



DEPARTMENT OF THE ARMY
 DETROIT DISTRICT, CORPS OF ENGINEERS
 BOX 1027
 DETROIT, MICHIGAN 48231

14 MAR 1980

NCEED-T

SUBJECT: Interagency Agreement No. NRC-03-79-167, Task No. 1 - Midland Plant
 Units 1 and 2, Subtask No. 1 - Letter Report (INTERIM)

THRU: Division Engineer, North Central
 ATTN: NCEDED-2 (James Simpson)

TO: U.S. Nuclear Regulatory Commission
 ATTN: Dr. Robert E. Jackson
 Division of Systems Safety
 Mail Stop P-314
 Washington, DC 20555

1. The Detroit District team which provides geotechnical engineering support to the NRC has reviewed most of the available documents concerning plant fill at the Midland Plant. The team met with the NRC staff, the applicant Consumers Power Company (CPCO) and its consultants, participated in a site visit to observe site conditions and discussed the proposed remedial measures planned for Category I structures placed on plant fill. Since final design computations have not yet been provided for remedial measures, we feel it would be most expeditious for all parties to submit this INTERIM letter report to provide our initial evaluation of the remedial measures and recommend procedures to settle any unresolved issues, concerns and questions. The District also feels it is important to accomplish a thorough review which just cannot be done quickly.

2. The District's investigation to date has been centered mainly around the proposed remedial measures or other action for the Category I structures placed on fill materials. The review to date includes at least a preliminary look at all data received through Amendment 74. The initial indication of issues unresolved to date fall under the following four general types with subtopics as noted:

I. Soils:

- ~~a. Groundwater~~
- a. b. Borings and testing
- b. d. Settlement/Consolidation
- c. d. Seismic ~~concerns~~ *geotechnical concerns*

CPCO (Simpson) DEP. EX. NO. 15
 FOR ID., AS OF 7/19/80 *TC*

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~~d, e. ³ ~~Misc~~ structures constructed on fill not covered in Paragraph II~~

~~below~~
4. f. Quality control

II. Remedial Measures for Category I Structures on Fill

- ~~a. Dewatering~~
- b. Diesel generator building
- c. Service water building
- d. Borated water tanks
- d. Underground diesel fuel tanks
- e. Underground utilities
- f. Aux. building - Feedwater valve pit

III. Geology

- a. ~~Depth to rock~~
- b. ~~Layer formation~~
- c. ~~Fault and seismic history~~
- d. ~~Crustal rebound~~
- e. ~~Interpretation of borings, test pits, lab tests, etc.~~
- b. ~~Design review event~~

IV. Miscellaneous or General.

3. ~~Questions, uncertainties and unresolved issues~~ ^{and additional data} are stated in the following pages. These are in addition to the responses ~~and~~ ^{to be received} from the applicant concerning additional design support information to the 10 CFR 50.54 (f) questions concerning structures on plant fill. The source of each ~~question, concern or issue~~ is indicated at the end of ~~each item~~.

I. Soils

Change to tablet

a. Borings and testing

(1) Who and what are the qualifications of the persons(s) who classified samples of all borings, driller or geologist? Were samples tested in a lab? Are samples still available? Where are the results, many appear to be missing? Source - site visit, various documents and general concern.

(2) Are final fill elevations available at completion of fill placement and prior to construction? Were additional borings taken prior to start of construction? If so, where are they? Source - Incl to CPCO letter, 2 Nov 79.

(3) Have all investigative borings for the plant fill problem been completed? If not, what are the locations of the remaining borings to be taken? Source - site visit 28 Feb 80.

conclusion necessary for revision

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c. Settlement/Consolidation

(1) Why have allowable soil bearing stresses not been discussed? What are the related soil spring constants so that settlement vs. load is quickly discerned? Source - site visit 27 Feb 80.

(2) Has the bearing value of the glacial till been determined and have settlements been estimated for this bearing stratum based on all building loads, particularly the reactor building? Source - site visit 27 Feb 80.

d. Seismic concerns

(1) New soil properties or new materials used for backfill should be used in the revised seismic analysis for determination of structural adequacy. Has this been accomplished and documented? Source - Question 262.13, Q&R 2.5-22.

e. Misc. structures constructed on fill not covered in Paragraph II below.

(1) Sand pockets have been noted in cooling pond dikes which lead toward the river. What are the adverse impacts (groundwater piping, leading to dike failure)? Was the dike properly compacted? Source - general concern.

(2) Have all structures on fill be investigated for settlement? If not why not? Have all buildings on fill been checked for cracking? Source - interim SER.

(3) The design of the Water Service Building retaining wall is critical and partially category I. This design should be provided for CofE review. What is the cause of the wall settlements noted during the 27 and 28 Feb 80 site visits? Source - site visit 28 Feb 80.

f. Quality control

(1) Why are there so many shrinkage cracks (assuming these are shrinkage cracks)? Is this simply poor quality control? Will cracks be repaired in same? Source - site visit 28 Feb 80.

II. Remedial Measures for Category I Structures on Fill

a. Dewatering

(1) Why not utilize a slurry cutoff wall or trench across the primary recharge zone near the service water building in addition to pumped wells planned? Use of clay slurry wall would provide positive cutoff. Source - site visit 27 Feb 80.

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✓ (2) What is the dewatering well gravel pack design? Does it vary with soil layer type? Source - site visit 27 Feb 80 (dewatering).

X (3) Will groundwater piping occur from cooling pond to well points over time? Any preventative measures proposed to stop this? What about piping along piles, building foundations or caissons? Source - site visit 27 Feb 80 (dewatering).

✓ (4) Will weep holes in retaining wall at the service water building be plugged since these are no longer necessary with the dewatering planned? This could be a likely source of possible groundwater piping in the future. Source - site visit 27 Feb 80 (dewatering).

✓ (5) What are the test results concerning incrustation of the dewatering system as well as fines removal (additional settlement) concerns? Source - site visit 27 Feb 80 (dewatering).

✓ (6) What is the final dewatering plan; number of wells, spacing, location, depth, diameter, pumping rates, recharge rates, back-up systems, etc? Source - site visit 27 Feb 80 (dewatering).

X (7) Are there any known problems of operations of the dewatering system due to presence of gas pockets in the area? What about fire/explosion hazards with the electrical controls? Source - general concern, prior experience.

✓ (8) Has the need for localized dewatering in sand fill lenses been analyzed for structures other than the D.G. building? Source - site visit 27 Feb 80 (dewatering).

✓ (9) Upon reaching a steady state in dewatering, a geophysical survey should be made to confirm the position of the water table and to insure that no perched water tables exist. Source - site visit 27 Feb 80 (dewatering).

b. Diesel generator building

(1) Provide additional verification that surcharge loading has indeed solved the settlement problem. Additional borings, if taken, should indicate higher blow counts when compared to borings taken prior to application of pre-load. Settlement analysis should be made on samples from new borings. The drop in groundwater levels, implying heavier soil unit weights, and diesel plus seismic vibrations should be considered in the settlement and seismic analyses. Source - Q&R 2.5-22 and site visit 27 and 28 Feb 80.

(2) How was sand surcharge placed inside D.G. building? Was it compacted? How was it removed? What was in-place unit weight of sand used?

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removal of sand by heavy equipment cause cracking? Source - Q&R 2.5-21,
n 362.12.

✓ (3) Establish cracking history as a function of construction and
large activities. Source - site visit 27 Feb 80 (Anal. Investigations).

(4) What is the explanation of the "hump" in the settlement
in the two western-most generator bays on the south side of the building?
- Incl. to CPCO letter 2 Nov 79.

(5) Since certainty that the surcharge provided proper compaction
not yet been satisfactorily demonstrated to the Corps, and as a hedge
against liquefaction, confidence in the structure could be established by
underpinning. Source - site visit 27 Feb 80.

✓ (6) Are post surcharge borings and related test data available?
If so, these should be provided. Source - CPCO letter 2 Nov 79.

✓ (7) Why is there no floor in D.G. building? Will a floating slab
be placed later? Source - site visit 28 Feb 80.

✓ (8) Further, explanation of the 1 1/2" of additional settlement
due to earthquake, 3/4" static load and 1/4" dewatering) is requested. The
1/2" additional settlement due to earthquake loads must be reviewed by WES.
Source - Q&R 2.5-34, Q362.17.

c. Service water building

(1) Corrective piles are to be 100 ton piles. How is this load
to be developed and established, by tip elevation or blow count? Discuss the
pile load test(s) to be performed. Resolve the problem of possible
differential settlement that could occur between the pile supported end and
the portion placed on fill. Source - site visit 28 Feb 80 (Davisson
presentation).

(2) What computations show that sufficient lateral stability is
provided to the proposed underpinning piles by the building? Source - site
visit 28 Feb 80 (Davisson presentation).

(3) Would building lateral stability be improved by plugging the
retaining wall weep holes and maintaining the dewatered condition? Source -
site visit 28 Feb 80 (Davisson presentation).

d. Borated water tanks

(1) The soil test investigation reports at the tank farm should be
provided for our review. Bearing capacities should be determined from plate
load tests. The yield point of the foundation should be determined. Source -
site visit 27 Feb 80 (remedial work).

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✓ (2) Why has the ring foundation cracked? Is this crack in the area of the reported broken air line? The diagonal crack did not appear to be a shrinkage crack. Source - site visit 27 and 28 Feb 80.

X (3) Why not increase the test load for the tank by a surcharge in addition to filling the tank with water? Source - Interim SER.

✓ (4) Since applicant agreed that broken air line may have degraded the foundation material, the tests taken in this area must be conclusive. Source - NRC 28 Aug 79 Memo.

✓ (5) What are the residual settlement predictions and the consequences thereof? Source - Interim SER.

e. Underground diesel fuel tanks

X (1) What are the settlement predictions on these tanks and will these then function properly? Any differential settlement expected? Source - Interim SER.

X (2) Does differential settlement reduce the fuel storage capacity? If so, how much? Source - general concern, Interim SER.

(3) Are these tanks designed against "bouyancy?" Source - Interim SER.

f. Underground utilities

X (1) Why not inspect the interior of water circulation piping with video camera with sensing devices to show pipe cross-section, infiltration and slope? Source - site visit 27 Feb 80.

(2) Have electrical duct banks at D.G. building been damaged? Have these been inspected after it was shown they were severely loaded? Direct observation of the western-most duct would seem appropriate and easy at this time. Source - site visit 27 and 28 Feb 80.

(3) Have all Category I underground utilities, ducts, pipes etc. been profiled? This would seem to be the only positive way to be certain no damages to pipes or utilities have been sustained. What about corrosion to buried pipes or chemical attack of concrete pipes underground? What about stress induced by differential settlement? Are all stress levels below allowable and what about added stress due to residual settlement? Source - site visit 27 Feb 80 (evaluation of piping).

(4) Will all utility settlements be monitored throughout the plant lifetime, particularly at connections? Source - site visit 27 Feb 80 (evaluation of piping).

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X (5) Passing a "rabbit" through conduits is not a suitable safeguard or insurance that conduits are undamaged. Source - Interim SER.

✓(6) During our site investigation on 28 February 80 it was noted that the "rattle space" had been reduced at several buildings. How will these defects be corrected? Source - site visit 28 Feb 80.

✓(7) The category I pipelines (outlets, inlets) for return water at the emergency heat sink could be covered by a slope failure during a seismic event. The applicant should analyze the sideslope to determine if a sufficient factor of safety exists. Source - site visit 27 and 28 Feb 80.

g. Auxiliary building - feedwater valve pits

(1) Seismic analysis of this area is needed concerning change from fill to lean concrete. Source - Questions 362.13 Q&R 2.5-23.

II. Geology

c. Fault and seismic history

(1) Canadian faulting of major magnitude exists at Sault Ste. Marie and Sudbury, Ontario. Why were these not considered in the FSAR? Source - FSAR Figure 2.5-27.

e. Interpretation of borings, test pits, lab tests, etc.

(1) Many undisturbed soil samples were taken, yet no test results or reports are available for many of these. Why not? Source - general review of documents.

IV. Miscellaneous or General

X (1) Why are there so many shrinkage cracks, especially in plant area structures placed on fill? This appears to be more than a coincidence. Source - site visit 28 Feb 80.

✓ (2) Will C.P.Co. consultants Peck, Davisson, Gould & Hendron submit summary statements to NRC concerning their presentations at the 28 Feb 80 site visit? Source - site visit 28 Feb 80.

✓ (3) Cooling pond dikes have been repaired due to erosion. This dike design should be provided for CofE review. Source - site visit 28 Feb 80.

(4) Will the applicant provide minutes of the 27 and 28 Feb 80 meeting?

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(5) The entrance road to the plant appeared to be below cooling pond elevation. Would access to the plant be impaired for emergency vehicles in the event of a dike failure? Source - site visit 27 and 28 Feb 80.

(6) What provisions will be made to insure the dewatering system will be maintained in proper operating condition? Source - site visit 27 Feb 80 (dewatering).

(7) Some of the cracks noted appear to be enlarging with time. The width of these cracks would be already in excess of a shrinkage crack. Source - site visit 27 and 28 Feb 80.

4. The District's recommendations concerning questions, uncertainties and unresolved issues presented above are given when possible and appropriate below in a like numbered paragraph:

I. Soils

e. Miscellaneous structures constructed on fill not covered in Paragraph II below.

(2) All structures, including utilities should be checked for settlement and cracking.

f. Quality control

(1) Undertake a comprehensive analysis on cracked structure. Statements that all cracks are due to shrinkage or do not affect structural integrity are not sufficient.

II. Remedial Measures for Category I Structures on Fill.

a. Dewatering

(1) Consider benefits of using clay slurry cutoff wall in conjunction with pumped dewatering.

(3) Analyze possible groundwater piping along the paths indicated.

(4) Analyze pros and cons of plugging weepholes.

(5) Consider a control panel in control tower area to indicate plant groundwater level in the critical plant areas so that monitoring can be easily accomplished.

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b. Diesel generator building

(1) Take additional borings and tests to prove surcharge worked.

f. Underground utilities

(2) Conduct an visual inspection of at least one (the westernmost) electrical duct bank at the D.G. building.

(3) Investigate any category I utilities not investigated.

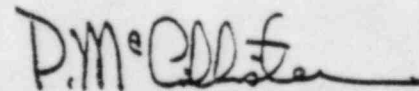
(5) Provide additional assurance the category I utilities have not been over stressed.

(6) Establish minimum rattle space criteria and restore as necessary.

(7) Analyze outlet pipes located in heat sink pit side slopes for seismic event (SSE & OBE).

5. If you have any questions concerning this interim letter report, please contact Mr. N.A. Gehring at FTS 226-6793.

FOR THE DISTRICT ENGINEER:



P. McCALLISTER
Chief, Engineering Division

DEPARTMENT OF THE ARMY
 DETROIT DISTRICT, CORPS OF ENGINEERS
 P. O. BOX 1027
 DETROIT, MICHIGAN 48231

25 JUL 1980

WCCD-T

SUBJECT: Intersagency Agreement No. WRC-03-79-167, Bi-Monthly Letter

Dr. Robert E. Jackson
 U.S. Nuclear Regulatory Commission
 Division of Systems Safety
 Mail Stop 7-314
 Washington, DC 20555

Dear Dr. Jackson:

This is the fourth of the bi-monthly letters required by subject intersagency agreement. The status of the items requested in the agreement is provided in the following paragraphs.

Efforts Completed During the Period 20 May to 24 July 1980

Midland. The seismic analysis was received from the USAF Waterways Experiment Station (WES) on 3 June 1980. ESM revision No. 28 was received on 3 June 1980. On 14 May and 20 June 1980, draft letter reports were informally furnished to WRC and our North Central Division (NCD) office for comment. The letter report, subtask no. 1, was mailed to WRC through WCD on 7 July 1980.

Bally. On 27 May and 18 June 1980, draft letter reports were informally furnished to WRC and WCD for comment. On 10 July 1980, the letter report, subtask no. 1, was mailed to WRC through WCD. On 29 and 30 May 1980, WISCO responses to RCP's and requests for information 362.01 through 362.29 and 362.30, respectively were received. On 3 June 1980, a draft clarification statement was received from WRC to further define the Detroit District work effort required under subject agreement. John Grandtson, Bally Lead reviewer for Detroit District, was in Washington for discussions with the WRC and to attend a 2-day pile driving seminar.

Amount of Funds Expended

Site	From 1 May 80 to 30 Jun 80	Cumulative
Midland	\$14,695.40	\$ 61,957.80
Bally	13,175.00	42,404.33
Total	\$27,870.40	\$104,362.13

CPCO (Sampson) DEP. EX. NO. 16
 FOR IDL. AS OF 7/19/80 twa

8007290759

25 JUL 1980

NCDED-T

SUBJECT: Interservice Agreement No. NSC-01-79-167, Bi-Monthly Letter

Problems Encountered or Anticipated:

Our letter of 30 June 1980 to WDC, Division of Contracts, indicated that at the District's rate of expenditure in March, April and May 1980 (approximately \$20,000/month), that an additional \$40,000 over and above the \$144,000 available would be needed through the end of FY 80.

Progress Summary

Midland. Pending WDC acceptance, subtask no. 1 (letter report) of task 1 (Midland) is complete.

Bally. Pending WDC acceptance, subtask no. 1 (letter report) of task 2 (Bally) is complete.

Plans for the Next Reporting Period 21 July 80 - 21 September 1980.


Midland. Initiate work on the draft Safety Evaluation Report (SER).

Bally. Initiate work on draft SER.

General. A schedule of subtask activities based on the District's progress through 30 June 1980 is attached as Incl 1 for your information.

Sincerely,

1 Incl
Schedule

for 
P. McAllister
Chief, Engineering Division

Copy furnished:
U.S. Nuclear Regulatory Commission, Director, Division of Systems Safety,
Washington, DC 20555, ATTN: S. L. Cranier

NCDED-G

Liquification Potential

1. ER 1110-2-1806 (30 Apr 77) Good outline of ^{appropriate} sound investig.
Says " In-situ ϕ & D_r should be determined. For dyn. anal.,
make downhole, cross hole & surface geophysical tests to est.
in-situ compression & shear moduli. Determine critical void
ratio. PZ probe may be used in sat. material to assess
dilative or contractive in-situ properties.

2. ^{Journal of S.M. & Found. Div} Seed - ASCE proceedings Apr '72. The crux of this article is
tho: Liq. can occur in dry or moist materials as well as sat.

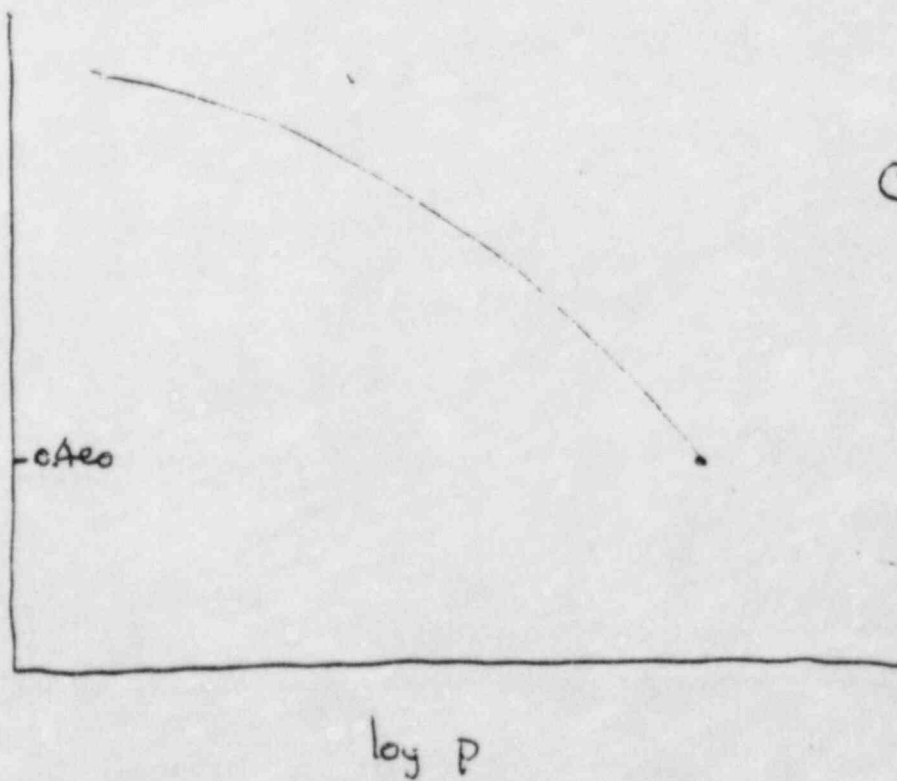
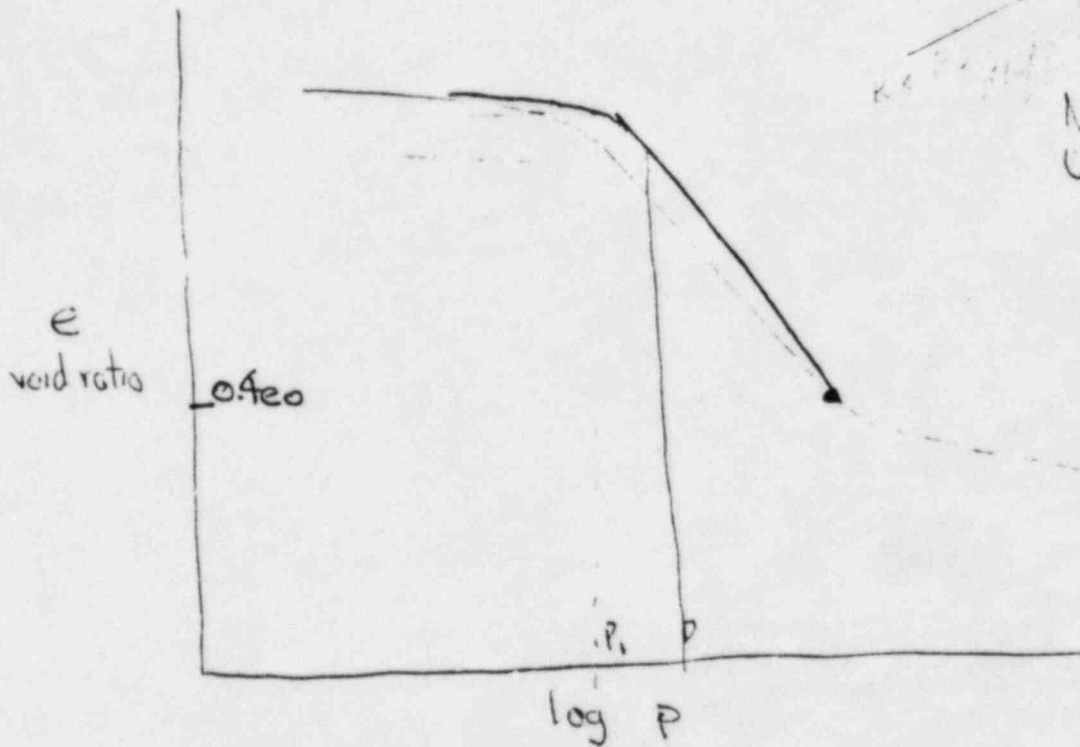
3. Seed - Wintertorn & Fang, pg 721.

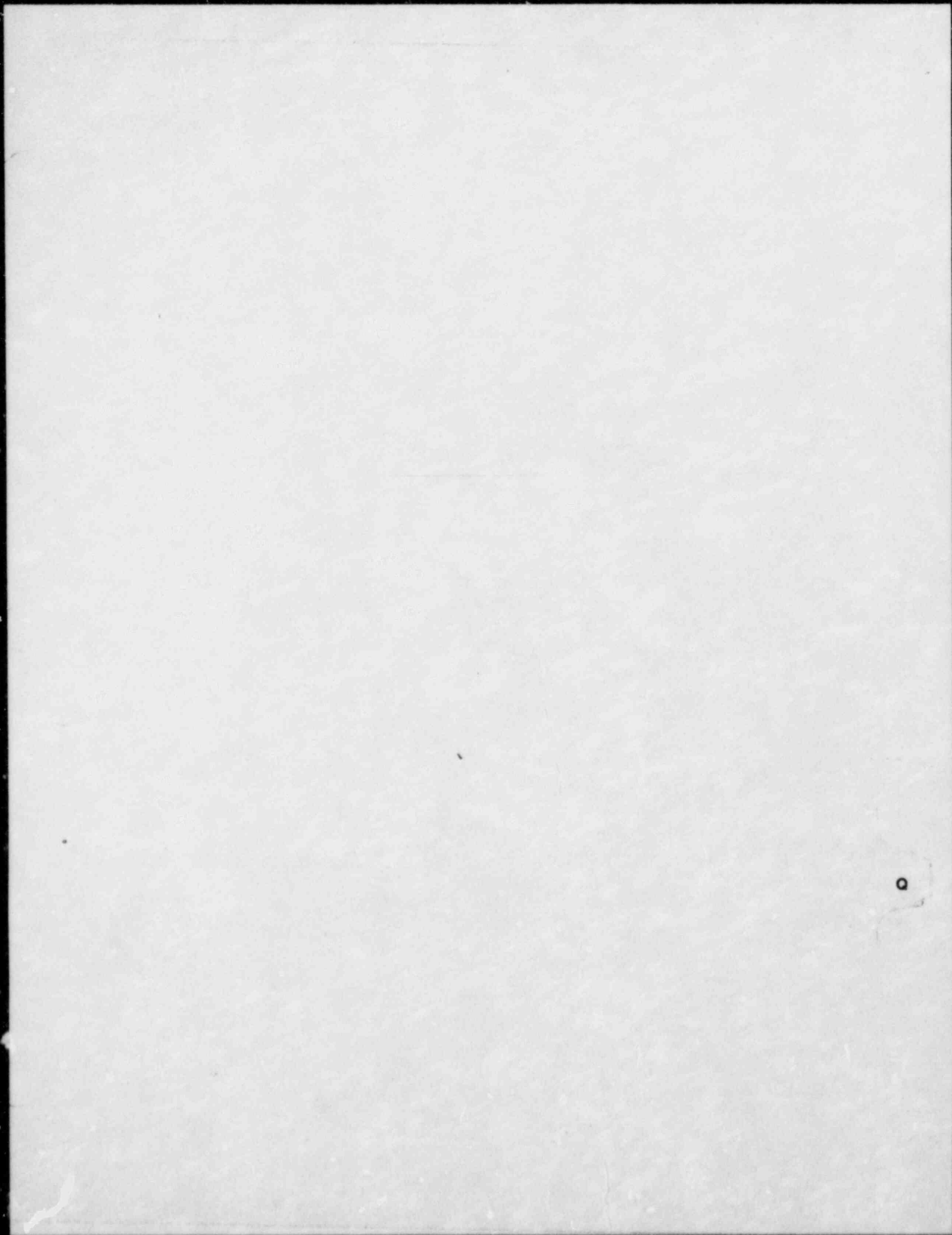
(a) Liq. can occur in any zone at any depth (implied that ~~the zone~~
may be relatively small.)

(b) Liq. of upper layers may result from induced liq. at depth
which causes upward hy. gradients if conditions are right.

Consolidation Ex. 14 10.
12/2/80 (100%)

10 minutes
100% consolidation
Normal Consolidated





CPCO Ex 1. id.
12/18/80 (singh)

Name: Hari Narain Singh

Address: 34174 Koch Avenue
Sterling Heights, Michigan 48077

AXS-12 18-80
to AP 183-1874
"SAND OVER MUD"
(MAYWORT, FLA. PIP)

Professional Licenses:

- (1) Registered Structural Engineer - Pennsylvania - 1970, 15552E.
- (2) Registered Civil Engineer - Pennsylvania - 1970 15552E.

Education:

- (1) B.S. (Civil) - 1956 - University of Patna, India
- (2) M.S. (Civil) - 1969 - University of Colorado, Boulder, U.S.A.
Completed 30 additional semester hours beyond M.S. degree.

(3) ~~XXXX~~ (Geotechnical) - Wayne State University **DETROIT**
(Presently working for Ph.D. degree)

Professional Experience:

- A. October 1978 to Present: Civil Engineer, U.S. Army Corps of Engineers, Detroit, Michigan.
- B. April 1978 to September 1978: Civil Engineer (bridges & foundation) Arizona State Highway Department, Phoenix, Arizona.
- C. March 1970 to March ~~1970~~¹⁹⁷⁸: Civil Engineer, Pennsylvania Department of Transportation, Franklin, PA 16323
- D. September 1965 to September 1969: Graduate student and Research Assistant, University of Colorado, Boulder, U.S.A.
- E. May 1959 to July 1965: Assistant Professor of Civil Engineering, Department of Industries, Government of Bihar State, India. Posted at the Ranchi School of Engineering (1959-1961) and the Regional Institute of Technology, Jamshedpur, India.
- F. April 1958 to April 1959: Assistant Civil Engineer, Government of India (Tripura Administration), India.
- G. July 1956 to April 1959: Engineer Assistant (Civil), Government of Bihar State, India.

Summary of Experiences: Twenty-four (24) years experience in civil engineering activities which include teaching, design, construction and maintenance. Completed design and reviewed design for more than fifty (50) bridge structures and their foundations. Carried out soil explorations and foundation investigations for structures.