9



DIESEL GENERATOR BUILDING EXECUTIVE SUMMARY

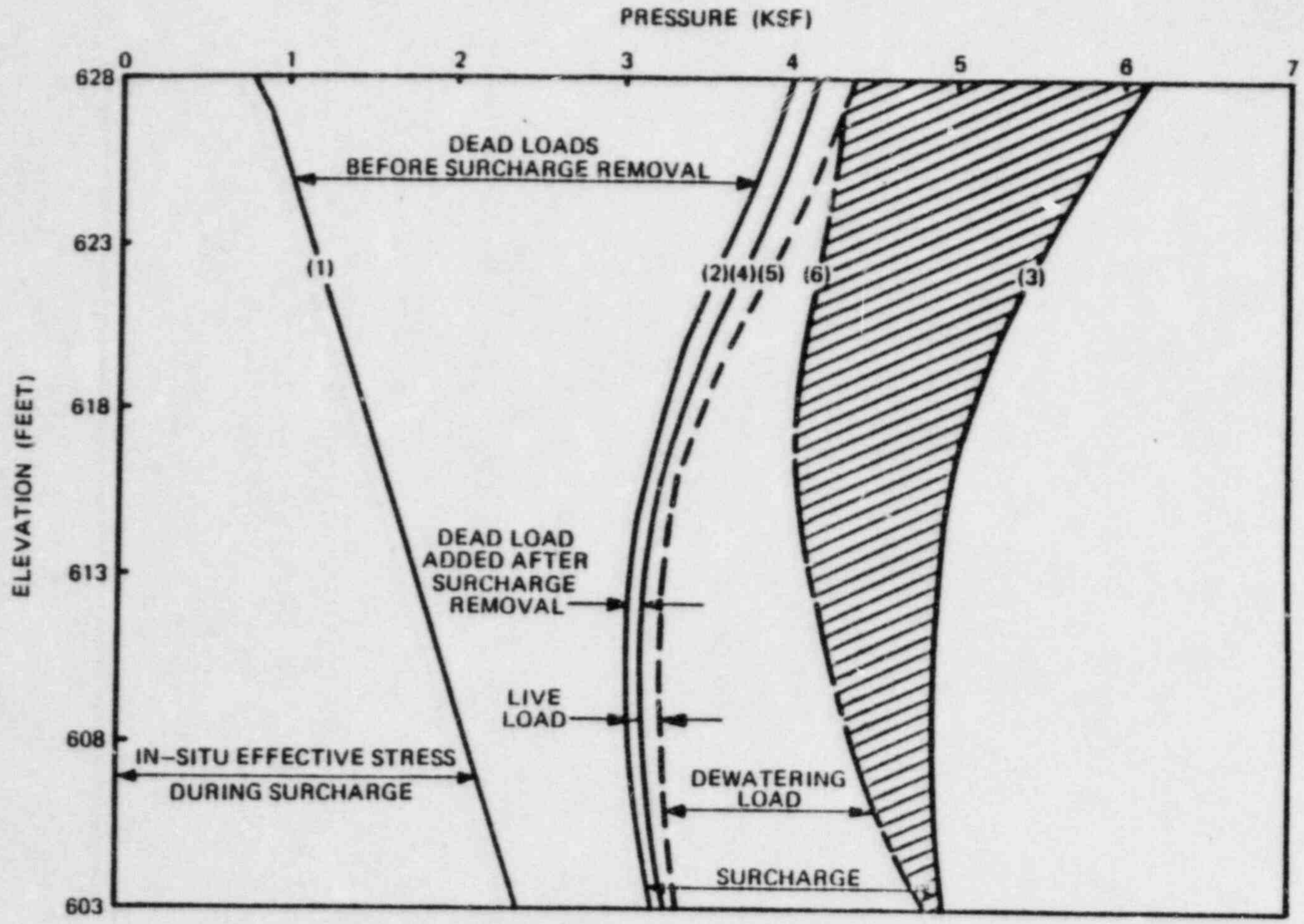
SETTLEMENT VS. LOGARITHM OF TIME SINCE 9/14/79 SHOWING CORRECTED SLOPE MARKER DG-3

FIGURE ES-10



NOTE:
Open and closed symbols represent tests at different locations.

DIESEL GENERATOR BUILDING EXECUTIVE SUMMARY
SHEAR WAVE VELOCITY PROFILE
FIGURE ES-11



EXPLANATIONS

(1) In-situ effective overburden pressure (GWT at 627).

(2) Total effective pressure before surcharge removal due to In-situ effective overburden pressure and structural dead loads present during surcharge.

(3) Total effective pressure at the end of surcharge due to In-situ effective overburden pressure, structural dead loads, and surcharge loads.

(4) Total effective pressure due to In-situ effective overburden pressure and total structural dead loads (loads present during surcharge plus dead loads added after surcharge removal).

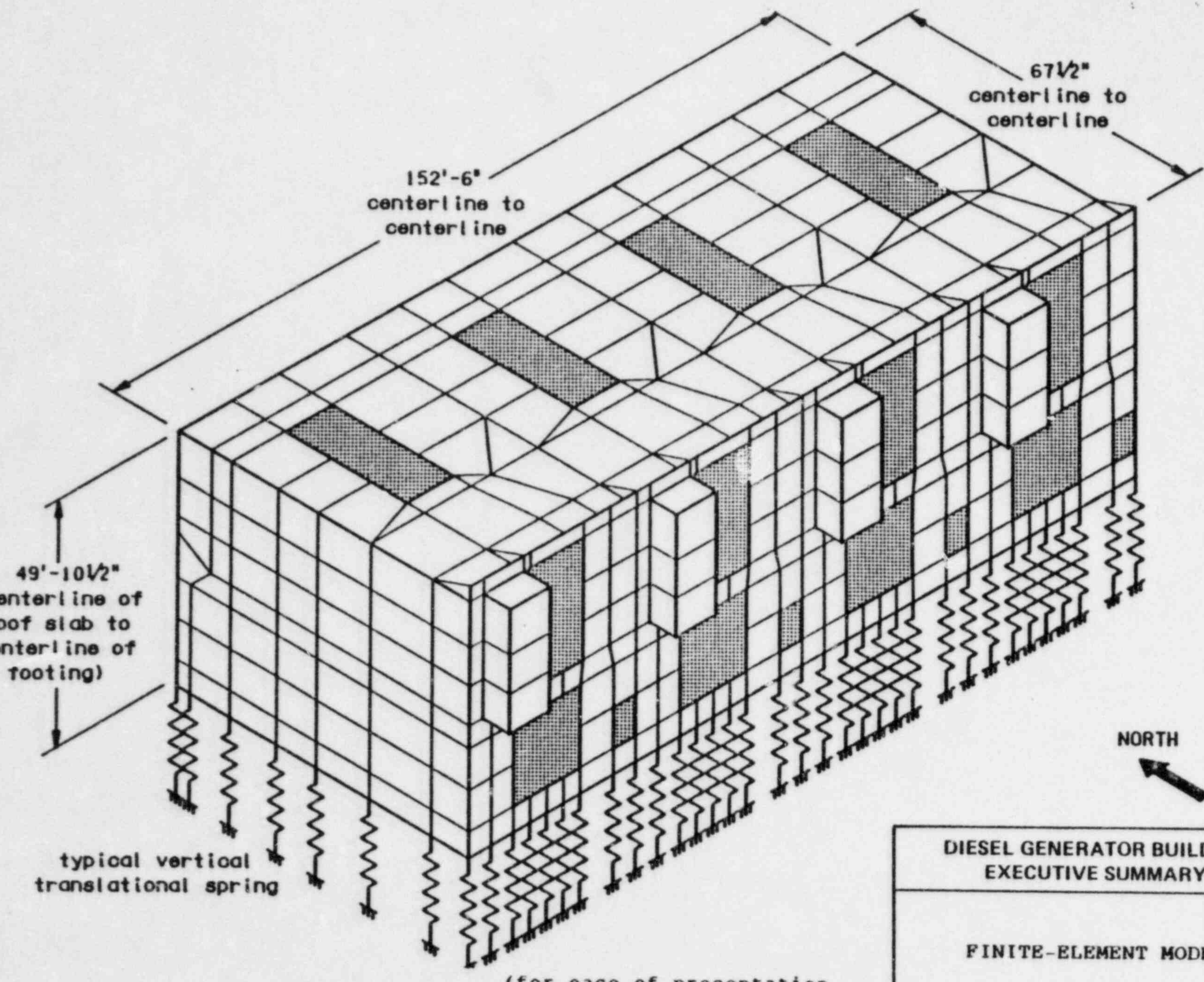
(5) Total effective pressure due to In-situ effective overburden pressure, total structural dead loads, and expected live loads.

(6) Total effective pressure during the life of plant operation due to In-situ effective overburden pressure, structural dead loads, dewatering loads, and expected live loads.

DIESEL GENERATOR BUILDING
EXECUTIVE SUMMARY

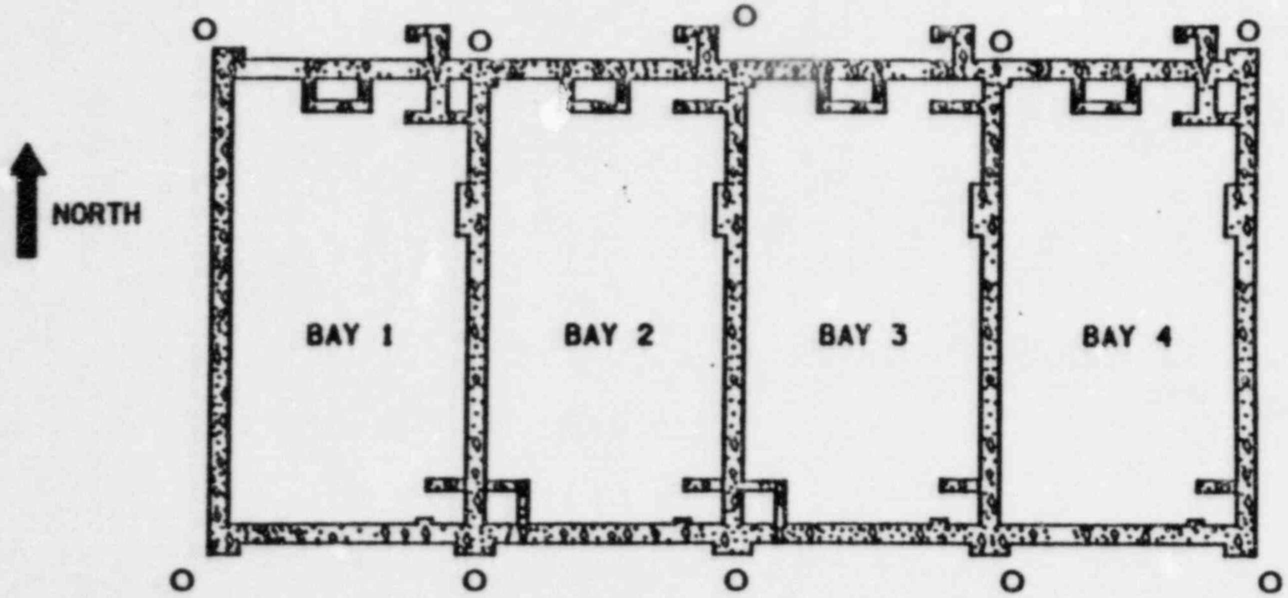
COMPARISON OF EFFECTIVE STRESS BEFORE AND AFTER SURCHARGE SOUTHWEST CORNER

FIGURE ES-12



DIESEL GENERATOR BUILDING EXECUTIVE SUMMARY
FINITE-ELEMENT MODEL
FIGURE ES-13

LINE A	1.19	1.02	0.90	0.85	0.76
LINE B	0.77	1.09	1.54	1.98	2.41
LINE C	1.50	1.51	1.78	1.86	1.91
LINE D	1.33	1.15	1.19	1.18	1.29
TOTAL	4.79	[illegible].77	5.41	5.87	6.37



LINE A	1.67	1.42	1.28	1.44	1.99
LINE B	1.14	1.12	1.46	1.92	2.21
LINE C	3.00	2.92	3.16	3.37	3.24
LINE D	1.62	1.67	1.69	1.98	1.89
TOTAL	7.43	7.13	7.59	8.71	9.33

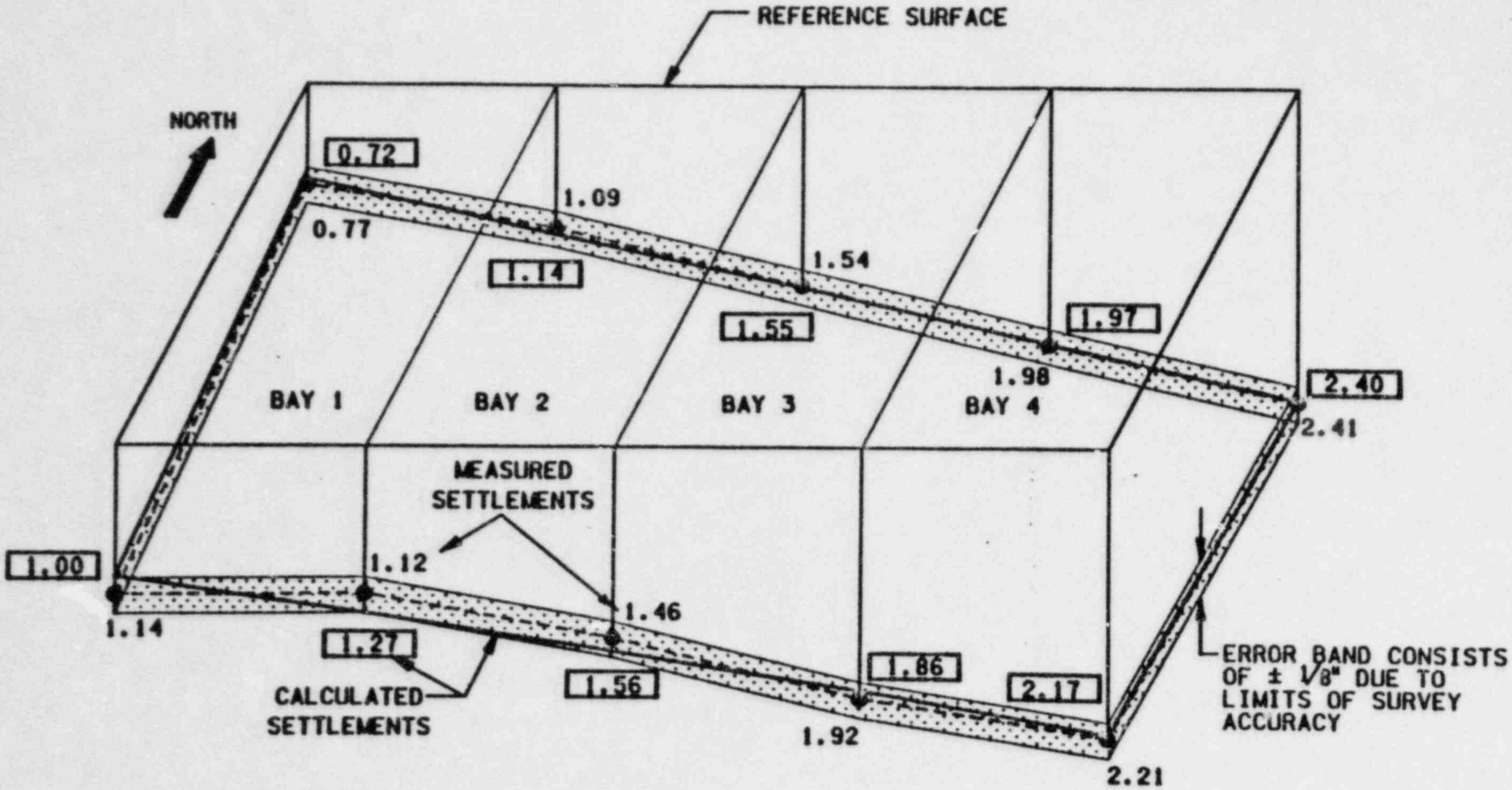
LEGEND

O —— DIESEL GENERATOR BUILDING SETTLEMENT MARKER

SETTLEMENT IN INCHES FOR

PRE-SURCHARGE PERIOD (3/78-8/78)............LINE A
PRE-SURCHARGE PERIOD (8/78-1/79)............LINE B
SURCHARGE PERIOD (1/79-8/79) ....LINE C
POST SURCHARGE PERIOD (9/79-12/2025) ....LINE D
ASSUMING SURCHARGE REMAINS IN PLACE

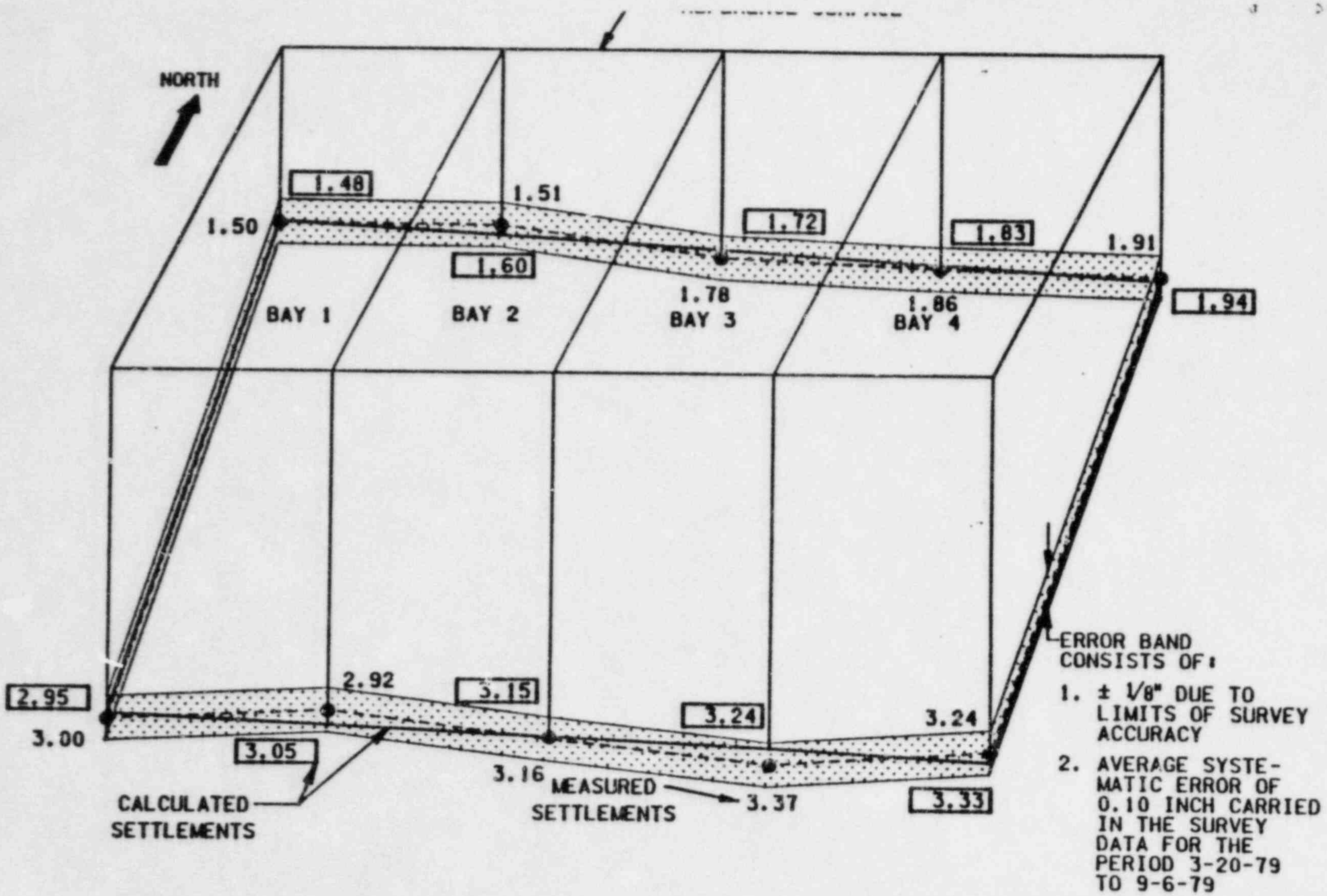
DIESEL GENERATOR BUILDING EXECUTIVE SUMMARY
SUMMARY OF ACTUAL AND ESTIMATED SETTLEMENTS
FIGURE ES-14



DIESEL GENERATOR BUILDING
EXECUTIVE SUMMARY

COMPARISON OF SETTLEMENT VALUES
PRE-SURCHARGE PERIOD
AUGUST 1978 - JANUARY 1979

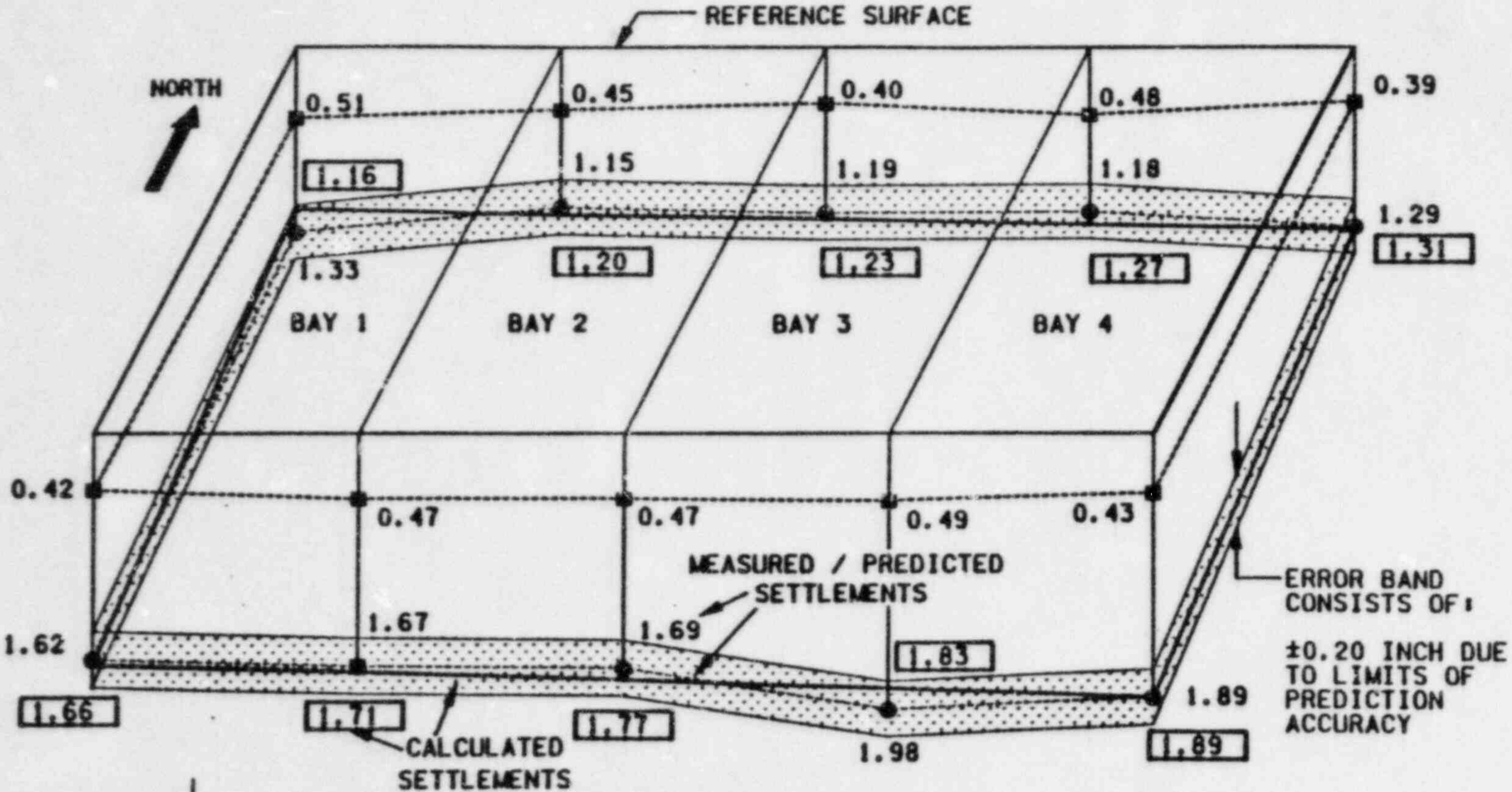
FIGURE ES-15



DIESEL GENERATOR BUILDING
EXECUTIVE SUMMARY

COMPARISON OF SETTLEMENT VALUES
SURCHARGE PERIOD
JANUARY 1979 - AUGUST 1979

FIGURE ES-16



ACTUAL MEASURED SETTLEMENT FROM SEPT.14, 1979 TO DEC.31, 1981. THESE INCLUDE EFFECT OF DEWATERING TO APPROXIMATELY EL. 595', AND REPRESENT MOVEMENT OF THE STRUCTURE DUE TO SETTLEMENT OF THE FILL AND NATURAL SOIL BELOW.

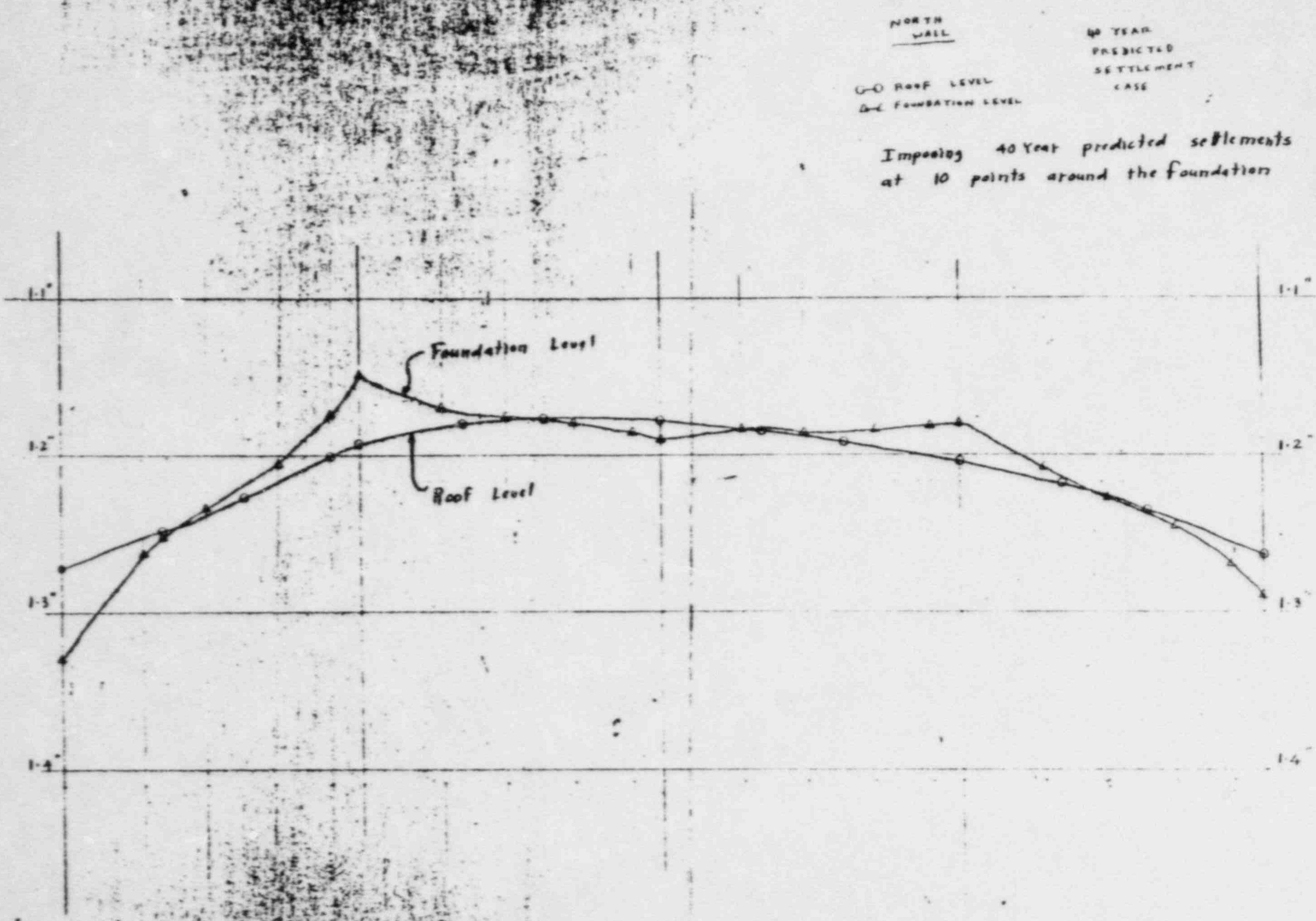
ACTUAL MEASURED SETTLEMENTS FROM SEPT.14, 1979 TO DEC.31, 1981 PLUS ESTIMATED SECONDARY COMPRESSION SETTLEMENT FROM DEC.31, 1981 TO DEC.31, 2025 ASSUMING SURCHARGE REMAINS IN PLACE.

DIESEL GENERATOR BUILDING
EXECUTIVE SUMMARY

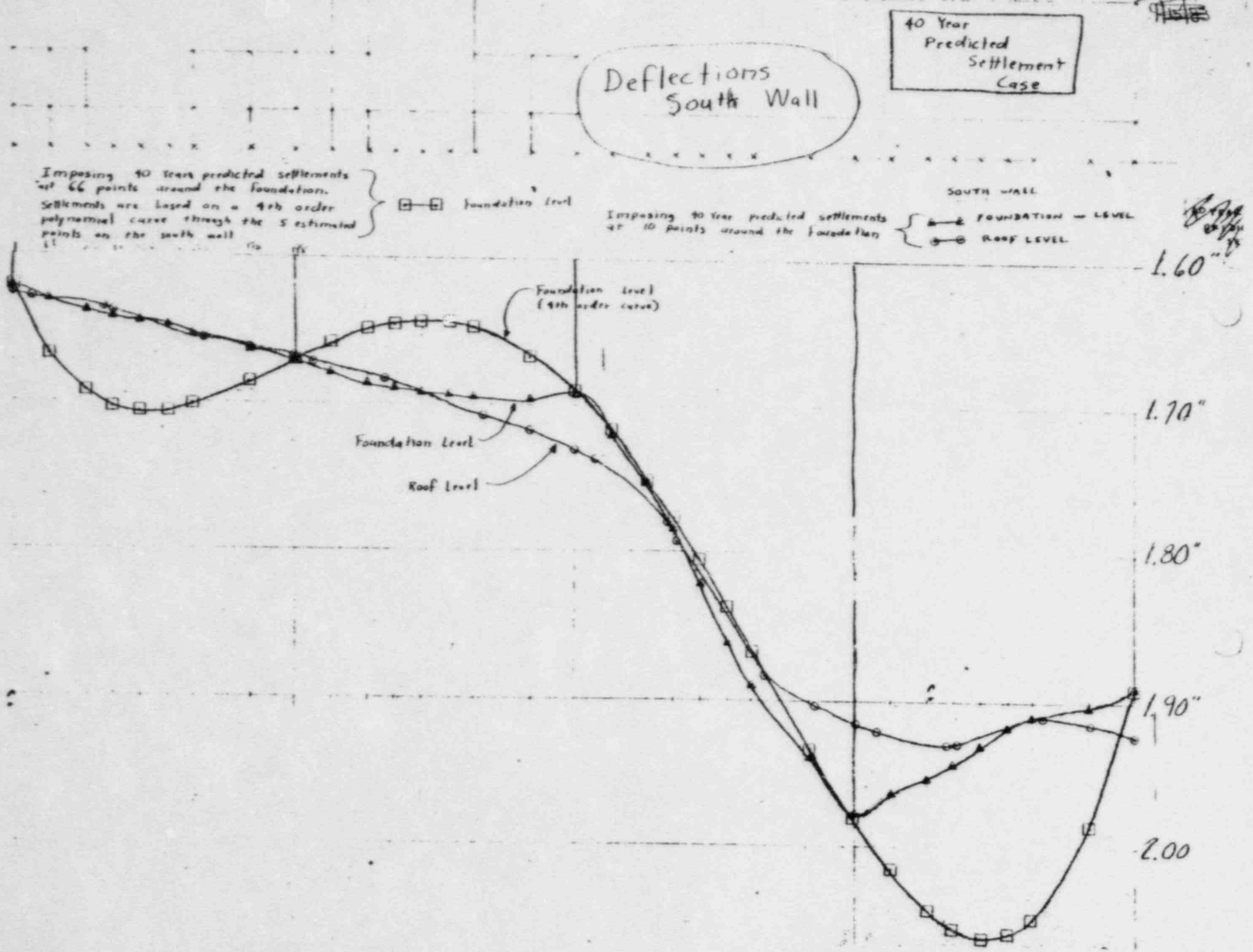
COMPARISON OF SETTLEMENT VALUES
POST-SURCHARGE PERIOD
SEPTEMBER 1979 - DECEMBER 2025

FIGURE ES-17

ATTACHMENT 3



ATTACHMENT 4



Attachment 5

ATTENDEES
SEPTEMBER 13, 1933
WOLVERINE INN, ANN ARBOR

R. Landsman	RIII
C. P. Tan	SGEB/DE/NRR
R. D. Romney	SGEB/DE/NRR
D. S. Hood	LB#4/DL/NRR
C. J. Costantino	BNL
C. A. Miller	BNL
A. J. Philippacopoulos	BNL

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

October 11, 1983

Docket Nos: 50-329 OM, OL
and 50-330 OM, OL

MEMORANDUM FOR: The Atomic Safety and Licensing Board for the Midland Plant, Units 1 & 2

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

SUBJECT: SUPPLEMENTARY NOTIFICATION REGARDING DR. LANDSMAN'S CONCERNS FOR THE MIDLAND DIESEL GENERATOR BUILDING (BN 83-153)

Board Notifications 83-109 and 83-142 have transmitted the NRC staff's plan to address the concerns of Dr. Ross Landsman of Region III regarding the structural adequacy of the Midland Diesel Generator Building (DGB). These Notifications are deemed to provide information material and relevant to safety issues in the Midland OM/OL proceeding, including testimony by members of the NRC staff and staff consultants during the December 10, 1982, hearing session.

This Board Notification 83-153 further supplements the information regarding Dr. Landsman's concern, and is provided for your information. Enclosure 1 provides a reply by Mr. J. P. Knight to inquiries (Enclosure 1 to Knight's memorandum) by Mr. R. Vollmer as to (1) whether or not any members of Mr. Knight's staff, or consultants thereto, share Dr. Landsman's concerns that the DGB is inadequate to return to service from a safety point of view, and (2) whether or not any of these individuals share Dr. Landsman's specific technical concerns, notwithstanding their judgement that the building is safe for operation.

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

Enclosures:
As stated

DISTRIBUTION LIST FOR BOARD NOTIFICATION

Midland Units 1&2,
Docket Nos. 50-329/330

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T. J. Creswell
Steve J. Galder, P.E.
Dr. Jerry Harbour
Mr. Wayne Hearn
Mr. James R. Kates
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Mr. Wendell H. Marshall
Michael I. Miller, Esq.
Thomas S. Moore, Esq.
Mr. Paul Rau
Ms. Mary Sinclair
Ms. Barbara Stamiris
Frederick C. Williams, Esq.

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Dr. Max W. Carbon
Mr. Jesse C. Ebersole
Mr. Harold Etherington
Dr. William Kerr
Dr. Harold W. Lewis
Dr. J. Carson Mark
Mr. William M. Mathis
Dr. Dade W. Moeller
Dr. Milton S. Plesset
Mr. Jeremiah J. Ray
Dr. David Okrent
Dr. Paul C. Shewmon
Dr. Chester P. Siess
Mr. David A. Ward

MIDLAND (For BNs)

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Vice President
Consumers Power Company
1945 West Parnall Road
Jackson, Michigan 49201

cc: Stewart H. Freeman
Assistant Attorney General
State of Michigan Enviornmental
Protection Division
720 Law Building
Lansing, Michigan 48913

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Midland Daily News
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Midland, Michigan 48640

Mr. R. B. Borsum
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Resident Inspectors Office
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Mr. Ron Callen
Michigan Public Service Commission
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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SEP 23 1983

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

FROM: James P. Knight, Assistant Director
for Components & Structures Engineering
Division of Engineering

SUBJECT: MIDLAND

This is in response to your note of August 15, 1983 asking if any members of my staff, or our consultants, share R. Landsman's concerns that the Midland diesel generator building is inadequate for its intended service and whether they share any of his specific technical concerns.

A task group, including consultants from Brookhaven National Laboratory (BNL), was formed under the supervision of Dr. P. T. Kuo of the NRC staff to conduct a reevaluation of the staff's position with regard to acceptance of the Midland diesel generator building. Upon receiving Dr. Landsman's statement of concerns, dated July 19, 1983, members of the Midland review staff, and consultants named below, were given copies of Dr. Landsman's memo. Their initial reactions were that Dr. Landsman's statement contained no new information and that their previous sentiments, as discussed further below, remained unchanged. On September 8, 1983, the task group consisting of Dr. Kuo, Dr. C. P. Tan and Mr. N. Romney of the NRC staff, with the assistance of Drs. C. A. Miller, C. J. Constantino and A. J. Philippacopoulos of BNL, conducted individual interviews with Mr. J. Kane, NRC staff, Dr. L. Heller, NRC staff, and Mr. H. Singh, Corps of Engineers, and a group interview with Mr. F. Rinaldi of the NRC staff, Mr. J. Matra of the Naval Ordinance Laboratory and Dr. G. Harstead of Harstead Associates. These individuals represent to the best of our knowledge all members of the NRC staff and our consultants who were principally involved in the review activities associated with the Midland diesel generator building. As you know, the task group solicited all information and opinions related to the diesel generator building in addition to comments on Dr. Landsman's statement.

The results of all interviews conducted in this effort are being compiled as a part of the overall task group report which is scheduled to be completed in October, 1983. It is my understanding that the sentiments expressed by these individuals were essentially the same sentiments contained in the staff and consultant testimony before the Atomic Safety & Licensing Board; Mr. Rinaldi, Mr. Matra, Dr. Harstead, Mr. Kane and Mr. Singh were among the staff and consultant witnesses on this matter. Although Dr. Heller, Mr. Kane and Mr. Singh were not satisfied with certain aspects of the analyses performed by the

SEP 23 1983

applicant, and some of these same aspects were echoed by Dr. Landsman in his July 19, 1983 statement, none of these individuals have made a final assessment as to the acceptability of the diesel generator building for its intended service because they feel that the basis for such a judgement is incomplete.

Consistent with the hearing record, Dr. Harstead, Mr. Matra and Mr. Rinaldi reiterated their judgement that the diesel generator building was structurally acceptable for service, i.e., would remain structurally functional under design loading conditions.

The task group met with representatives of the applicant at the offices of Bechtel Corporation in Ann Arbor, Michigan and went to the site on August 24 & 25, 1983. The task group returned to the Bechtel offices in Ann Arbor on September 12 & 13, 1983 for a further audit of the calculations employed to investigate the predicted performance of the diesel generator building. Both of these meetings were preannounced public meetings; however, there was no attendance by members of the public. Dr. Landsman was also interviewed by the task group on September 13, 1983.

George Lear
for James P. Knight, Assistant Director
for Components & Structures Engineering
Division of Engineering

Enclosure:
R. Vollmer's Note to J. Knight
dated August 15, 1983

cc w/encl:
H. Denton
D. Eisenhut
T. Novak
E. Adensam
G. Lear
D. Hood
L. Heller
P. T. Kuo
F. Rinaldi
J. Kane

Enclosure 1

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

August 15, 1983

NOTE TO: Jim Knight

With respect to the Landsman issue, I would like to know if any of your staff or consultants share Landsman's concerns that the Midland Diesel Generator Building is inadequate to return to service from a safety point of view, i.e., inability to meet design requirements. I would also like an answer to the broader question: do they share any of his specific technical concerns even though their bottom line judgment would be that the building is safe for operation.

I would like to discuss this with you on August 22nd.

R. Vollmer

~~8308290029 XA~~ 18

File
Cy for BN File

PRINCIPAL STAFF			
RA		ENF	
D/RA		SCS	
A/RA		PAO	
DPRP		SLO	
DRMA		RC	
DRMSP			
DE			
ML			
OL		FILE	

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

[redacted] SEP 22 1983

Docket Nos.: 50-329 OM, OL
and 50-330 OM, OL

MEMORANDUM FOR: The Atomic Safety and Licensing Board for the Midland Plant, Units 1 and 2

FROM: Thomas M. Novak, Assistant Director for Licensing
Division of Licensing
Office of Nuclear Reactor Regulation

SUBJECT: SCHEDULE FOR COMPLETION OF RE-REVIEW OF THE MIDLAND DIESEL GENERATOR BUILDING (BN 83-142)

On July 27, 1983, Board Notification 83-109 transmitted the NRC staff plan to address the concerns of Dr. Ross Landsman of Region III regarding the structural adequacy of the Midland Diesel Generator Building (DGB). Enclosures 1, 2 and 3 to that Notification provided respectively: (1) a discussion of the Region III and NRR activities in this regard; (2) Dr. Landsman's written statement of his concerns and; (3) a detailed NRR action plan, including the schedules for completion of the effort.

This Board Notification 83-142 further supplements the information regarding the DGB re-evaluation. As with the original Notification, this updated information is provided in accordance with NRC procedures regarding Board Notifications and is deemed as information material and relevant to safety issues in the Midland OM/OL proceeding. Specifically, the re-evaluation effort is relevant to: (1) concerns expressed by Dr. Landsman in the OM - OL hearing and elsewhere regarding the adequacy of the Diesel Generator Building and; (2) testimony by members of the NRC staff and staff consultants during the December 10, 1982 hearing session regarding the Diesel Generator Building.

The enclosure contains a memorandum from D. G. Eisenhut to R. H. Vollmer accepting a delayed schedule for completion of the review of Dr. Landsman's concerns. Attachments to the Eisenhut memorandum include the Vollmer to Eisenhut memo noting the need for the delay in the schedule which was provided in BN 83-109. The Vollmer memo notes that issuance of the task force's findings will be delayed from September 28, 1983 (i.e. 45 working days after receipt of Dr. Landsman's statement) to October 15, 1983. The Vollmer memo also includes a revised work plan. The events shown through September 13, 1983 have been completed as scheduled. The discussions with various individuals on September 8 and 13, 1983 were in accordance with the task force's role to interview concerned individuals. Although not shown,

~~8308300337~~ 4pp

SEP 28 1983

the individuals with whom the task force met on September 8, 1983 also included H. Singh of the U.S. Army Corps of Engineers. A second attachment to the Eisenhut memo is a letter from B. Garde of the Government Accountability Project expressing concerns related to the task force review.

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

Enclosures:
As stated

cc: Licensee/Boards Service List
SECY
OGC
OPE

DISTRIBUTION LIST FOR BOARD NOTIFICATION

(BN 83-142)

Midland Units 1&2,
Docket Nos. 50-329/330

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Mr. David A. Ward

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Director, Citizens Clinic
for Accountable Government
Government Accountability Project
Institute for Policy Studies
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477 Michigan Avenue
Detroit, Michigan 48226

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

SEP 20 1983

MEMORANDUM FOR: Thomas Novak, Assistant Director for Licensing

FROM: Darrell G. Eisenhut, Director
Division of Licensing

SUBJECT: BOARD NOTIFICATION FOR MIDLAND

I have determined that the attached correspondence concerning a new schedule for the review of the Landsman concerns should be transmitted to the Board and parties for Midland according to the procedure of Office Letter No. 19. Your transmittal should include both enclosures to my memorandum to Vollmer.

Issue this as Board Notification 83-142.

Darrell G. Eisenhut, Director
Division of Licensing

Enclosure:
As Stated

cc: E. Adensam
D. Hood

~~8403010211~~ 1p.

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

SEP 20 1983

MEMORANDUM FOR: Thomas Novak, Assistant Director for Licensing

FROM: Darrell G. Eisenhut, Director
Division of Licensing

SUBJECT: BOARD NOTIFICATION FOR MIDLAND

I have determined that the attached correspondence concerning a new schedule for the review of the Landsman concerns should be transmitted to the Board and parties for Midland according to the procedure of Office Letter No. 19. Your transmittal should include both enclosures to my memorandum to Vollmer.

Issue this as Board Notification 83-142.

Darrell G. Eisenhut, Director
Division of Licensing

Enclosure:
As Stated

cc: E. Adensam
D. Hood

~~8403010211~~ 1p.

ENCLOSURE 1

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

SEP 20 1983

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

FROM: Darrell G. Eisenhut, Director
Division of Licensing

SUBJECT: EVALUATION OF THE LANDSMAN CONCERNS FOR MIDLAND

Your letter of September 8, 1983 (Enclosure 1) provided a revised schedule for the DE work plan regarding the Landsman concerns. While I find the proposed schedule acceptable I feel compelled to emphasize that we must ensure that no further slippage occurs.

I am also in receipt of a letter from Billie Garde (Enclosure 2) that indicates their understanding that several staff members had "strong feelsings about the approval by the DGB resolution." Please consider this letter in your ongoing review.

Darrell G. Eisenhut, Director
Division of Licensing

Enclosures:
1. Vollmer memo to DGEisenhut
   8/8/83
2. B. Garde to DGEisenhut
   7/19/83

8406020241

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

SEP 8 1983

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

FROM: Richard H. Vollmer, Director
Division of Engineering, ONRR

SUBJECT: EVALUATION OF LANDSMAN'S CONCERNS REGARDING DIESEL GENERATOR BUILDING AT MIDLAND

References:
1. Memo, Eisenhut to Keppler, June 27, 1983
2. Memo, Vollmer to Eisenhut, July 21, 1983
3. Memo, Landsman to Warnick, July 19, 1983

Due to schedule conflicts between the Diablo Canyon Review and this effort on Midland which affects the personnel from Brookhaven National Laboratory (BNL), DE must reschedule the completion of the Midland DGB review from September 28 to October 15, 1983. During the month of September, the BNL personnel will partially be committed to Diablo Canyon reviewing ITR's, preparing testimony and taking depositions. If you do not concur with slipping this effort to accommodate the demands of Diablo Canyon, please advise accordingly.

Enclosed is a revised Work Plan for the completion of the DE evaluation of the Landsman's concerns. The ASLB (via OELD) should be advised of the revised schedule for completion.

Richard H. Vollmer, Director
Division of Engineering, ONRR

Enclosure:
As stated

cc: H. Denton
J. Knight
G. Lear
P. Kuo
N. Romney
C. Tan
E. Adensam
D. Hood

CONTACT: N. Romney, SGEB
49-28987

ENCLOSURE

Midland NPP Diesel Generator Building Review

Work Plan

August 24 - 25, 1983	Task Force - Site Visit - Completed
September 8, 1983	Task Force meet with: F. Rinaldi J. Kane J. Matra G. Harstead
September 13, 1983 (AM)	Task Force meet with R. Landsman (Ann Arbor, Michigan)
September 12 - 13, 1983	Task Force conduct audit of Midland DGB (Ann Arbor, Michigan)
October 15, 1983	Issue Report of Findings

GOVERNMENT ACCOUNTABILITY PROJECT
Institute for Policy Studies
1901 Que Street, N.W., Washington, D.C. 20009 (202) 234-9382

August 19, 1983

Mr. Darrell G. Eisenhut, Director
Division of Licensing
Office of Nuclear Reactor Regulations
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Eisenhut:

On August 10, 1983 you responded to my Aug. 8, 1983 request for information regarding the review group formed to consider the concerns of Mr. Ross Landsman. On Aug. 11, 1983 during a public meeting on the Construction Completion Plan (CCP) you indicated that a review of the NRR Engineering Division had indicated no support or agreement with Mr. Landsman. Mrs. Barbara Stamiris, the Citizen Intervenor on the soils settlement ("OM") proceedings inquired specifically about Mr. Joe Kane of your office and a consultant, Dr. Sing, of the U.S. Army Corps of Engineers. You indicated that you were not aware of whether or not those individuals had been asked or not. Please inform Mrs. Stamiris and myself of the answer to that question.

More specifically, it is our clear understanding that several members of the Engineering Staff in both the Region and in headquarters had very strong feelings about the approval of the DGB resolution. We expect your technical review to include the past concerns of both Regional and headquarters engineers. Furthermore, since the concerns about this issue and its resolution are of interest to Congress, the local intervenors and GAP we respectfully request that your office issue an Interim report, allow time for review and comment by the public, and hold at least one open meeting prior to the issurance of the final report on this subject.

A final concern we wish to raise with your office deals with the background of the individuals you have nominated to complete the review of Dr. Landsman's concerns. All of the people selected are structural engineers. Dr. Landsman of course, is a geo-technical engineer. Clearly, any review team should contain professional representation from Dr. Landsman's discipline, and suggest that you appoint an independent geo-technical consultant to review the work of your engineers.

Finally, we concur with Mr. Robert Warnicks suggestion contained in his July 21, 1983 memo to you that "all related correspondence and the resulting report(s) and documentation should be placed in the public document room and distribution list."

Thank you for your extraordinary promptness to my August 8, 1983 letter, it was a pleasant surprise. I look forward to an equally pleasant substantive report on the DGB from your office.

Sincerely,

Billie Pirner Garde
Citizens Clinic Director

wgw

THIRD PARTY REVIEWS

-INPO Self-initiated Evaluation by MAC

-Independent Design Verification of Auxiliary Feedwater and one Other System

DG Power System
Chilled Water System
Containment Isolation

for ongoing construction

-Independent Installation Implementation Overview (Soils Work being performed by Stone & Webster)

SELF-INITIATED EVALUATION

-INPO Received Report January 31, 1983

-Submission to NRC

-Corrective Action Implementation

TERA
S&W

INDEPENDENT INSTALLATION IMPLEMENTATION OVERVIEW

-Status

-Scope

1 - Familiarization With Procedures, Drawings, Specs, Organizations, Interfaces

2 - Evaluate adequacy of the above

3 - Evaluate compliance with above for construction activities and QC activities

4 - Submit observations and reports to Consumers Power with copies to NRC

-Schedule

1 - Award Contract February 15, 1983

2 - Activities 1 through 5 February 15 to August 15, 1983

3 - Final Report, Evaluation and Decision on Need to Extend Overview Schedule 9/1/83

117

* Upgraded Program
* Reinspection of Plant
* IDVP + ICVP
* Soils Ongoing
* Other Safety Related Work Ongoing

A G E N D A

Opening Remarks	JWCook
Construction Completion Program	
Introduction	DBMiller
Detailed Description	RAWells
Third Party Review	GSKeeley/TERA
Bechtel Comments	JARutgers
Closure	JWCook

Meeting Helpful
Program sound good
Third Party Review Needed
Proposal covers lots of bases
Need to reflect; don't do anything
re IR's without touching base with NRC

CONSTRUCTION COMPLETION PROGRAM

SOURCES OF INPUT

1. Evaluation of systems completion
2. Transfer of QC to CPCo QA (MPQAD)
3. INPO self-initiated evaluation
4. 1981 SALP Report and subsequent discussions
5. The October/November Diesel-Generator Building inspection
6. November NRC letter to the ACRS
7. Need to place more emphasis on soils start

CONSTRUCTION COMPLETION PROGRAM

OBJECTIVES

IMPROVE PROJECT INFORMATION STATUS BY:

-PREPARING AN ACCURATE LIST OF TO-GO WORK AGAINST A DEFINED BASELINE.

-BRINGING INSPECTIONS UP-TO-DATE AND VERIFYING THAT PAST QUALITY ISSUES HAVE BEEN OR ARE BEING BROUGHT TO RESOLUTION.

-MAINTAINING A CURRENT STATUS OF WORK AND QUALITY INSPECTIONS AS THE PROJECT PROCEEDS.

IMPROVE IMPLEMENTATION OF THE QA PROGRAM BY:

-EXPANDING AND CONSOLIDATING CONSUMERS POWER COMPANY CONTROL OF THE QUALITY FUNCTIONS.

-IMPROVING THE PRIMARY INSPECTION PROCESS.

-PROVIDING A UNIFORM UNDERSTANDING OF THE QUALITY REQUIREMENTS AMONG ALL PARTIES.

CONSTRUCTION COMPLETION PROGRAM (CONTD)

ASSURE EFFICIENT AND ORDERLY CONDUCT OF THE PROJECT BY:

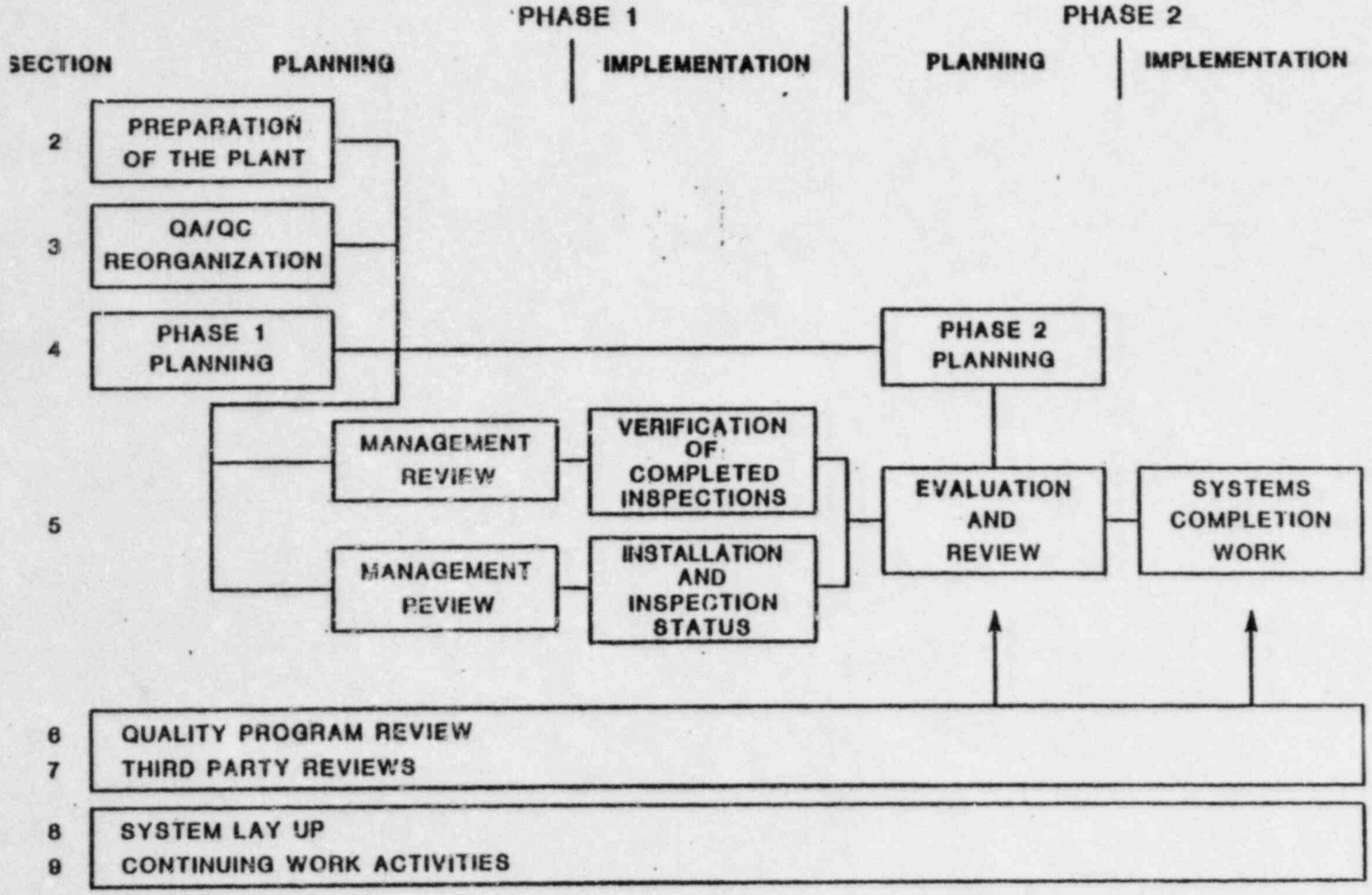
- ESTABLISHING AN ORGANIZATIONAL STRUCTURE CONSISTENT WITH THE REMAINING WORK.

- PROVIDING SUFFICIENT NUMBERS OF QUALIFIED PERSONNEL TO CARRY OUT THE PROGRAM.

- MAINTAINING FLEXIBILITY TO MODIFY THE PLAN AS EXPERIENCE DICTATES.

FIGURE 1-1

CONSTRUCTION COMPLETION PROGRAM SCHEMATIC



SECTION 2.0

PREPARATION OF THE PLANT

OBJECTIVES: To allow improved access to systems for program activities

DESCRIPTION: Reduce the workforce and limit Q activities

Remove the construction equipment and clear areas

Inspect, store and salvage equipment

RESULTS: Plant is in a condition to facilitate installation and inspection status and verification of completed work

STATUS: Reduction in force started 12/1/82 with cleanup completed on 1/31/83.

SECTION 3.0

QA/QC ORGANIZATIONAL CHANGES

OBJECTIVE:

- ESTABLISH INTEGRATED QA/QC ORGANIZATION UNDER CPCO CONTROL
- TRAIN AND RE-CERTIFY QC INSPECTION PERSONNEL

DESCRIPTION:

- QC ORGANIZATION REPORTS DIRECTLY AND SOLELY TO CPCO MPQAD
- QA AND QC RESPONSIBILITIES REDEFINED AS AN INTEGRATED TEAM
- QA DEVELOPS INSPECTION PLANS - QC IMPLEMENTS PLANS - QA MONITORS
- BECHTEL'S QC AND QA MANUALS USED AS APPROVED FOR MIDLAND
- ASME REQUIREMENTS REMAIN IMPOSED ON CONTRACTOR AS N-STAMP HOLDER - QA MONITORS
- QC INSPECTORS RECERTIFIED

RESULT EXPECTED:

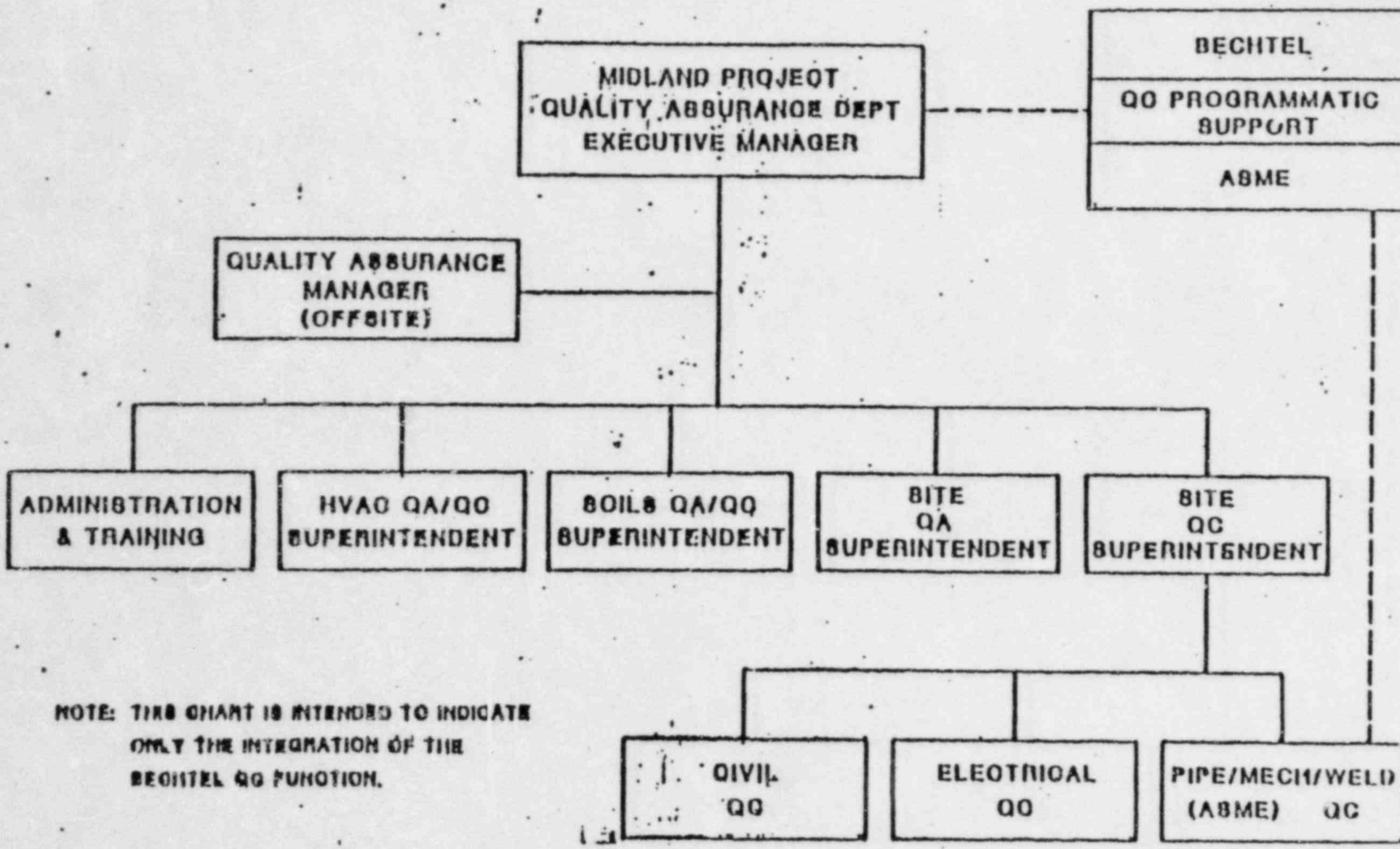
- FULLY INTEGRATED QUALITY ORGANIZATION UNDER CPCO CONTROL
- UNIFORM UNDERSTANDING OF QUALITY REQUIREMENTS AMONG ALL PARTIES
- IMPROVED PRIMARY INSPECTION PROCESS WITH RECERTIFIED PERSONNEL
- IMPROVED AND AGGRESSIVE IMPLEMENTATION OF QA PROGRAM

STATUS:

TRANSFER QC ORG TO CPCO	SUBMIT PROGRAMMATIC CHANGES TO NRC	COMPLETE INSPECTOR RECERTIFICATION
1/17/83	2/17/83	4/1/83

FIGURE Q-1

MPQAD ORGANIZATION



NOTE: THIS CHART IS INTENDED TO INDICATE ONLY THE INTEGRATION OF THE BECHTEL QC FUNCTION.

QC RECERTIFICATION

Need to Formalize Position re Rework!

PROGRAM:

- COVERS ALL QC INSPECTORS INTEGRATED WITH MPQAD
- CLASS ROOM TRAINING ON PROGRAMMATIC AND INSPECTION PLANS
- WRITTEN CLOSED BOOK EXAMINATIONS WITH 80% ACHIEVEMENT REQUIREMENT ON PROGRAMMATIC AND INSPECTION PLANS
- ON THE JOB TRAINING AND PERFORMANCE DEMONSTRATION EXAMINATIONS WITH 100% ACHIEVEMENT REQUIREMENT ON INSPECTION PLANS
- FINAL CERTIFICATION GIVEN BY MPQAD PERSONNEL QUALIFIED AS ANSI LEVEL III

TRAINING STAFF:

- UNDER MPQAD DIRECTION
- DEDICATED STAFF WITH SUPPORT BY EXPERIENCED MPQAD STAFF
- EXPERIENCED TRAINING SUPERVISION AND SELECTED INSTRUCTORS
- PRESENT COMPLEMENT
  - SUPERVISORS
  - INSTRUCTORS
  - PROGRAM SUPPORT (LESSON PLANS - EXAMS)

STATUS:
(AS OF 2/4/83)

- ALL PERSONNEL RECERTIFIED TO QC PROGRAM
- NEARLY 500 INSPECTOR - PQCI TESTS
- OVER 100 PERFORMANCE DEMONSTRATIONS
- APPROXIMATELY 75 INSPECTOR - PQCI CERTIFICATIONS

SECTION 4.2 AND 4.4

PROGRAM PLANNING

TEAM ORGANIZATION

OBJECTIVE: ORGANIZE AND TRAIN TEAM AND PREPARE PROCEDURES FOR INSTALLATION AND INSPECTION STATUS ASSESSMENT AND FOR SYSTEMS COMPLETION.

DESCRIPTION:
- .DEVELOP TEAM CONCEPT
- .SELECT PILOT TEAM TO TEST PROCESSES AND PROCEDURES
- .PREPARE JOB RESPONSIBILITIES AND PROCEDURES
- .PROVIDE TEAM TRAINING FOR STATUS ASSESSMENT AND SYSTEMS COMPLETION

RESULTS EXPECTED:
- .IMPROVED INSPECTION AND INSTALLATION PLANNING AND EXECUTION
- .IMPROVED DIRECTIONS TO CRAFTS
- .IMPROVED COMMUNICATION BETWEEN CONSTRUCTION, QC, ENGINEERING AND TESTING

STATUS: ESTABLISH TEAM CONCEPT AND DESIGNATE PILOT TEAM 1/21/83

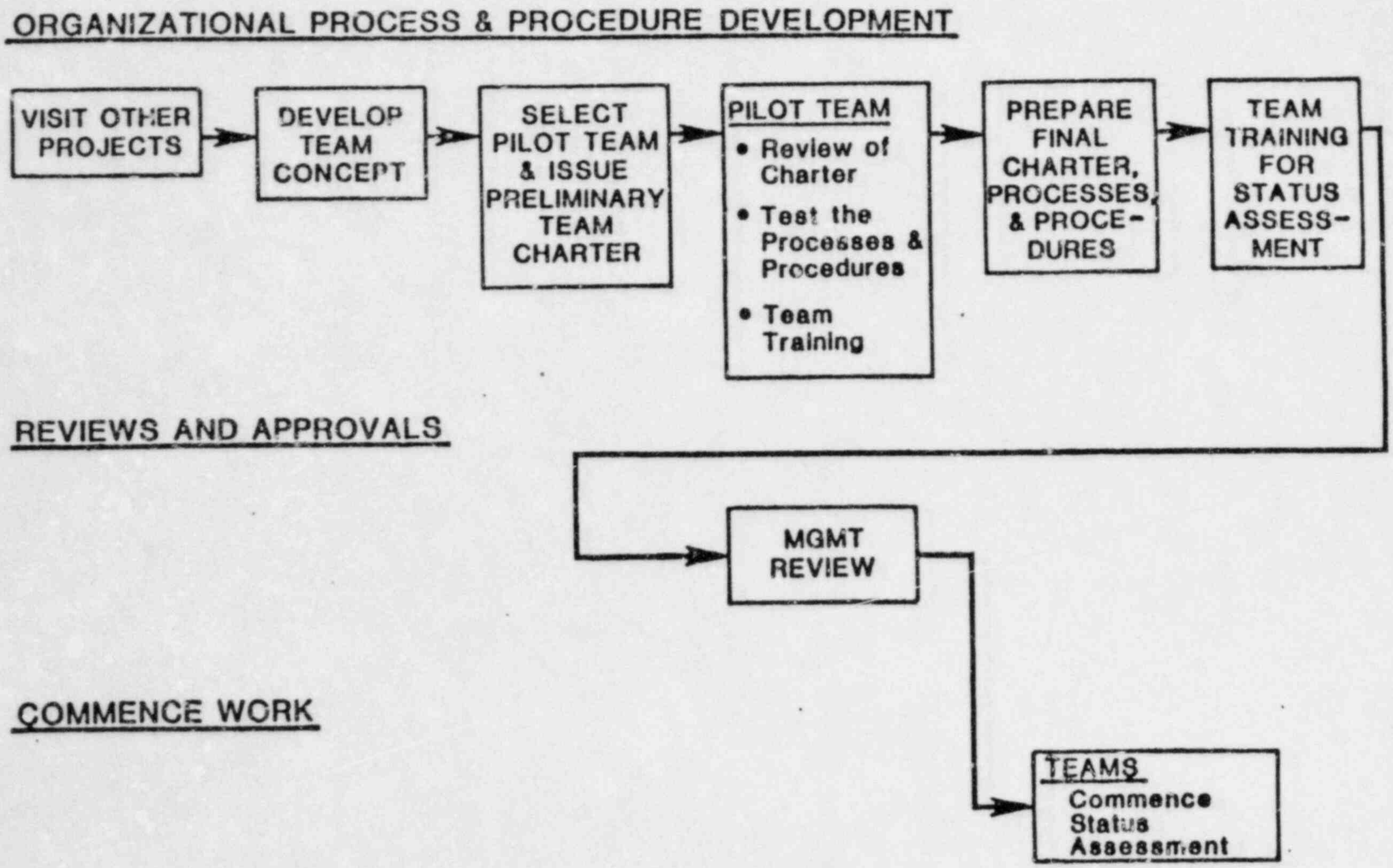
BENEFITS OF "COMPLETION TEAM" APPROACH

- SINGLE GROUP RESPONSIBLE FOR ALL ASPECTS OF SYSTEM COMPLETION TO FUNCTIONAL TURNOVER
- IMPROVED COMMUNICATION BY BEING PHYSICALLY LOCATED TOGETHER
- IMPROVED MAINTENANCE OF STATUS OF WORK
- SINGLE POINT CONTACT FOR QUALITY INSPECTION REQUIREMENTS
- IMPROVED INTEGRATION OF QUALITY INSPECTION PLANS WITH THE INSTALLATION PLANS
- SINGLE POINT CONTACT FOR ENGINEERING/DESIGN REQUIREMENTS
- SINGLE POINT CONTACT FOR TESTING REQUIREMENTS

Q/M-0467-1

subject
no.

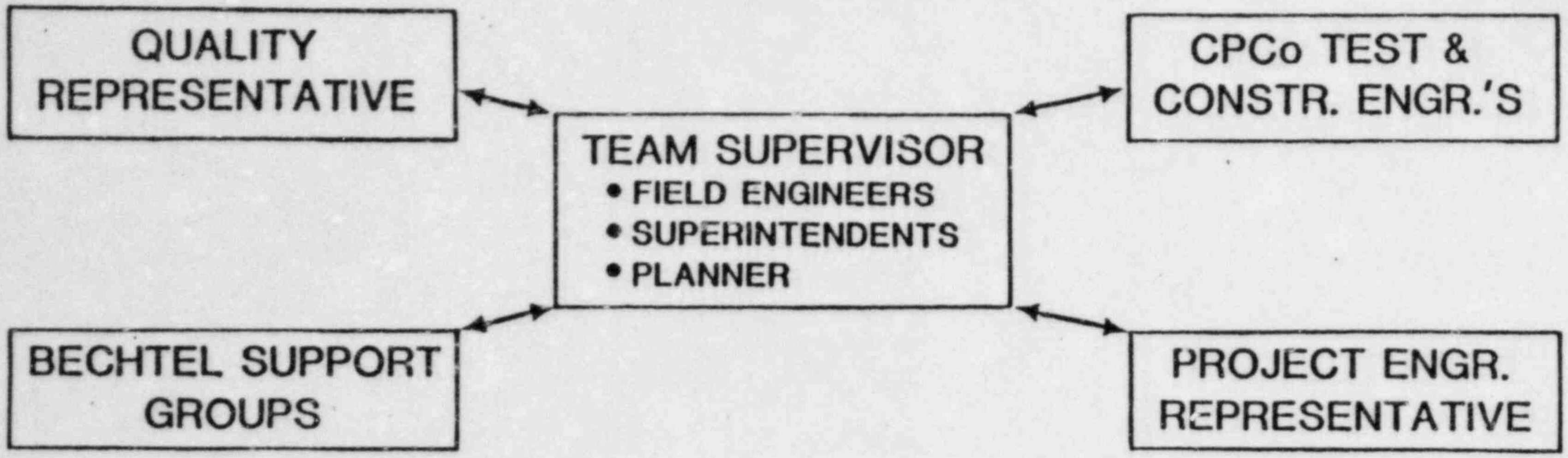
SYSTEM TEAM DEVELOPMENT



G/M-0467-3

subject
no.

SYSTEM TEAM OPERATIONS



PHASE I

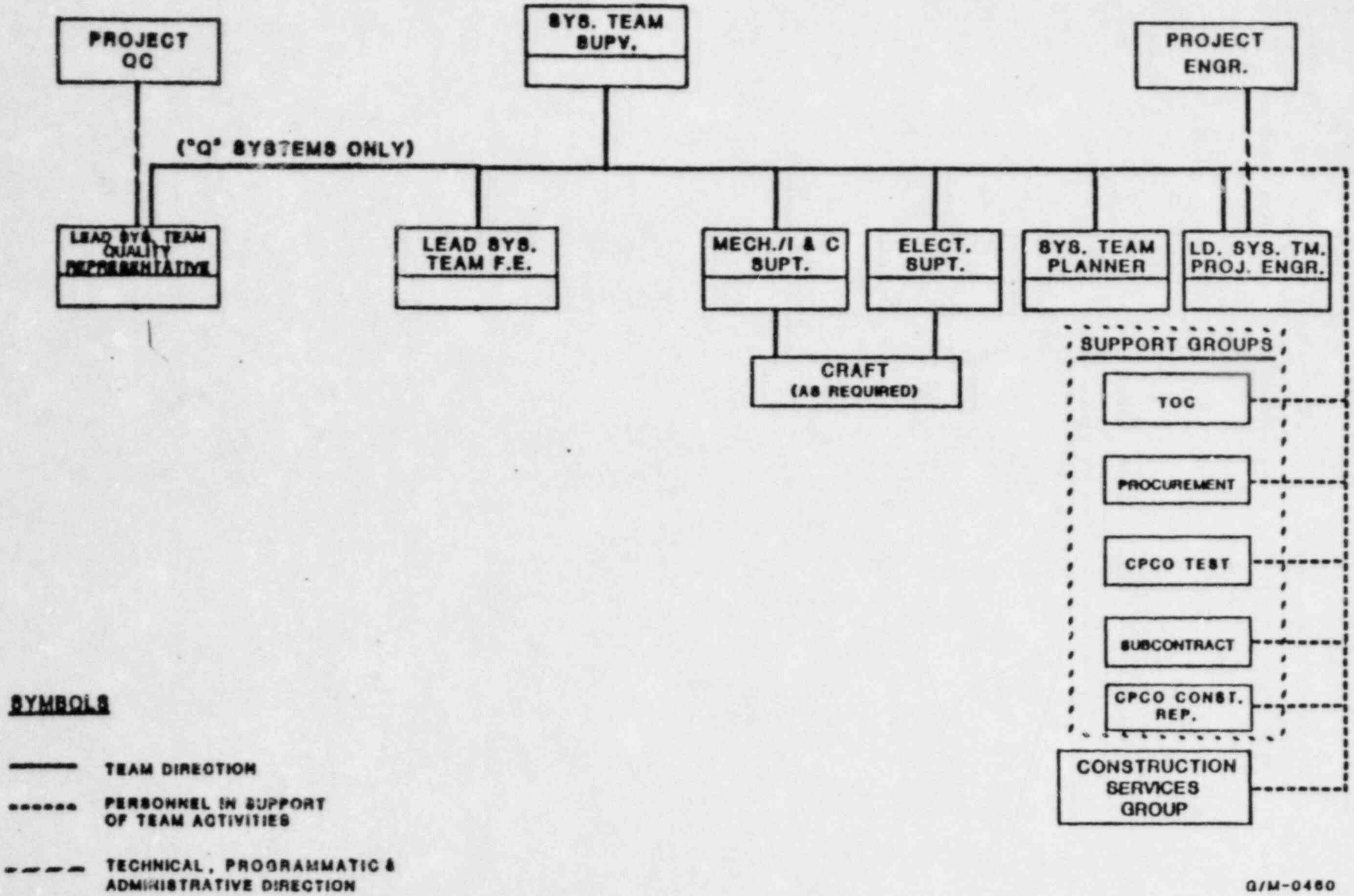
- REVIEW DOCUMENTS TO DESCRIBE THE SYSTEM SCOPE
- COMPARE PHYSICAL STATUS TO THE DOCUMENTS
- PERFORM QUALITY VERIFICATION ACTIVITIES AS ASSIGNED
- IDENTIFY REMAINING WORK

PHASE II

- DEVELOP DETAIL SYSTEM COMPLETION SCHEDULES
- DIRECT & ACCOMPLISH THE WORK
- MONITOR & REPORT STATUS/PROGRESS
- IDENTIFY PROBLEMS FOR RESOLUTION & MGMT. REVIEW
- COMPLETE THE SYSTEMS FOR FUNCTIONAL TURNOVER

Q/M-0467-2

SYSTEM TEAM ORGANIZATION



SECTION 4.3

PROGRAM PLANNING - PHASE 1

QUALITY VERIFICATION

OBJECTIVES:

- DEVELOP AND IMPLEMENT A QUALITY VERIFICATION PROGRAM FOR COMPLETED INSPECTIONS

DESCRIPTION:

- REVIEW EXISTING INSPECTION PLANS (PQCI) AND REVISE AS NECESSARY
- WRITE NEW INSPECTION PLANS (PQCI) IF REQUIRED
- VALIDATE PAST COMPLETED INSPECTION

RESULT EXPECTED:

- ESTABLISH THE VALIDITY OF COMPLETED INSPECTIONS AND INSTALLATION QUALITY STATUS
- DOCUMENT AND CORRECT ANY NONCONFORMING CONDITIONS

STATUS:

PQCI REVISION TO SUPPORT START OF REINSPECTION	DEVELOP VERIFICATION PROGRAM CONCEPT	DEVELOP DETAILED PLANS FOR VERIFICATION EFFORT
2/22/83	2/15/83	2/28/83

INSPECTION PLAN (PQCI) REVIEW AND REVISION

EXISTING PQCI'S REVIEWED AND REVISED, AS NECESSARY, BY MPQAD-QA

NEW PQCI'S WILL BE WRITTEN IF REQUIRED

PQCI'S MUST MEET RELEVANT CRITERIA INCLUDING:

- CONFIRM THAT ATTRIBUTES IMPORTANT TO SAFETY ARE INCLUDED
- ACCEPT/REJECT CRITERIA CLEARLY STATED
- INFORMATION NECESSARY FOR INSPECTION CONTAINED IN PQCI
- INSPECTION POINTS CLEARLY NOTED

- PROCEDURE FOR DOCUMENTATION UNDER REVIEW AND REVISION
- INSPECTION PLANS REVIEWED BY PROJECT ENGINEERING AS AN OVERVIEW TO INSURE ALL TECHNICAL REQUIREMENTS INCLUDED
- REVISED/NEW PQCI PILOT TESTED BEFORE IMPLEMENTATION
- QC INSPECTORS RETRAINED TO REVISED PQCI

Need to clarify "Q" Systems, etc

VERIFICATION PROGRAM CONCEPTS

- ESTABLISH THE VALIDITY OF PAST/CLOSED INSPECTION REPORTS
- CONFIRM THE ACCEPTABLE CONDITION OF INSTALLED COMPONENTS, SYSTEM AND STRUCTURES
- DOCUMENT AND CORRECT NONCONFORMING CONDITIONS
- SCOPE OF PROGRAM INCLUDES ALL COMPLETED INSPECTION REPORTS
- INSPECTION REPORTS CATEGORIZED BY PQCI
- VERIFY THE QUALITY OF COMPLETED WORK USING AN ACCEPTABLE SAMPLING PLAN WHERE APPROPRIATE

100% reinspection where sampling problems are identified

- VERIFICATION PLAN BASED UPON SPECIFIC INSPECTION REPORT POPULATIONS:
  - ITEM ACCESSIBLE FOR REINSPECTION
  - DOCUMENTATION ONLY IS AVAILABLE
  - UNIQUE AREAS OF CONCERN
  - LOT SIZES NOT APPROPRIATE FOR STATISTICAL SAMPLE
- CONTINUATION OF REINSPECTIONS ALREADY COMMITED
  - CABLE ROUTING AND IDENTIFICATION
  - HANGERS
- DETAILS OF PLAN STILL UNDER DEVELOPMENT

SECTION 4.5

QA/QC SYSTEMS COMPLETION PLANNING (PHASE 2)

OBJECTIVE:

- FORMALLY INTEGRATE INSPECTION PLANNING WITH CONSTRUCTION SEQUENCE
- VERIFY THAT PQCI'S ARE FULLY ACCEPTABLE FOR NEW INSPECTIONS

DESCRIPTION:

- ESTABLISH AN IN PROCESS INSPECTION PROGRAM
- CLEARLY DEFINE INSPECTION POINTS IN PQCI
- UTILIZE QUALITY REPRESENTATIVE ON SYSTEM COMPLETION TEAM
- MPQAD-QA CONDUCT FINAL REVIEW OF PQCI

RESULT EXPECTED:

- TIMELY COMPLETION OF QC INSPECTIONS ON SYSTEM COMPLETION WORK
- CLEAR AND DETAILED INSPECTION REQUIREMENTS
- TIMELY DOCUMENTATION AND CORRECTION OF NONCONFORMANCES

STATUS:

DEVELOP CONCEPTUAL PROCEDURES FOR INTEGRATED INSPECTION	DEVELOP PROCEDURES FOR INTEGRATED INSPECTION WITH PILOT TEAM	FINAL REVIEW OF PQCI
2/22/83		

CONCEPTS OF IN PROCESS INSPECTION PROGRAM

- MPQAD-QA ISSUES FINAL PQCI WITH IDENTIFIED INSPECTION POINTS
- INSPECTION POINTS INTEGRATED INTO CONSTRUCTION SCHEDULE
- QUALITY REPRESENTATIVE ON SYSTEM COMPLETION TEAM RESPONSIBLE FOR OVERALL QUALITY:
  - INSURE THE TEAM PROPERLY PLANS FOR INSPECTION
  - INSURE PROPER PQCI'S IDENTIFIED FOR TEAM
  - INSURE AVAILABILITY OF QUALIFIED INSPECTORS
  - INSURE NONCONFORMANCES REPORTED TO MPQAD-QA FOR TIMELY DISPOSITION AND ANALYSIS
  - INSURE QC INSPECTIONS PERFORMED ON TIMELY BASIS
  - INSURE THAT NEW WORK DOES NOT OBSCURE NONCONFORMANCES
- PROCEDURES TO BE DEVELOPED BY PILOT TEAM

SIGNIFICANT INSPECTION PROCESS IMPROVEMENTS

IMPROVED QUALITY CONTROL INSPECTIONS AND INSPECTION REPORTS

REVIEWED AND MODIFIED TO:

- MINIMIZE INSPECTOR INTERPRETATIONS BY IDENTIFYING SPECIFIC ACCEPT/REJECT CRITERIA IN SELF CONTAINED PQCI
- INSURE CLARITY AND EFFECTIVENESS OF PQCI BY PILOT TESTS
- INSURE ALL INSPECTION ATTRIBUTES AND ACCEPTANCE CRITERIA ARE INCLUDED BY MPQAD-QA PREPARATION AND PROJECT ENGINEERING OVERVIEW

ABSOLUTE AND TIMELY REPORTING OF NONCONFORMANCES

PROCEDURES REVISED TO:

- REQUIRE ALL NONCONFORMANCES ARE IDENTIFIED AND RECORDED FOR ANALYSIS AND DISPOSITION
- IMPROVE TRENDING AND IDENTIFICATION OF PROCESS DEFICIENCIES FOR TIMELY MANAGEMENT ACTION
- ELIMINATE DUPLICATIVE NONCONFORMANCE REPORTING SYSTEMS

QUALITY REPRESENTATIVE ON SYSTEM COMPLETION TEAM REPRESENTS MPQAD-QA/QC

INTEGRATED CONSTRUCTION/INSPECTION PROCESS

IMPROVED INTEGRITY AND TIMELINESS OF INSPECTIONS BY:

- USE OF DEFINED HOLD POINTS FOR INSPECTION IN CONSTRUCTION SEQUENCES
- FORMAL DOCUMENTATION OF ALL OBSERVED NONCONFORMANCES AT ALL INSPECTION POINTS

SIGNIFICANT INSPECTION PROCESS IMPROVEMENTS

(CONT'D)

- DEDICATED QUALITY REPRESENTATIVE FOR SYSTEMS AS MEMBER OF TEAM
- INTEGRATED PLANNING FOR INSPECTIONS BY TEAM

INTEGRATED QUALITY PROCEDURES DUE TO QA/QC INTEGRATION

- ELIMINATION OF REDUNDANT OR DUPLICATIVE PROCEDURES
- FOCUS ON SINGLE MISSION FOR QUALITY ORGANIZATIONS
- ELIMINATION OF POTENTIAL INSPECTOR MISINTERPRETATION

SECTION 5.0
PROGRAM IMPLEMENTATION

OBJECTIVE: .PROVIDE A PROCESS FOR CONTROL, REVIEW AND APPROVAL OF EACH MAJOR TASK AS THE PROGRAM PROCEEDS.

DESCRIPTION: .ESTABLISH COMPLETION AND QUALITY STATUS

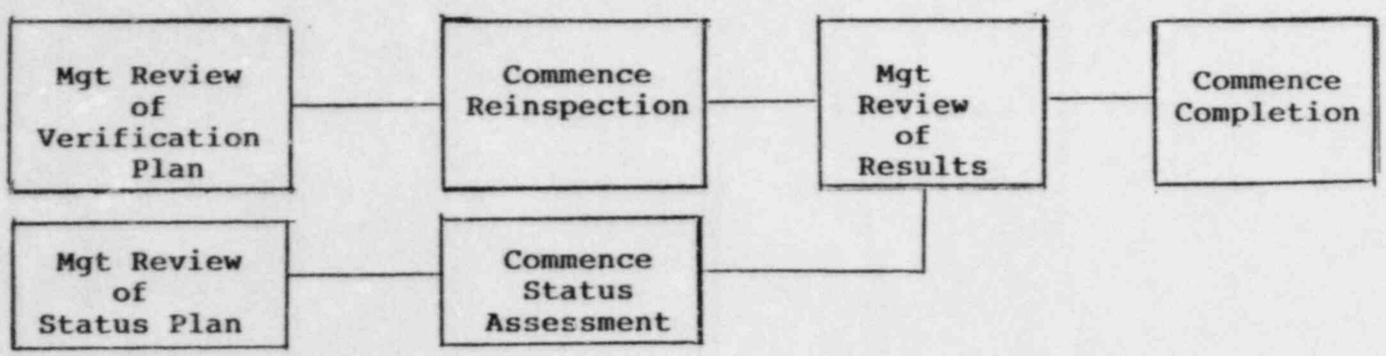
.INTEGRATE CONSTRUCTION AND QUALITY ACTIVITIES

.IMPROVE ON-GOING QUALITY PERFORMANCE

RESULT EXPECTED .COMPLETE SYSTEMS FOR TURNOVER TO CPCo TESTING

.PROVIDE CONTINUING DEMONSTRATION OF QUALITY AS WORK PROCEEDS

.PROVIDE VERIFICATION OF QUALITY IN COMPLETED WORK



SECTION 6.0

QUALITY PROGRAM REVIEW

OBJECTIVE: REVIEW THE ADEQUACY AND COMPLETENESS OF THE QUALITY PROGRAM AND MAKE REVISIONS AS NECESSARY:

- ON AN ONGOING BASIS FOR GENERAL IMPROVEMENTS
- IN RESPONSE TO SPECIFIC CONCERNS (D/G INSPECTION)
- IN RESPONSE TO THIRD PARTY REVIEWS

DESCRIPTIONS:

- R_ 'IEW SPECIFIC PROCEDURES FOR COMPLIANCE TO PROGRAM REVIEW
- REVIEW ACTUAL IMPLEMENTATION OF PROCEDURES
- COORDINATE REVIEWS WITH OTHER PROJECT AREAS
- PROVIDE INPUT AND RECOMMENDATION TO MANAGEMENT

RESULT EXPECTED:

- CONTINUED OVERALL IMPROVEMENT IN THE QUALITY PROGRAM CONTENT AND IMPLEMENTATION

STATUS:

ONGOING REVIEWS	COMPLETE PRESENT SPECIFIC EFFORTS

CURRENT SPECIFIC PROGRAMMATIC REVIEWS

EFFORTS PRESENTLY UNDERWA. TO REVIEW PROGRAMMATIC REQUIREMENTS AND IMPLEMENTATION FOR:

MATERIAL TRACEABILITY:

- REVIEW OF ALL PROJECT COMMITMENTS
- REVIEW OF IMPLEMENTING PROCEDURES
- REVIEW OF PRIOR AUDITS
- REVISION OF RECEIPT INSPECTION PQCI

Q-SYSTEM RELATED REQUIREMENTS

- VERIFICATION OF PROJECT COMMITMENTS BY ENGINEERING AND LICENSING

DESIGN DOCUMENT CONTROL

- FLOW CHART OF EXISTING PROCEDURES
- CHECK OF ACTUAL IMPLEMENTATION
- COMPARISON WITH PROGRAMMATIC REQUIREMENTS

RECEIPT INSPECTION

- REVIEW OF SOURCE INSPECTION/RECEIPT INSPECTION SYSTEMS
- PQCI REVISED
- RECERTIFICATION OF INSPECTORS
- CONSIDERATION OF SELECTED OVERINSPECTION

SECTION 8.0

SYSTEM LAYUP

OBJECTIVE: PROVIDE ADEQUATE PROTECTION FOR PLANT SYSTEMS AND COMPONENTS UNTIL PLANT STARTUP

DESCRIPTION:

- IDENTIFY AND PROTECT SYSTEMS WETTED DUE TO HYDRO TESTING OR FLUSHING
- PROVIDE SCHEDULES FOR WALKDOWN TO ENSURE CLEANLINESS AND ADEQUATE PREVENTIVE MAINTENANCE
- CARRY OUT WALKDOWNS TO ENSURE COMPLETENESS OF SYSTEM LAYUP ACTIVITIES

RESULTS EXPECTED:

IMMEDIATE PROTECTION OF WETTED SYSTEMS

PROVIDE CONTINUED CARE FOR ALL COMPONENTS UNTIL SYSTEM TURNOVER

STATUS:

COMPLETE LAYUP OF ALL WETTED SYSTEMS	1/15/83
ISSUED SCHEDULES FOR WALKDOWNS	1/15/83

SECTION 9.0

CONTINUING WORK ACTIVITIES

OBJECTIVES:

- Meet previous NRC requirements and continue with activities which do not impede the execution of the program

- Provide design support for orderly system completion work and resolution of identified issues

- Establish a management control to initiate additional specified work that can proceed outside of the Systems Completion activities

SECTION 9.0

CONTINUING WORK ACTIVITIES

DESCRIPTION: THOSE ACTIVITIES THAT HAVE DEMONSTRATED EFFECTIVENESS IN THE QUALITY PROGRAM IMPLEMENTATION WILL CONTINUE DURING IMPLEMENTATION OF THE CONSTRUCTION COMPLETION PROGRAM.

THESE ARE:

*✓ 1. NSSS INSTALLATION OF SYSTEMS AND COMPONENTS BEING CARRIED OUT BY B&W CONSTRUCTION COMPANY

*✓ 2. HVAC INSTALLATION WORK BEING PERFORMED BY ZACK COMPANY. WELDING ACTIVITIES CURRENTLY ON HOLD WILL BE RESUMED AS THE IDENTIFIED PROBLEMS ARE RESOLVED

3. POST SYSTEM TURNOVER WORK, WHICH IS UNDER THE DIRECT CONTROL OF CONSUMERS POWER COMPANY, WILL BE RELEASED AS APPROPRIATE USING ESTABLISHED WORK AUTHORIZATION PROCEDURES

4. HANGER AND CABLE RE-INSPECTIONS, WHICH WILL PROCEED ACCORDING TO SEPARATELY ESTABLISHED COMMITMENTS TO NRC

*✓ 5. REMEDIAL SOILS WORK WHICH IS PROCEEDING AS AUTHORIZED BY THE NRC

6. DESIGN ENGINEERING WILL CONTINUE AS WILL ENGINEERING SUPPORT OF OTHER PROJECT ACTIVITIES

Not Covered under the Reverification Program (*)

SECTION 9.0

CONTINUING WORK ACTIVITIES

STATUS: . THESE ACTIVITIES ARE PROCEEDING WITH SCHEDULES THAT ARE INDEPENDENT OF THIS PLAN.

Consumers Power Company

James W Cook
Vice President - Projects, Engineering and Construction

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

January 10, 1983

JOKA has / orig+3 has

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

MIDLAND NUCLEAR COGENERATION PLANT
MIDLAND DOCKET NOS 50-329, 50-330
CONSTRUCTION COMPLETION PROGRAM
FILE 0655 SERIAL 20428

REFERENCE LETTER TO J W COOK, DATED DECEMBER 30, 1982, FROM NRC REGION III REGARDING CONSTRUCTION COMPLETION PROGRAM

On December 2, 1982, Consumers Power Company met with Mr Warnick and other members of your staff to discuss the general concept of our proposed Construction Completion Program. The enclosure to this letter documents in detail the Construction Completion Program, as requested at the meeting and in your follow up letter (Reference).

Since our meeting, the program has undergone considerable development and evolution. Details have been supplied and more specific objectives and implementing methods have been established. Further details are still being developed. While the Company expects the Program, as presently constituted, to be a workable and sufficient framework for future action, revisions may be necessary as future needs and experience dictate.

The Construction Completion Program is a positive step in the overall advancement of Project goals. It represents the best efforts of Project management, support and quality assurance personnel. We believe it will produce an improvement in Project installation and inspection status, systems construction and QA implementation. The quality verification effort should provide increased confidence of the NRC that the plant has been properly built. Other aspects of the Program, including the measure to improve ongoing inspections and scheduling interfaces, should contribute to that result. This Program, together with recent Consumers Power Company commitments regarding quality assurance and remedial soils work, can establish a basis for improved relations between the Company and the NRC Region group assigned to inspect Midland. The Construction Completion Program demonstrates the Company's responsiveness to both NRC concerns and the particular needs of this Project. It is our expectation that the Program, created out of a desire to enhance the

oc0183-0308a100

JAN 11 1983

~~8301210272~~ 32pp.

orderliness and quality of construction, will achieve its intended purpose and lead to the successful "completion of construction" of the Midland Plant in accordance with regulatory requirements.

We hope that this submittal fulfills your request for written information regarding the Construction Completion Program. Consumers Power Company is prepared to support the public meeting proposed for January 26, 1983 in Midland, Michigan.

James W. Cook

JWC/DMB/cl

CC Atomic Safety and Licensing Appeal Board
CBechhoefer
FPCowan, ASLB
JHarbour, ASLB
DSHood, NRC
MMCherry
RWHernan, NRC
RJCook, Midland Resident Inspector
FSKelley
HRDenton, NRC
WHMarshall
WDPaton, NRC
WDShafer, NRC
RFWarnick, NRC
BStamiris
MSinclair
LLBishop

oc0183-0308a100

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

Letter Serial 20428 Dated January 10, 1983

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 its Construction Completion Program.

CONSUMERS POWER COMPANY

By JW Cook
J W Cook, Vice President
Projects, Engineering and Construction

Sworn and subscribed before me this 10th day of January, 1983

Patricia A Puffer
Notary Public
Bay County, Michigan

My Commission Expires 3-4-86

oc0183-0308a100

Construction Completion Program
Executive Summary

The Construction Completion Program has been formulated to provide guidance in the planning and management of the design and quality activities necessary for completion of the construction of the Midland Nuclear Cogeneration Plant. Construction completion is defined in this Plan as carrying all systems to the point they are turned over to Consumers Power Company for component checkout and preoperational testing. The Construction Completion Program does not include the Remedial Soils Program which is treated in separate interactions between Consumers Power Company and the Nuclear Regulatory Commission.

Background

The Construction Completion Program was developed in response to a number of management concerns that have been identified during the period preceding the initiation of the Program. The Midland Project had been proceeding at a high level of activity as it approached completion. The final transition from area construction to system completion, using punch lists, has been difficult for most nuclear projects. The Midland Project has not escaped these difficulties which have been compounded due to the congested space and the continuing numerous design changes, both generally attributable to the age of the Project. These factors lead to the need for improved definition of work status, increased emphasis on overall Project objectives as well as continued focus of construction and inspection resources on completion of systems for short-term milestones and increased effort to complete engineering ahead of field installation.

The Midland Project has been criticized by the NRC regional office as not having met their expectations for implementation of the Project's Quality Assurance Program. The result has been that the Project management has too often, during the past few months, been in a reactive rather than proactive posture with regard to quality assurance matters.

In recognition of these conditions, management has concluded that a change in approach was needed to effectively complete the Project while maintaining high quality standards.

Objectives

The development of the Program has considered the Project's current status and recent history and attempts to address the underlying or root causes of the problems currently being experienced. In order to develop the Program the following overall objectives were established under three general headings. The Program must:

Improve Project Information Status By:

- Preparing an accurate list of to-go work against a defined baseline.

- Bringing inspections up-to-date and verifying that past quality issues have been or are being brought to resolution.

- Maintaining a current status of work and quality inspections as the Project proceeds.

Improve Implementation of the QA Program By:

- Expanding and consolidating Consumers Power Company control of the quality function.

- Improving the primary inspection process.

- Providing a uniform understanding of the quality requirements among all parties.

Assure Efficient and Orderly Conduct of the Project By:

- Establishing an organizational structure consistent with the remaining work.

- Providing sufficient numbers of qualified personnel to carry out the program.

- Maintaining flexibility to modify the Plan as experience dictates.

Description

The Construction Completion Program entails a number of major changes in the conduct of the final stages of the construction process and can be described in summary as a two-phase process.

First, after certain necessary preparations, the safety-related systems and areas of the plant will be systematically reviewed. This first phase will be carried out on an area-by-area basis, but will be accomplished mainly by teams organized with systems responsibility and a separate effort to verify the completed work. The product from this phase of the program will be a clear status of remaining installation work and a current inspection status which provides quality verification of the existing work. The teams organized to carry out this first phase will continue to function in the second phase as the responsible organizational units to the complete the work.

In order to achieve its complete set of objectives, the Program contains a number of activities and elements that support and are linked to the two major phases described above. The major components of the Plan, which are discussed in more detail in the balance of this report, can be described as follows:

- A significant reduction in the construction activity in the safety-related portion of the plant, material removal and a general cleanup will be carried out in preparation for installation and inspection status assessment and quality verification activities.

- A review will be made of equipment status to assure that the proper lay-up precautions have been implemented to protect the equipment until the installation work is completed.
- The integration of the Bechtel QC function into the Midland Project Quality Assurance Department (MPQAD) under Consumers Power Company management will be completed.
- The Consumers Power Company is carrying out recertification program of Bechtel QC inspectors, and a review of the inspection procedures to be utilized.
- The system completion teams will be organized, staffed and trained according to procedures developed to define the team's work process.
- The systems completion teams will 1) accomplish installation and inspection status assessment, 2) perform systems construction completion and construction quality performance and 3) determine that all requirements have been met prior to functional turnover for test and operation.
- Quality verification of completed work will be carried out in parallel with installation and inspection status activities of the system completion teams.
- A series of management reviews will be carried out to carefully monitor the conduct of the Program and to revise the plan as appropriate.
- Review and resolution will proceed on outstanding issues related either to QA program or QA program implementation as raised by the NRC or third party overviews of the Project.
- Third party reviews will be undertaken to monitor Project performance and to carry out the NRC's requirements for independent design verification.

Schedule Status

The Program was initiated on December 2, 1982 by limiting certain ongoing safety-related work and starting preparations for the phase-one work of status assessment and quality verification activities. Since the Program also has incorporated a number of commitments made to the NRC during the past few months, activities in support of these commitments such as QC integration into MPQAD and the recertification of QC inspectors, had been initiated prior to December.

Status and schedules for each element of the Plan are enumerated in the text. In general, preparation for the Phase 1 activities are underway and will continue through January. A pilot team to develop the procedures and training requirements will be initiated during January. It is expected that the first areas to undergo Phase 1 status assessment will be defined and teams mobilized during March.

Quality verification of completed work will start in late January or early February.

The Program provides for the Phase 1 results on a system or partial system to be reviewed and evaluated prior to initiating Phase 2 system completion work on that system or partial system. Management will monitor both process readiness and Phase 1 evaluation results.

The major areas of continuing safety-related work are NSSS construction as performed by B&W Construction Co, HVAC work under the Zack subcontract, the Remedial Soils Program and post-turnover punch list work released to Bechtel construction by Consumers Power Company. The Zack work is currently limited until a recently identified question on welder certification is resolved.

During the implementation of the Program in 1983, the NRC Resident Inspectors can use the Plan to monitor safety-related construction activities at the site. Since a substantial portion of the Plan directly relates to commitments made to NRC management, Consumers Power Company intends to schedule periodic reviews of Program status and progress with the NRC.

TABLE OF CONTENTS

1.0 INTRODUCTION

The Construction Completion Program has been formulated to provide guidance in the planning and quality activities necessary for completion of the construction of the Midland Nuclear Cogeneration Plant. Construction completion is defined in this Plan as carrying all systems to the point they are turned over to Consumers Power Company for component checkout and preoperational testing. The Construction Completion Program does not include the Remedial Soils Program which is treated in separate interactions between Consumers Power Company and the Nuclear Regulatory Commission. The Construction Completion Program will be referred to as the Program in this document which contains the Plan for Program development and implementation.

Background

The Construction Completion Program is being developed in response to a number of management concerns that have been identified during the period preceding the initiation of the Program. The Midland Project had been proceeding at a high level of activity as it approached completion. The final transition from area construction to system completion, using punch lists, has been difficult for most nuclear projects. The Midland Project has not escaped these difficulties which have been compounded due to the congested space and the continuing numerous design changes, both generally attributable to the age of the Project. These factors lead to the need for improved definition of work status, increased emphasis on overall Project objectives as well as continued focus of construction and inspection resources on completion of systems for short-term milestones and increased effort to complete engineering ahead of field installation.

The Midland Project has been criticized by the Nuclear Regulatory Commission regional office as not having met their expectations for implementation of the Project's Quality Assurance Program. The result has been that the Project management has too often, during the past few months, been in a reactive rather than proactive posture with regard to quality assurance matters.

In recognition of these conditions, Consumers Power Company has concluded that a change in approach is needed to effectively complete the Project while maintaining high quality standards.

Objectives

The development of the Program has considered the Project's current status and recent history and attempts to address the underlying or root causes of the problems currently being experienced. In order to develop the Program, the following overall objectives were established under three general headings. The Program must:

Improve Project Information Status By:

- Preparing an accurate list of to-go work against a defined baseline.

- Bringing inspections up-to-date and verifying that past quality issues have been or are being brought to resolution.

- Maintaining a current status of work and quality inspections as the Project proceeds.

Improve Implementation of the QA Program By:

- Expanding and consolidating Consumers Power Company control of the quality function.

- Improving the primary inspection process.

- Providing a uniform understanding of the quality requirements among all parties.

Assure Efficient and Orderly Conduct of the Project By:

- Establishing an organizational structure consistent with the remaining work.

- Providing sufficient numbers of qualified personnel to carry out the Program.

- Maintaining flexibility to modify the Plan as experience dictates.

PLAN CONTENTS

The Program was initiated on December 2, 1982 by limiting on-going work on Q-systems to pre-defined tasks and preparing the major structures housing Q-systems for an installation and inspection status assessment and verification of completed work. The relationship of the major elements of the Plan is shown in Figure 1-1. The sections of the Plan address the following major activity areas:

PREPARATION OF THE PLANT (Section 2.0)

The buildings are being prepared for a status assessment and verification of completed work.

QA/QC ORGANIZATION CHANGES (Section 3.0)

A new QA organization that integrates the QA and QC functions under a Consumers Power Company direct reporting relationship is being established. As a part of this transition, the Bechtel QC inspectors are being recertified to increase confidence in the quality inspection performance.

PROGRAM PLANNING (Section 4.0)

The overall Plan for the Program is being developed in two major phases.

The first phase includes:

- A team organization assigned on the basis of systems is being developed to determine present installation and inspection status. The inspection status assessment includes performing inspections on completed work to bring them up to date. A closely coordinated effort involving the construction contractor and Consumers Power Company (QA/QC, testing and construction) will improve quality performance.

- The quality verification of completed work will be based, in part, on a sampling technique using re-certified inspectors as described in Section 3.0.

The second phase includes:

- Following installation and inspection status assessment the team organization will retain responsibility for systems completion work.

- The QC inspection process of new work will be integrated with the systems completion work to ensure adequate quality performance.

PROGRAM IMPLEMENTATION (Section 5.0)

The first phase implementation of the Program will be initiated with a review of the process, procedures and team assignments that will be used. The plan for verification of completed work will be reviewed separately. The teams will conduct the installation and inspection status assessment; verification of completed and inspected work will proceed, as planned, in coordination with the team effort. Following phase 1 completion of the first work segment, a management review of the plan effectiveness will be made.

In second phase Program implementation, the assigned team will plan and schedule the remaining work needed for completion including QC inspections.

QUALITY PROGRAM REVIEW (Section 6.0)

The adequacy and completeness of the quality program will be reviewed on an ongoing basis, taking into consideration questions raised by NRC inspections and findings by third party reviewers. The results of these reviews will be considered as part of the management review that are a part of the Program implementation (Section 5).

THIRD PARTY REVIEWS (Section 7.0)

Independent assessments of the Midland Project will provide management and NRC with evaluations of Project performance.

SYSTEM LAY-UP (Section 8.0)

The on-going work to protect plant equipment and systems will be augmented as necessary to provide adequate protection during implementation of this Plan.

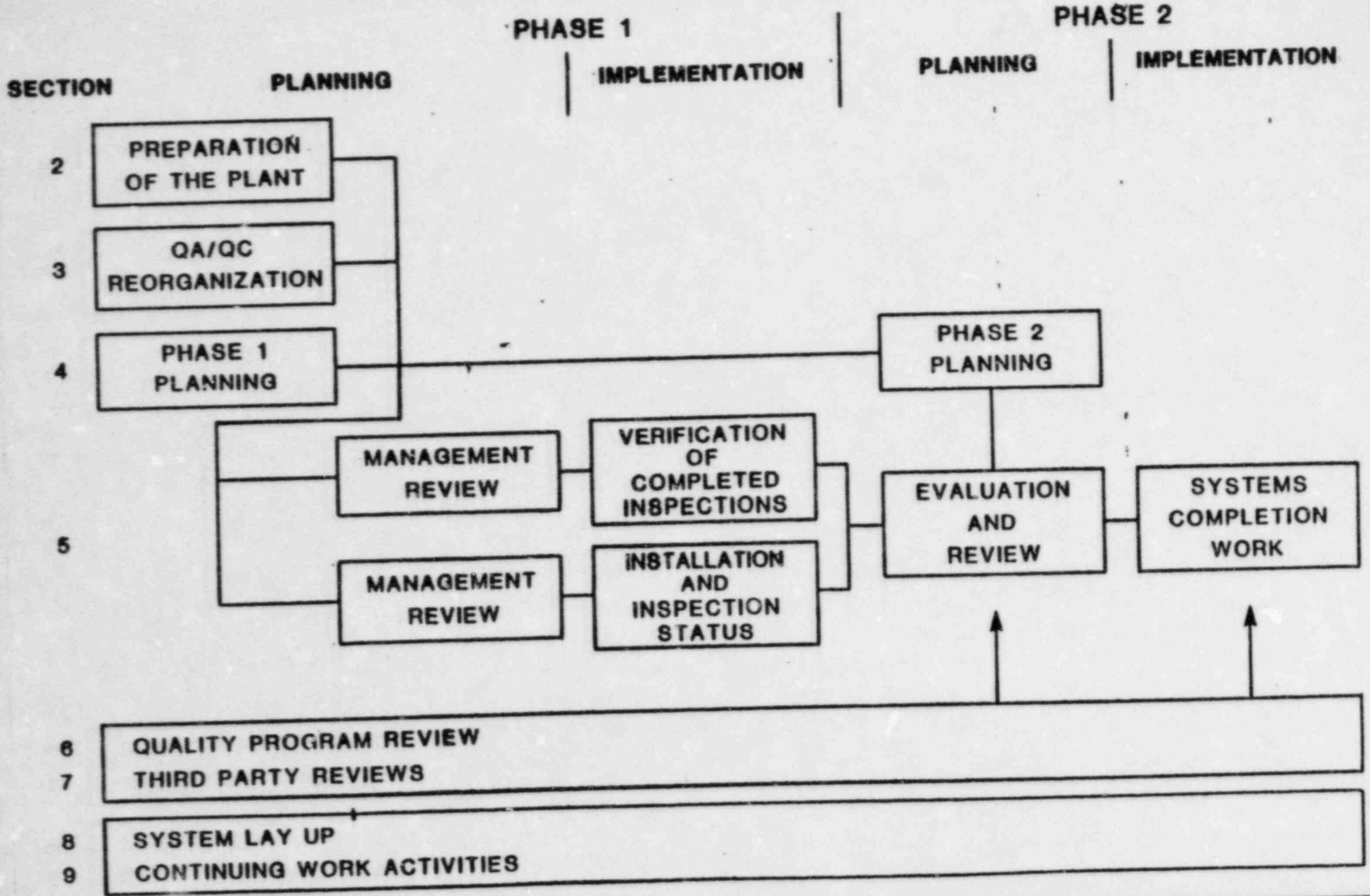
CONTINUING WORK ACTIVITIES (Section 9.0)

Work on Q-Systems has been limited to specific activities. This limitation permits important work to proceed while allowing building preparation for status assessment and verification activities.

SUMMARY

Each section of this Plan presents detailed objectives, a description of the activity involved, and a schedule for achieving major milestones. The Program, however, is still in an evolutionary state and revisions to the Plan may be necessary as Consumers Power Company gains experience in the implementation of Program elements.

FIGURE 1-1
CONSTRUCTION COMPLETION PROGRAM SCHEMATIC



2.0 PREPARATION OF THE PLANT

2.1 Introduction

The preparation of the Plant will clear the auxiliary, diesel generator and containment buildings and the service water pump structure of materials, construction tools and equipment and temporary construction facilities.

2.2 Objective

To allow improved access to systems and areas for the Program activities.

2.3 Description

The preparation activities minimize obstacles and interferences for the Program activities. This is being accomplished through the following steps.

1. Limitation of Q-work to activities and areas defined in Section 9 resulting in substantial work force reduction.

2. Removal and storage of construction tools and equipment, and temporary construction facilities (scaffolding, etc) from the buildings identified in Section 2.1.

3. Removal, control and storage of uninstalled materials from the buildings identified in Section 2.1.

4. Appropriate housekeeping of all areas following material and equipment removal.

The preparation for each area will be complete before initiating further Program activity. The on-going work described in Section 9 will continue as scheduled during the preparation.

2.4 Schedule Status

The preparation of the Plant began on December 2, 1982. It will be complete by January 31, 1983.

3.0 QA/QC ORGANIZATION CHANGES

3.1 Introduction

The Consumer Power Company's Midland Project Quality Assurance Department (MPQAD) is being expanded to assume direct control of Bechtel QC activities. The new organization and the plan for the transition are described below. The transferred QC Inspectors will be recertified as part of this transition.

3.2 Objectives

Establish New QA/QC Organization

Establish an integrated organization which includes the transition of Bechtel QC to MPQAD while accomplishing the following objectives:

1. Establish direct Consumers Power Company control over the QC inspection process.

2. Establish the responsibilities and roles of the QA and QC Departments in the integrated organization.

3. Use qualified personnel from existing QA and QC departments and contractors to staff key positions throughout the integrated organization.

Recertify QC Inspectors

Ensure that those Quality Control inspection personnel transferring to MPQAD from Bechtel will be trained and recertified in accordance with MPQAD Procedure B-3M-1.

3.3 Description

Establish New QA/QC Organization

A new organization will be implemented under Consumers Power Company and will be described in appropriate Topical Reports (CPC-1A and BQ-TOP-1) and quality program manuals (Volume II, BQAM and NQAM). Changes to these documents will be submitted to NRC.

Features of the new organization include:

1. Lead QC Supervisors report directly to a QC Superintendent who reports to the MPQAD Executive Manager. Any required support from Bechtel Corporate QC and QA functions (except ASME N-Stamp activities) is provided at the level of the MPQAD Executive Manager.

2. The MPQAD Executive Manager will review the performance of lead personnel in his department.

3. QA will develop and issue Quality Control inspection plans and be responsible for the technical content and requirements of such plans. QC will be responsible to implement these plans.

4. QA will continue to monitor the Quality Control inspection process to insure that program requirements are satisfactorily implemented.

5. MPQAD will continue to use Bechtel's Quality Control Notices Manual (QCNM) and Quality Assurance Manual (BQAM) as approved for use on the Midland Project.

6. ASME requirements imposed upon a contractor as N-Stamp holder will remain with that contractor. MPQAD QA will monitor the implementation of ASME requirements.

An organization chart (Fig 3-1) showing reporting relationships in the new organization is attached.

Recertify QC Inspectors

The training and recertification process for QC inspectors has been revised to include commitments made during the September 29, 1982 public meeting with the NRC. Those inspectors transferred from Bechtel to MPQAD will be trained and examined in accordance with MPQAD Procedure B-3M-1. Upon satisfactory completion of the training and examination requirements, inspection personnel will be certified for the Project Quality Control Instruction(s) (PQCI(s)) they are to implement. Inspection personnel will be certified on a schedule which supports ongoing work and system completion team activities.

3.4 Schedule Status

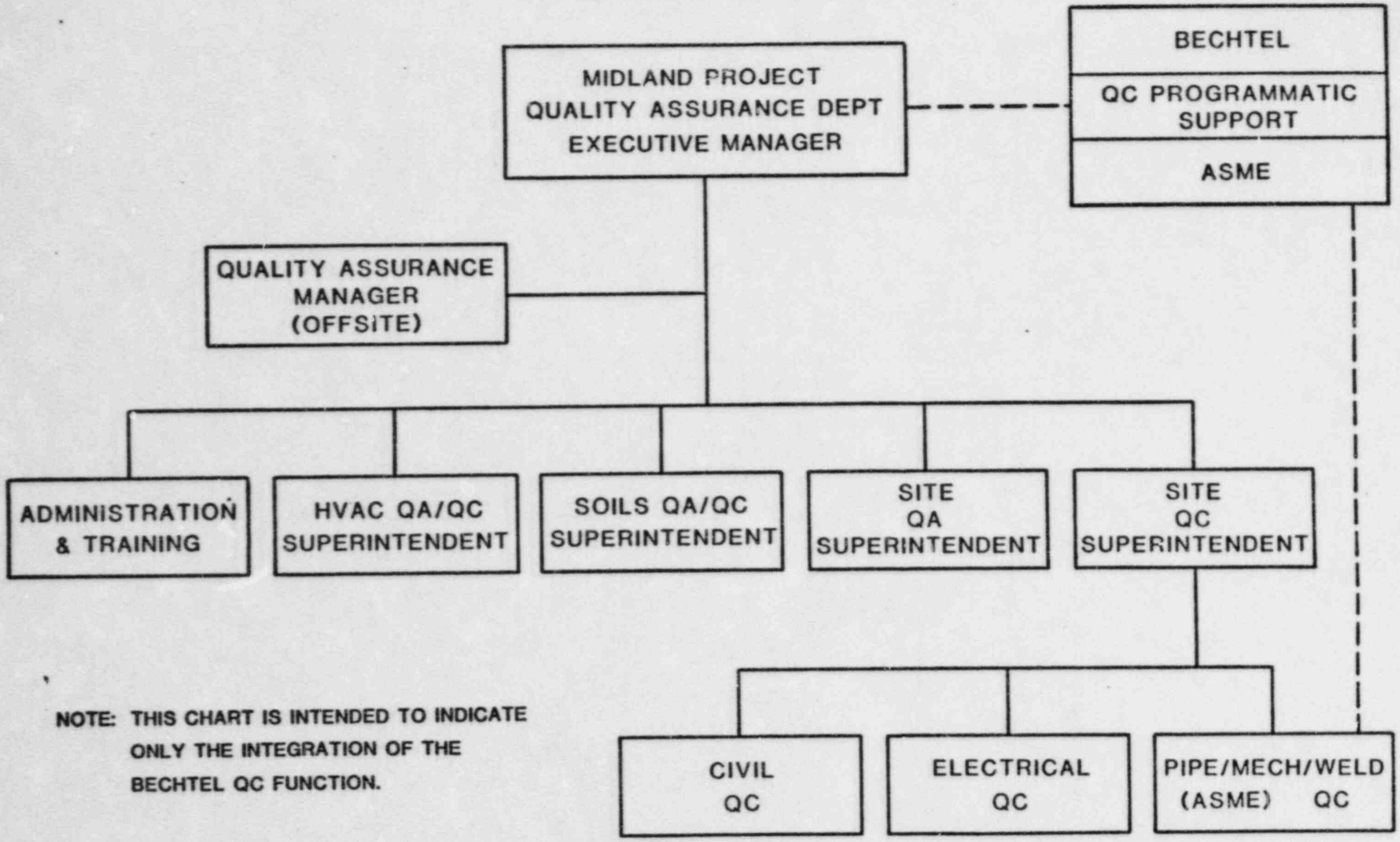
Establish New Organization

Advise NRC of the structure of the integrated organization.	12/15/82
Transfer the Bechtel QC Organization to MPQAD.	1/17/83
Submit changes to Topical Reports and quality program manuals to NRC.	2/17/83

Recertify QC Inspectors

Specify the revised training and examination requirements for certification (B-3M-1).	10/25/82
Complete recertification	4/01/83

FIGURE 3-1
MPQAD ORGANIZATION



NOTE: THIS CHART IS INTENDED TO INDICATE ONLY THE INTEGRATION OF THE BECHTEL QC FUNCTION.

4.0 PROGRAM PLANNING

4.1 Introduction

The detailed planning for the major portion of the Construction Completion Program is described in this section.

Planning in support of Phase 1 consists of the activities to set up a team organization to assess the installation and inspection status of Q-systems within major structures (Section 4.2) and to verify the adequacy of completed inspection effort (Section 4.3).

The Phase 2 planning effort covers the process and procedures that will be used by the team organization for systems completion work (Section 4.4). The procedures to integrate the quality program requirements with continuing systems completion work will be developed (Section 4.5).

4.2 Team Organization (Phase 1)

4.2.1 Introduction

Organize and train teams and prepare procedures for an installation and inspection status assessment.

4.2.2 Objective

1. Establish and implement a team organization ready to inspect and assess systems for installation and inspection status.

2. Develop the organizational processes and procedures necessary to implement the team approach for status assessment.

3. Provide training to ensure required inspection and installation status assessment activities are satisfactorily performed.

4.2.3 Description

1. The team organization structure will vary depending upon the assigned scope of work. The organization will consist of a team supervisor and personnel as appropriate from field engineering, planning, craft supervision, project engineering, MPQAD and Consumers Power Company Site Management Office. The team may be augmented by procurement personnel, subcontract coordinators and turnover coordinators.

   Teams will be assigned a specific scope of work and held accountable for status assessment and overall completion within this scope. The scope includes the requirements to develop a viable working schedule and insure early identification and resolution of problem areas. Project processes and procedures will be reviewed and modified to incorporate the team organization. The team MPQAD representative is responsible for providing the QA/QC support for the team. He receives scheduling direction from the Team Supervisor and technical direction from MPQAD. For his team's work, he analyzes the quality requirements and plans the QC activities to integrate them with the team effort. He assures the necessary PQCI's and certified inspection personnel are available for performing the inspections. He maintains cognizance of the quality status of the verification activities.

The Washington Nuclear Plant #2 (WNP-2) team organization will be used as a starting point for a Midland specific approach.

A pilot team or teams will be utilized to develop and test processes and procedures during the development stage to assure that Program objectives can be met. This will also provide practical field input to assure that efficient and workable methods are used.

Team members will be physically located together to the extent practicable to improve communication, status assessment, problem identification and problem resolution.

2. Training for inspection and installation status assessment will be provided to team members. It will include responsibilities, reporting functions, indoctrination of project processes and procedures and familiarization with the project quality program to ensure effective implementation.

3. A separate organization of design engineers (presently existing) will coordinate spatial interaction, review and examination with the activities of these teams.

4.2.4 Schedule Status

- Designate pilot team. 1/21/83
- Complete grouping of systems for assignment to teams. 2/28/83
- Complete assignment of team supervisors and members to designated systems. 3/31/83

4.3 Quality Verification (Phase 1)

4.3.1 Introduction

The verification program is the activity undertaken to determine, using a variety of methods, that the inspections performed on completed work were done correctly.

4.3.2 Objectives

The objectives of the verification program are to:

- Review existing PQCI's and revise as necessary to assure that:

  a. Attributes important to the safety and reliability of specific components, systems, and structures are identified for verification.

  b. Accept/reject criteria are clearly identified.

  c. Appropriate controls, methods, inspection and/or testing equipment are specified.

  d. Requisite skill levels are required per ANSI N45.2.6 or SNT-TC-1A.

- Develop and implement verification inspection plan for completed work which considers:

  a. Re-inspection of accessible items.

  b. Review of documentation for attributes determined to be inaccessible for re-inspection.

  c. Sampling techniques using national standards.

4.3.3 Description

PQCI's will be revised as necessary to meet the objectives in Section 4.3.2. Verification of the quality of accessible completed contruction, which has been previously inspected will be performed by use of sampling plans based on MIL-S-105D (1963) or other acceptable methods. Attributes determined to be inaccessible for direct re-inspection due to embedment or the status of completed construction or installation (eg, weld preparation of completed welds, reinforcement in placed concrete, installed anchor bolts, etc) will be verified as appropriate, by examination of records.

4.3.4 Schedule Status

- Complete review and revision of PQCI's. (Date to be determined.)
- Establish verification inspection plan for completed work. (Date to be determined.)

4.4 System Completion Planning (Phase 2)

4.4.1 Introduction

Establish the processes for system completion, prepare procedures and expand training to cover systems completion work.

4.4.2 Objective

The objectives of the systems completion planning are as follows:

- Establish processes and interfaces for system completion.
- Prepare procedures defining tasks of each system completion team.
- Train team members by expanding upon training received previously for inspection and status assessment.
- Establish scheduling methods to be used during system completion activities.

4.4.3 Description

The team organization (developed in Section 4.2) and the processes and procedures will be extended to accomplish the systems completion work.

- Training will be conducted to assure that supervisors understand the team objectives and their role. Emphasis will be placed on completion of all work in accordance with the design requirements, the change control process used when the design must be modified, and changes to the established team processes and procedures.

4.4.4 Schedule Status

- Complete team preparation for systems completion work. (Date to be determined.)

4.5 QA/QC Systems Completion Planning (Phase 2)

4.5.1 Introduction

The QA/QC systems completion activity covers the planning to support of system completion work.

4.5.2 Objectives

Establish in-process inspection program and complete review and modification of PQCIs.

4.5.3 Description

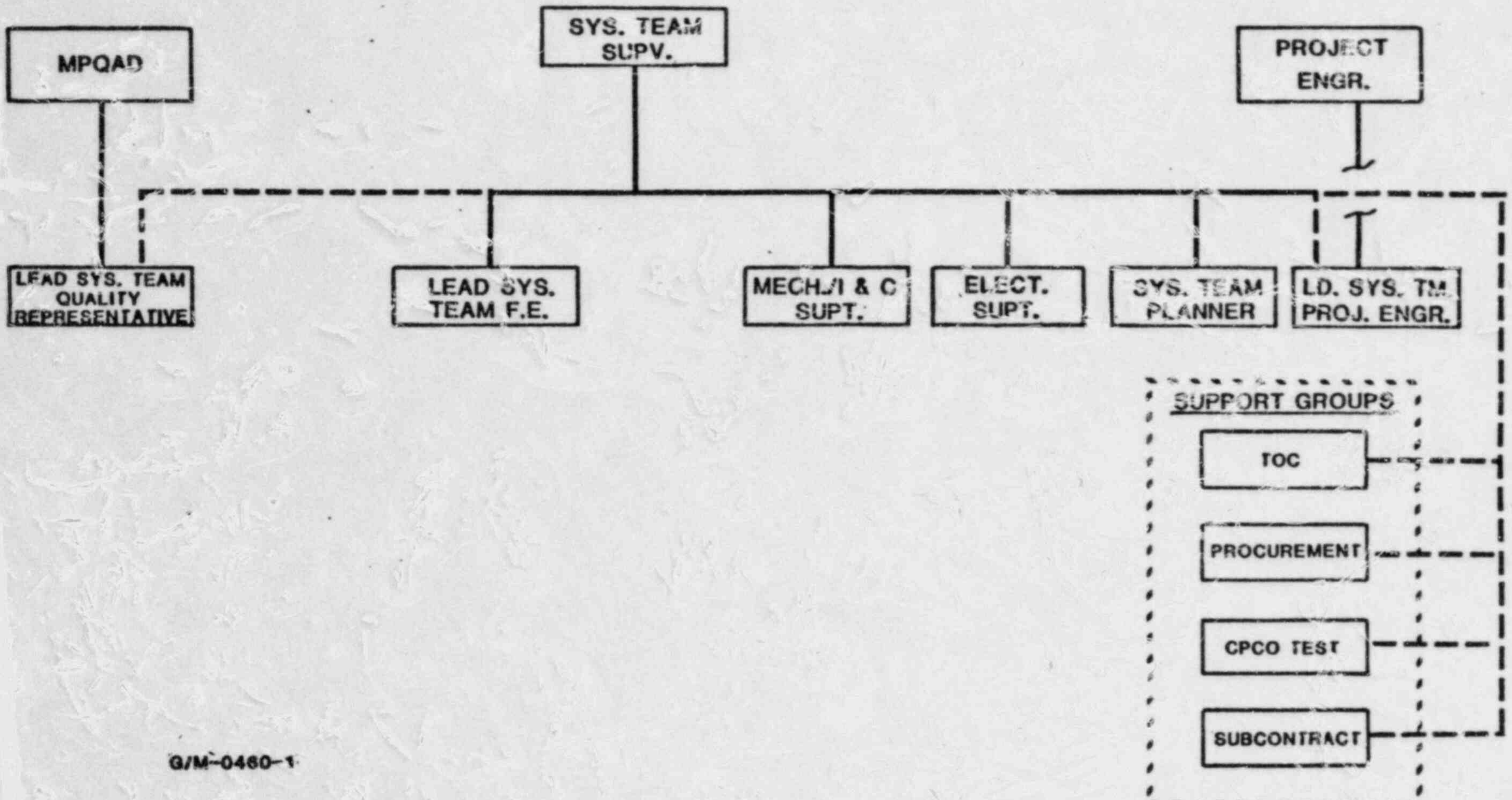
The QC in-process inspection program will be directly coordinated with future installation schedules to insure that inspection points, identified by MPQAD QA in the PQCI's, are integrated with the installation schedule. The identification of applicable PQCI's and required inspection points will be used by system completion teams to insure that QC inspections are adequately scheduled into the process. The system completion team quality representative will be responsible for providing the link between the system completion team and MPQAD to insure that quality requirements are satisfied.

PQCI's will be reviewed, and modified as necessary, to insure that proper attributes are being inspected, that inspection plans are clear and concise, that inspection points are specifically scheduled with installation activities and that inspection results are properly documented. MPQAD QA will be responsible for the PQCI review activity and will obtain assistance, as required, from other project functions, such as Project Engineering and Quality Control. Revised PQCI's will be used to conduct inspection of future installation activities.

4.5.4 Schedule Status

Issue procedure for integrating inspection points into the construction schedule. 2/22/83

FIGURE 4-1
CONCEPTUAL TEAM ORGANIZATION



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5.0 PROGRAM IMPLEMENTATION

5.1 Introduction

The implementation of the Phase 1 Construction Completion Program activities will be initiated after a management review of the overall process insures that Project performance and quality objectives have been addressed. The Phase 1 work will then be carried out by the various teams in accordance with the procedures described in the preceding sections. The installation and inspection status assessment of a system or partial system will be followed by a review of results by MPQAD and a second management review before initiating the Phase 2 systems completion work. The Phase 2 work will then be initiated on that system or partial system.

5.2 Objectives

The objectives to be met are:

- Establish the present installation completion and quality status.
- Integrate the construction and quality activities for all remaining work.
- Improve performance in demonstrated conformance to quality goals in all system completion work.

5.3 Description

Management Reviews

Project management will conduct formal review of the plans for implementation activities prior to initiation of team activities for the Phase 1 work. These reviews will ensure that identified project management and quality issues have been adequately addressed by specific actions and that Program objectives are met. The reviews will cover the process for both 1) the verification of completed inspection activity and 2) the installation and inspection status activity.

The installation and inspection status assessment will be performed on a system and/or area basis. Phase 2 is initiated after a formal Project management review of the first status assessment results to evaluate implementation effectiveness. After completion of this review, a work segment will be released for systems completion. Subsequent status assessment results will be reviewed by site management prior to initiation of additional systems completion segments. Reports will be made to Project management at regularly scheduled meetings.

Phase 1 Implementation

The existing installation and inspection status will be established in accordance with the plan presented in Section 4.

Evaluate Phase 1 Results

MPQAD will review the status assessment results to determine if any programmatic or implementation changes must be made. Verification scope will be adjusted, as necessary, based on evaluation results. Also, the evaluation will check for reportability to the NRC (as required by 10 CFR 50.55(e)) and Part 21.

Phase 2 Implementation

This activity starts systems completion for turnover. Work will be scheduled as installation and inspection status assessments are completed and reviewed. Correction of identified problems will be given priority over initiation of new work, as appropriate, and the system completion teams will schedule their work based on these priorities.

5.4 Schedule Status

- Complete Management review and initiate implementation of plan for verification of completed inspections. (Date to be determined.)
- Complete Management review and initiate implementation of plan for status assessment. (Date to be determined.)
- Complete Management review of initial installation and inspection status results and initiate systems completion work. (Date to be determined.)

6.0 QUALITY PROGRAM REVIEW

6.1 Introduction

The adequacy and completeness of the quality program is reviewed as part of the ongoing Project management attention to quality. These reviews consider any questions raised by NRC inspections or findings raised by third party evaluations.

6.2 Objective

Address issues raised by internal audits, NRC inspections and third party assessments. Program changes, if needed, will be evaluated and, as findings are processed, will be factored into the Project work.

6.3 Description

Consumers Power Company believes Midland QA program is sound. From time to time, questions arise on detailed aspects of the program or program implementation. The normal process of addressing these issues ensures that all necessary information is provided to NRC and that internal confidence in the program is maintained.

The recent inspection of the diesel generator building has raised several issues of programmatic concern. These are in the areas of material traceability, design control process, Q-system related requirements, document control and receipt inspection. Project management has directed that MPQAD provide an expeditious evaluation of these issues to be considered as part of the management review prior to initiation of Phase 2. Once the NRC inspection report is received and specified items are identified, these items will be addressed and resolved through the normal process of closing the inspection findings. Any corrective action or program changes will be implemented as appropriate in Project work on a schedule provided in the inspection report response.

The Project will also receive, from time to time, findings from third party assessments (Section 7). These findings or recommendations may also result in program modification or adjustments. Corrective action taken by the Project will be implemented on a schedule stated in the response to these findings.

7.0 THIRD PARTY REVIEWS

7.1 Introduction

This section describes third party evaluations and reviews that have been performed and are planned to assess the effectiveness of design and construction activity implementation. Third party reviews being conducted as part of the Remedial Soils Program are not included in this activity.

7.2 Objectives

To assist in improving Project implementation and assessment of Midland design and construction adequacy, consultants will be utilized in order to:

- Achieve a broad snapshot of current Project practices and performance in relation to a national program.
- Provide continuous monitoring and feedback to Management of Project performance.
- Identify any activities or organizational elements needing improvement.
- Improve confidence (including the NRC's and the public's) in overall Project adequacy.

7.3 Description

The use of consultants to overview Project design and construction activities with particular emphasis on construction is part of the effort to improve the Project's implementation of the quality program. Specifically, the plan overview employs the use of consultants for three separate functions: (1) To carry out a self-initiated evaluation (SIE) of the entire Project under the INPO Phase I program, (2) to utilize a third party overview of ongoing site construction activities to provide monitoring of the degree of implementation success achieved under the new program and (3) to conduct a third party Independent Design Verification (IDV) Program.

1. The INPO self-initiated evaluation was planned as part of an industry commitment to the NRC in response to concerns over nuclear plant construction quality assurance. For the Midland SIE, the evaluation was contracted to be carried out entirely by third party, experienced personnel from the Management Analysis Company.

   The evaluation was performed by a team of 17 consultants familiar with the INPO criteria and evaluation methodology. Over a period of a month they interviewed Project personnel at various locations and observed work in progress. The initial results of their evaluation have been presented to the Company and a Project response to each finding will be prepared and included as part of the evaluation report to be submitted first to INPO and then to the NRC Region III Administrator, together with the INPO overview.

2. A third-party installation implementation overview is being undertaken using, as a model, the program developed specifically for the underpinning portion of the soils remedial work. The overview will be initiated by retaining an independent firm, having considerable experience and depth of personnel in the nuclear construction field. The consultant's overview team will be located at the Midland Plant site and will observe the work activities being conducted in accordance with this Plan on safety-related systems. The overview will continue for a period of six months, after which the Project's cumulative performance will be evaluated. Based on the overview team's findings, a determination will be made by the Company's top management on what modification, if any, should be made to the consultant's scope of work. Findings identified by the installation overview team will be made available to the NRC in accordance with the procedures established for the conduct of independent verification programs.

3. An Independent Design Verification (IDV) is being conducted by Tera Corporation.

   The IDV is directed at verifying the quality of design and construction for the Midland Plant. The approach selected is a review and evaluation of a detailed "vertical slice" of the Project design and construction. The design and as-built configuration of two selected safety systems will be reviewed to assure their adequacy to function in accordance with their safety design bases and to assure applicable licensing commitments have been properly implemented. The field work done in support of this activity will not take place until after Phase I implementation (Section 5) has been completed on the systems being reviewed.

   The Unit 2 Auxiliary Feedwater System (AFW) plus another system to be selected with NRC concurrence, will be reviewed to fulfill the requirements of the IDV.

7.4 Status/Schedule

1. INPO Construction Project Evaluation

Select consultant and conduct evaluation	Complete
Submit report to INPO	Jan 20, 1983

2. Independent Construction Overview

Define scope	Dec 30, 1982
Select consultant	Jan 31, 1983
Mobilize assessment team	(Date to be determined)
Receive assessment team report	(Date to be determined)

3. IDV

Select 2 Systems	
.AFW System	Complete
.Obtain NRC concurrence for second system.	(Date to de determined)
Complete Evaluation	(Date to be determined)

8.0 SYSTEM LAYUP

8.1 Introduction

Perform system lay-up activities to protect plant equipment.

8.2 Objectives

Expand the protection of completed and partially completed plant systems and components until plant start-up, to take into account any special considerations during the status assessment.

8.3 Description

Procedures and instructions are provided in the Testing Program Manual to protect equipment during the on-going installation and test work. These will be extended to cover special considerations associated with the Program implementation. Both the pre- and post-turnover periods are covered. System and component integrity is ensured through existing programs and implementation of control and verification procedures.

In summary, these procedures and instructions require: Test Engineers to complete walkdowns of Q-Systems (in the auxiliary, diesel generator and containment buildings and the service water pump structure), paying particular attention to systems/components that are open to the atmosphere (eg open ended pipes, open tanks, missing spools, disconnected instrument lines, etc). Systems that have been hydrotested but are not currently in controlled layup require action to place the system in layup. Layup will vary from system to system but in general will consist of air blowing to remove moisture and closing the system from the atmosphere.

8.4 Schedule/Status

- Start extended layup activities 1/15/83
- Issue walk down schedules 1/15/83
- Complete the layup preparation walkdown 2/28/83

9.0 CONTINUING WORK ACTIVITIES

9.1 Introduction

This section describes the activities that are proceeding in accordance with previously established commitments during the implementation of the Program.

9.2 Objectives

- Maintain installation and support effort on work that will alleviate work interference in congested portions of the plant and facilitate completion and protection of equipment on systems turned over to Consumers Power Company.
- Meet previous NRC commitments on activities which do not impede the execution of the Program.
- Provide design support for orderly system completion work and resolution of identified issues
- Establish a management control to initiate additional specified work that can proceed outside of the systems completion activities

9.3 Description

Those activities that have demonstrated effectiveness in the Quality Program implementation will continue during implementation of the Construction Program.

These are:

1. NSSS Installation of systems and components being carried out by B&W Construction Company.
2. HVAC Installation work being performed by Zack Company. Welding activities currently on hold will be resumed as the identified problems are resolved.
3. Post system turnover work, which is under the direct control of Consumers Power Company, will be released as appropriate using established work authorization procedures.
4. Hanger and cable re-inspections which will proceed according to separately established commitments to NRC.
5. Remedial Soils work which is proceeding as authorized by NRC.

6. Design engineering which will continue for the Midland Plant as will engineering support of other project activites.

Additional activities related to the systems completion effort, may be initiated, as appropriate, to support orderly completion of the overall Project. Any activities in this category that are initiated prior to release of an area for systems completion work will be reviewed with the NRC Resident Inspector before initiation.

9.4 Status Schedule

These activities are proceeding with schedules that are independent of this Plan.

Keppler

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

January 11, 1983

NOTICE OF SIGNIFICANT LICENSEE MEETING

Name of Licensee: Consumers Power Company

Name of Facility: Midland Nuclear Power Plant, Units 1 and 2

Docket No.: 50-329; 50-330

Date and Time of Meeting: February 8, 1983 at 1:00 p.m.

Location of Meeting: Quality Inn
Meeting Room E
1815 South Saginaw Rd.
Midland, MI

Purpose of Meeting: To discuss the licensee's integrated Construction Completion Program and third party assessment effort

Region III Attendees:
James G. Keppler, Regional Administrator
Others as designated by Region III

OIE Headquarters Attendees:
James H. Sniezek, Deputy Director, Office of Inspection and Enforcement
Others as designated by OIE

NRR Attendees:
D. Eisenhut, Director, Division of Licensing
Others as designated by OIE

Licensee Attendees:
J. W. Cook, Vice President, Midland Project
Others as designated by the licensee

NOTE: Attendance by NRC personnel at this Region III/licensee meeting should be made known by 9:00 a.m. before January 24, 1983, via telephone call to W. D. Shafer, Region III, FTS 384-2656.

Time will be scheduled to answer questions from members of the public at the conclusion of the NRC/licensee meeting.

Distribution:
See attached list

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Distribution:
J. M. Taylor, Director, Division of Quality Assurance, Safeguards, and Inspection Programs
E. L. Jordan, Director, Division of Emergency Preparedness and Engineering Response
J. Axelrad, Director, Enforcement Staff
J. P. Murray, Jr., Director, Rulemaking and Enforcement Division, ELD
R. Hernan, LPM, NRR
E. L. Adensam, Chief, LB4, NRR
T. Novak, Assistant Director for Licensing, Division of Licensing
R. A. Purple, Deputy Director, Division of Licensing, NRR