



DEPARTMENT OF THE ARMY

DETROIT DISTRICT, CORPS OF ENGINEERS
BOX 1627
DETROIT, MICHIGAN 48221

50-329
50-330

REPLY TO
ATTENTION OF

28 OCT 1983

Design Branch

SUBJECT: Two Memoranda Concerning the Midland Nuclear Power Plant

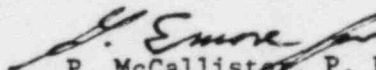
Mr. George Lear
U.S. Nuclear Regulatory Commission
Chief, Hydrologic and Geotechnical Engr Br
Division of Engineering
Mail Stop P-214
Washington, D. C. 20555

Dear Mr. Lear:

Attached are two memoranda providing Corps of Engineers comments regarding the recent controversy over the structural adequacy of the Diesel Generator Building (D.G.B.). These memoranda are Midland Nuclear Power Plant, Midland, Michigan dated 28 September 1983 and Applicant's Proposed Finding of Fact and Conclusions of Law on Remedial Soils Issues-Midland Nuclear Power Plant, Midland, Michigan.

Sincerely,

Enclosures


P. McCallister, P. E.
Chief, Engineering Division

XA Copy Has Been Sent to PDR

8311030133 831028
ADDCK 05000329 X4

XE02
11

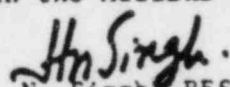
28 September 1983

SUBJECT: Midland Nuclear Power Plant, Midland, Michigan

TO: File

FROM: H.N. Singh

1. The controversy over the structural adequacy of the Diesel Generator Building (DGB) of the Midland Nuclear Power Plant led the formation of an Independent Review Committee of four experts by the Nuclear Regulatory Commission.
2. Pursuant to an interagency agreement between the U.S. Army Corps of Engineers (the Corps) and the U.S. Nuclear Regulatory Commission (NRC), which became effective in September 1979, we have reviewed the geotechnical aspects of the Midland Nuclear Power Plant, and have concluded that the DGB has not been correctly analysed (H.N. Singh's testimony of 10 December 1982 before the U.S. Atomic Safety Licensing Board, ASLB). Therefore, the Corps is not in a position to certify the adequacy of the structure.
3. The NRC geotechnical experts have also concluded that the effects of the foundation settlement have not been considered in the analyses, therefore, the structural analyses performed by the Consumers Power Company (CPCO) are not appropriate. Dr. R. B. Landsman of the NRC Region III office has testified to this aspect before the Congressman Udall's subcommittee, and before the ASLB. Mr. J. D. Kane, Principal geotechnical Engineer of the NRC also expressed his concern before the ASLB hearing on 10 December 1982.
4. On 8 September 1983, I was called upon by the newly formed Independent Review Committee to apprise the committee of the Corps' concerns regarding the DGB.
5. I informed the Committee that the details of my concerns are provided in my testimony of 10 December 1982 before the ASLB, and in the Corps' report of 7 July 1980, and 16 April 1981. An abstract of the Corps' concerns are:
 - a. The CPCO has not considered the effect of differential settlement of the DGB in structural analyses.
 - b. The DGB has numerous cracks on its walls. These cracks have reduced the rigidity of the structure, therefore, the effects of cracking must be considered in structural analysis.
 - c. ^PCPCO method of computing stresses in the reinforcing bars on the basis of the crack width is not appropriate.
6. A list of concerns resulting from the review of the ^PCPCO's "Proposed Findings of Fact and Conclusions of Law in the Midland Proceeding" is inclosed.


H. N. Singh, PESE

Lead Reviewer

Midland Nuclear Power Plant

NCDED-G

SUBJECT: Applicant's Proposed Findings of Fact and Conclusions of Law on Remedial Soils Issues - Midland Nuclear Plant, Midland, Michigan

The Corps of Engineers has reviewed the subject report. The following are the comments:

1. Para. 91: The main reason for uneven settlement of the Diesel Generator Building (DGB) is variable soil stiffness resulting from poorly compacted soil. No doubt, the duct banks did contribute to unequal settlement in the beginning, but there has been significant uneven settlement subsequent to their release from the walls in December, 1978.
2. Para. 92: The major cracks in the east wall of the DGB developed subsequent to the release of the duct banks from the building. The number of cracks prior to the release of the duct banks are shown in Attachment #2 of the original testimony of H. N. Singh. This attachment shows only 10 cracks on the east wall, but today there are 16 cracks on the wall.
3. Para. 92: The settlement of the D.G.B. after the release of the duct banks is not uniform as claimed by the Applicant in the last sentence of this paragraph. As shown in Attachment No.-2 (Fig-2) of the testimony of Mr. H. N. Singh, there has been considerable differential settlement after the release of the duct banks.
4. Para. 93: The settlement of the D.G.B. during the surcharge has created many cracks, (Singh's original testimony Q-9). On the east wall, the number of cracks increased from 10 to 16. Therefore, the surcharge did reduced the structural integrity of the D.G.B. The Applicant has not considered the settlement in his structural analyses (Singh testified before ASLD on 10 Dec 1982 to this aspect), and has not been able to demonstrate the adequacy of the D.G.B.
5. Para. 95: Partially saturated soil will not consolidate as saturated clay as claimed by the Applicant in this paragraph. The Corps of Engineers' concern as to this matter was communicated to the Applicant through the Corps' report of 7 July 1980 para. 63(a).
6. Para. 96,97, 98: We do not understand the intent of providing the contents of these three paragraphs. The matter described is well-known. Every soil engineer knows when primary consolidation is completed, and the secondary portion of consolidation continues as a straight line when plotted on logarithmic time scale.
7. Para. 99: Surcharging of a completed or partially completed structure is not a well established and widely accepted technique as claimed by the Applicant in this paragraph. A number of precedents described in Dr. Peck's testimony are nothing but surcharging of foundations; the portions of structures which are

NCDED-G

SUBJECT: Applicant's Proposed Findings of Fact and Conclusions of Law on Remedial Soils Issues - Midland Nuclear Plant, Midland, Michigan

affected by the differential settlement were not completed. The case of the D.G.B. is entirely different, where almost entire structure was completed during the surcharge. Therefore, surcharging has created major structural distress in different parts of the building.

8. Para. 102: The surcharge did not produce adequate stresses in the foundation soils to negate the effect of future loads (dewatering etc.) on the settlement. This has been substantiated by the excessive measured settlement after the plant area was dewatered to elevations less than 595.

9. Para. 103: It is not a sound engineering practice to cast concrete, when the structure is moving (settling). The Applicant's decision to cast concrete during the surcharge does not comply with the sound construction practices.

10. The piezometer readings and the shape of the consolidation curves did not confirm that all the excessive pore pressures were dissipated. The reasons are given in the Corps of Engineers report of 16 April 1981 (Question No 40).

11. Para. 106: To limit the accuracy of survey instruments (transit) to 1/8" is too high to be realistic. The normal measuring devices in leveling instruments can read up to 1/1000 of a foot, therefore, it appears that Applicant's settlement measuring method was not appropriate. Further, the error in measurement can be either plus or minus resulting in uncertainty in the measured settlement. In such case, to insure safety of the structure, it is reasonable to use higher values of settlement. The Applicant's method of computing settlement and creating error band of 1/4", and neglecting the differential settlement for computing stresses are not appropriate.

12. Para. 107: It is not known how the observations of the borros anchors would improve the precision of the data obtained. The data from borros anchors are more susceptible to errors than the reading on the markers which were located at the fixed points on the walls of the D.G.B.

13. Para. 112: Although, the pond level was raised to elevation 627.00, there is no evidence that water level below the D.G.B. rose above elevation 622.0 (Corps' report of 16 April 1981, see piezometer 12, 17, 23, 25, 29, 34, 36, 40, and 43).

14. Para. 114: The primary consolidation under the D.G.B. was not completed at all the points (Singh testified before ASLB on 10 Dec 1982 on this aspect) as claimed by the Applicant.

15. Para. 117: The foundation of the D.G.B. did not remain in plane after the removal of the surcharge. There has been considerable warping of the structure during and subsequent to the removal of the surcharge (see Singh's original testimony).

16. Para. 121: The reduction in stresses due to the surcharge removal did not exceed the stresses due to the added loads. For example the dewatering has added so much stress in excess of the surcharge stress that the foundation soils started showing primary consolidation.

NCDDED-G

SUBJECT: Applicant's Proposed Findings of Fact and Conclusions of Law on
Remedial Soils Issues - Midland Nuclear Plant, Midland, Michigan

17. Para. 125: The settlement due to the dewatering is primary settlement. I don't know when and how Dr. Peck added this settlement to the secondary settlement. It should be the part of the primary settlement. Part of this might be compensated by the additional settlement for continuing the surcharge load which has been included in the total predicted settlement. But definitely it has not been included in the secondary settlement.

18. Para. 130: There is no justification for correcting the measured settlement the way the Applicant has done. Applicant has consistently made unjustified corrections to reduce the differential settlement in the structure. If there are errors in survey, there is possibility that corrections might increase the settlement. But the Applicant's corrections have always reduced the settlement.

19. Para. 131: Dr. Peck's conclusion that piezometer observations are prone to anomalies is correct. But in the case of Midland Plant, a substantial number of piezometers consistently showed that pore pressures under the D.G.B. have not been completely dissipated. Hence taking advantage of anomalies to justify an incorrect result is not appropriate.

20. Para. 132: Dr. Peck's calculations of permeability are based on many questionable assumptions. Therefore, there is no merit in the values of the permeability calculated.

21. Para. 135: Dr. Peck's conclusion in para. 135 is not appropriate. In case of future cracks, a redistribution of stresses will take place, and the soil which was bridged by the structure before cracking will be subjected to more loading, causing additional settlement and more stresses in the structure.

22. Para. 138: I do not know whether Licensing Board has agreed with Peck's and Hendron's conclusions.

23. Para. 147: Dr. Peck's and Hendron's conclusion that the structural integrity of the structure has not been impaired is not correct. Mr. Singh has already shown in his original testimony that number of cracks on the east wall has increased from 10 to 16 after the surcharge. The curvature of the structure has considerably increased after the surcharge. This is a clear indication that stresses in the structure had increased to such a level due to the surcharge that numerous new cracks developed. Further the analysis of the D.G.B. structure due to settlement is incorrect. Differential settlement of the structure has not been considered in the evaluation of the stresses. Also numerous cracks which have developed due to the settlement have been ignored for the purpose of stress evaluation.

24. Para. 150, 151: The soil spring constant used in the analysis is not appropriate. Bechtel did not consider the correct values of spring constant.

NCDED-G

SUBJECT: Applicant's Proposed Findings of Fact and Conclusions of Law on
Remedial Soils Issues - Midland Nuclear Plant, Midland, Michigan

25. Para. 154: It is clear from the east wall that all the cracks which are inclined and have developed after the release of the duct banks are shear cracks. These cracks have bent towards south, indicating shear stress due to excessive settlement at the southeast corner.

26. Para. 166. The error band created by the Applicant is not justified. The ASLB has been informed by Mr. Singh and Mr. Kane on 10 December 1982 regarding this fact.

27. Para. 168: Dr. Corley was wrong in making the statement that there is no evidence in the structure of any other hard spot. I do not know what is the basis of his conclusion. There are evidences of large cracks on the east wall which occurred after the release of the duct banks. This clearly establishes that these large shear cracks have occurred following the settlement of the southeast corner. Further, settlement patterns developed after the release of the duct banks clearly indicate that there are many soft spots under the D.G.B. Further, the variation made in the spring constant over a 15' length was not adequate to reflect the softness of the large area under the foundation.

28. Para. 169: No cracks have been considered in the analysis.

29. Para. 170: If the Applicant can not analyse the structure correctly, that does not mean that he will perform incorrect analysis to justify the adequacy of the structure. Obviously, all of the Applicant's analyses are erroneous. If the structure can not be correctly analyzed, that is not a justification to declare it structurally adequate.

H.N. Singh.

H. N. SINGH, P.E.S.E.

NCDED-G

Lead Reviewer

Midland Nuclear Plant