Consumers Power Company

James W Cook
Vice President - Projects, Engineering and Construction

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

March 23, 1982

Harold R Denton, Director
Office of Nuclear Reactor Regulation
US Nuclear Regulatory Commission
Washington, DC 20555

MIDLAND PROJECT
MIDLAND DOCKET NOS 50-329, 50-330
TEST RESULTS OF THE SOIL BORING AND TESTING
PROGRAM FOR THE RETAINING WALLS
FILE: 0485.16 SERIAL: 16573
ENCLOSURE: "TEST RESULTS, RETAINING WALLS, SOIL BORING
AND TESTING PROGRAM, MIDLAND PLANT - UNITS 1 AND 2"

We are forwarding thirty (30) copies of the enclosed Woodward-Clyde Consultants (WCC) report entitled "Test Results, Retaining Walls, Soil Boring and Testing Program, Midland Plant - Units 1 and 2." This report describes the scope of the boring and sampling program and the subsequent laboratory testing program for the fill and the foundation materials at the retaining wall areas adjacent to the circulating water and service water intake structures. Detailed supporting data for the triaxial tests are also enclosed. The results of laboratory shear strength and consolidation tests along with related engineering characteristics of the natural soil are discussed below.

GENERAL

Three borings (COE-14, COE-15 and COE-15A) were drilled, sampled and logged in the area of the retaining walls. Boring COE-15 encountered an obstruction at a depth of about 17' from the ground surface, ie, at about Elevation 617'. This boring was relocated and redrilled as COE-15A. Samples of fill and foundation materials were obtained from Borings COE-14 and COE-15A.

Approximately 34' of predominantly cohesive fill materials were encountered in Boring COE-14, overlying dense natural sand from about Elevation 600'. The sand deposit is about 20' thick and is underlain by hard clay beginning at about Elevation 580'. About 39.5' of stiff to hard cohesive fill and some granular materials were encountered in Boring COE-15A, directly overlying natural hard clay at about Elevation 594.6'.

oc0282-0021a100

B001
S 1/30 cm
Shelf

SHEAR STRENGTH PARAMETERS

In order to evaluate the shear strength of the soil, unconsolidated undrained (UU) and isotropically consolidated-undrained ($\overline{CIU}$)shear strength tests on selected undisturbed soil samples, obtained from Borings COE-14 and COE-15A, were performed by WCC. A comparison of the soil shear strenth parameters used in the design of retaining walls and those determined from the tests performed by Woodward-Clyde Consultants (WCC) is indicated below:

Material Type	Shear Strength Parameters at Foundation Elevations	
	Design Values	WCC Test Values
Natural Soils		
Sand	$\phi = 20°$, $C = 0$	$\phi' = 38°$, $C' = 0$
Clay	$\phi = 0°$, $C = 2$	$\phi' = 36°$, $C' = 0.2$ $\phi = 0°$, $C = 11.0$*
Backfill Soils	$\phi = 20°$, $C = 0$	$\phi' = 30°$, $C' = 0.2$

*Estimated undrained shear strength corresponding to an overburden pressure of 3.5 ksf.

It can be seen from the above tabulation that the values of shear strength parameters used in the design are conservative relative to the values obtained from the recent 1981 WCC tests. Refer to the response to 10 CFR 50.54(f) Question 41 for the design values of shear strength.

BEARING CAPACITY EVALUATION

Utilizing the above shear strength parameters, the ultimate bearing capacity and the corresponding allowable bearing pressures were calculated. The allowable bearing capacity commitment made in Subsection 2.5.4.10.1 of the Midland FSAR requires a factor of safety of 3 for dead load plus sustained live loads (static load condition) and a safety factor of 2 for these loads plus seismic loading (seismic load condition). A comparison of applied pressures and the allowable bearing pressures obtained from the soil parameters derived from the tests by WCC is presented below:

Loading Conditions	Applied Pressures (ksf)	Estimated Allowable Bearing Pressures (ksf) Based on WCC 1981 Tests	
Walls Founded on Natural Soils (Elev 595')		Sand	Clay
(i) Static Load Conditions	7.3	9.0	8.7
(ii) Seismic Load Conditions	9.6*	13.5	13.0
Walls Founded On Fill Soils (Elev 611')		Cohesive Fill	
(i) Static Load Conditions	3.3	5.0	
(ii) Seismic Load Conditions	4.3*	7.6	

*Based on sustained loads (DL + LL) plus seismic loads produced by safe shutdown earthquake (SSE).

It can be seen from the above table that the allowable bearing pressures, based on the shear strength values obtained from WCC tests, are higher than the applied pressures under the retaining walls founded on natural soils and backfill soils. Consequently, the design based on the design shear strength parameters identified in the response to 10 CFR 50.54(f) Question 41 is conservative.

WALL STABILITY

The issue of the stability of retaining walls under the forces due to steady state seepage was addressed in the meeting with the NRC Staff on May 5-7, 1981 in Bethesda. As discussed in this meeting, the steady state seepage forces would not come into the analysis of the retaining wall stability because the plant site is to be permanently dewatered and no seepage force is expected from plant area fill into the pond. In the case of steady state seepage from the cooling pond side into the plant area fill, the seepage forces will tend

to increase the resisting forces, thereby, making the retaining walls more stable. Thus, neglecting seepage forces for the proposed operating conditions is a conservative approach.

James W. Cook

JWC/RLT/dsb

CC Atomic Safety and Licensing Appeal Board, w/o
CBechhoefer, ASLB, w/o
MMCherry, Esq, w/o
FPCowan, ASLB, w/o
RJCook, Midland Resident Inspector, w/o
RSDecker, ASLB, w/o
SGadler, w/o
JHarbour, ASLB, w/o
DSHood, NRC, w/a (2)
DFJudd, B&W, w/o
JDKane, NRC, w/a
FJKelley, Esq, w/o
RBLandsman, NRC Region III, w/a
WHMarshall, w/o
JPMatra, Naval Surface Weapons Center, w/a
WOtto, Army Corps of Engineers, w/a
WDPaton, Esq, w/o
FRinaldi, NRC, w/a
HSingh, Army Corps of Engineers, w/a
BStamiris, w/o

ATTACHMENT