

DISPOSITION FORM

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J. Kane
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REFERENCE OR OFFICE SYMBOL

NCDED-G

SUBJECT

Midland Nuclear Power Plant. Meeting for reviewing the preliminary design of the proposed remedial measures for the Service Water Pumping Structure (SWPS).

TO FILES

FROM HARI SINGH
NCDED-G

DATE 18 Sept 81
SINGH/af/35733

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1. Date and place of the meeting.

The meeting was held on 17 September 1981 at the Nuclear Regulatory Commission's (NRC) office in Bethesda, MD.

2. Attendees:

Darl Hood	NRC
Joe Kane	NRC
Liman Heller	NRC
Ross Landsman	NRC
Hari N. Singh	Corps of Engineers, NCD
Dennis Budzik	Consumers' Power Company (CPCO)
N. Ramanuzan	CPCO
Rajdan	CPCO
Thiruvengadam	CPCO
Bimal Dhar	Bechtel Corporation
Ed Burk	Mueser, Rutledge, Wentworth and Johnston, (MRWJ)

3. General Information about SWPS.

Service Water Pump Structure is a category-I structure. Its satisfactory performance is essential for safe operation and safe shutdown of the plant. The structure is rectangular in shape with overall dimensions of 106' x 86', and is built in two parts on split elevations. A main part, with a approximate size of 86' x 72', is founded on a stable foundation of natural soil (el= 587.00), and subsidiary part, with approximate size of 86' x 34', is founded on compacted fill (el= 617.00). The subsidiary part is built monolithic with the main part along their common dimension of 86'. Subsequent to the construction, numerous cracks appeared on the cross walls of the subsidiary structure. An investigation by the CPCO to determine the cause of the crackings, revealed that the fill materials which provide support to the subsidiary part are not adequately compacted. Based on this finding, the NRC and the Corps of Engineers concluded that the inadequately compacted soil settled under its own weight and under the foundation pressure. This caused redistribution of the structure loads and change in the structural behavior of the subsidiary structure (from a structure supported on mat foundation to a cantilever structure supported on elastic foundation) which caused the crackings. The existing cracks and their further propagation, and development of new cracks under the continued settlement of the fill materials are considered potentially dangerous to the safe operation of the plant. The remedial measures to stabilize the structure are needed. Several alternate methods to provide a stable support to the subsidiary part were considered by the CPCO, but they did not meet the design requirements of the state-of-the-art methods of static and dynamic design, and as such, were not acceptable to the Corps of Engineers and the NRC. The CPCO finally proposed to underpin the structure with foundation walls; the meeting of 17 September 1981 was held to discuss the merits of this proposal.

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4. New Proposal to Stabilize the Structure.

Mr. Ed Burk of MRWJ, a soil and foundation consulting engineering firm, New York, explained the new remedial measures to correct the subsidiary part of the SWPS. The explanations included the followings:

(a) Provide foundation walls under the outer walls of the subsidiary structure. The foundation walls will be built from the underside of the existing foundation slab, through the inadequately compacted fill, to the natural soil (El 587.00), and as such, will transmit the structure load directly to the natural material. Mr. Burk exhibited preliminary drawings showing that the foundation walls will be built in sequence of sections so that no temporary support would be needed during the construction. Excavation for the construction of first section of the wall in the sequence, will be such that the remaining soil support will provide adequate support to the structure for the short period of time needed to build the first section. After the first section is completed, excavation for the second section in the sequence will be made, and the load of the structure will be carried by the completed first section and the remaining soil support. In this way, the entire foundation wall will be completed without costly temporary support. Drawings for access shafts and excess tunnels needed for the construction were exhibited.

(i) The site will be dewatered to elevation 587.00. Because of this dewatering, there will be additional settlements in the compacted fill, causing further reduction in soil support to the subsidiary structure which, in turn, might cause additional crackings in the structure. To alleviate this problem, the subsidiary structure will be tied up with main structure with post tensioned cables (see Figure...).

(c) Mr. Burk also touched the theoretical design aspects of the new proposal (underpinning). He pointed out that there will be some differential settlements between the underpinning walls and the main portion of the structure. Effects of such differential settlements are not critical to the structure. These differential settlements constitute three parts; (i) settlement due to shrinkage of new concrete wall, (ii) creep in new concrete wall, and (iii) settlements in foundation soils due to additional load transmitted to them through the new walls. Mr. Burk showed graphs of the settlements versus time.

(d) Mr. Dhar of the Bechtel Corporation stated that when the underpinning walls will be completed, and the structure loads will be transferred to them, the existing foundation slab of the subsidiary structure will act as simply supported between the main structure and the underpinning walls. The slab has been checked for such new redistribution of loads and is found to be structurally adequate. Mr. Dhar also pointed out that *SOIL SPRING CONSTANTS WERE USED IN THE STRUCTURAL ANALYSIS TO CONSIDER THE EFFECT OF SETTLEMENTS*

5. Discussions by Messrs. H.N. Singh, Joe Kane and Liman Heller.

(i) Mr. H. N. Singh stated that the CPCO proposal, to construction the underpinning walls in sequence of sections and to use them to temporarily support loads many times more than they are intended to carry on long term basis, might cause shear failure in foundation soil. CPCO should perform analysis, determine factor of safety against shear failure in foundation soil under the maximum load an individual section of underpinning walls is likely to be subjected during construction, and furnish the analysis for review.

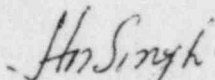
(ii) Mr. Heller asked, "what alternative method the CPCO would adopt if the foundation under an individual section of the underpinning walls fails in shear"? He requested CPCO to furnish the details of alternatives to be followed in case of such failure.

(iii) Messrs. Kane and Singh requested CPCO to furnish the details of static and dynamic spring constants used in analysis of the structure. The details should include: method used in determination of spring constants, magnitude of spring constants and assumptions, in any, made in determination of the spring constants.

(iv) In regards to the CPCO proposal of tying the subsidiary structure with main structure with post tensioned cables, Mr. Singh stated that such arrangement would bring additional vertical load on the main structure. CPCO should determine the additional foundation pressure under the main structure, determine resulting factor of safety, and furnish the results for review.

(v) The NRC staff and the Corps of Engineers are of the opinion that information provided in the meeting should be properly documented by CPCO and should be forwarded to the staff and the Corps of Engineers for detailed review. The material presented in the meeting were not adequate to make final decision regarding the adequacy of this proposal to stabilize the Service Water Pump Structure.

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