~~PDR~~

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

APR 2 1980

MEMORANDUM FOR: Robert E. Jackson, Chief
Geosciences Branch, DSS

THRU: Lyman W. Heller, Leader
Geotechnical Engineering Section
Geosciences Branch, DSS

FROM: Owen O. Thompson, Geotechnical Engineer
Geotechnical Engineering Section
Geosciences Branch, DSS

SUBJECT: MEETING WITH COE AND CONSULTANTS

PLANT NAME: Bailly Nuclear 1
LICENSING STAGE: Post CP
DOCKET NUMBER: 50-367
TAC NUMBER: 4764
MILESTONE NUMBER: R-18
RESPONSIBLE BRANCH: LWR-4; M. D. Lynch, LPM
REVIEW STATUS: Awaiting COE and Consultants Comments

On March 10, 1980, a meeting was held at the Ramada Inn, Champaign, Illinois between the NRC staff, Corps of Engineers (COE), Waterways Experiment Station (WES), and NRC consultants Dr. W. J. Hall and Dr. M. T. Davisson. The attendance list is attached.

The purpose of the meeting was to identify issues regarding pile driving at the Bailly site, to categorize the issues as either resolved or unresolved, and to determine the best method(s) to obtain solutions to the unresolved issues. The meeting was an informal exchange of ideas and thus the following summary is presented as a group effort rather than as input from a particular individual or agency.

Issues and Resolutions (R)

1. The COE stated that they had not completed their review of the stratigraphy and the indicator pile program submitted by the applicant, and thus the COE was not convinced that the bearing layer was as well defined as implied by the applicant. The concern was that piles could terminate in unsuitable material, such as compressible silt (ML), and undesirable long-term settlements could develop.

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R. It was agreed that, provided adequate driving resistance is attained, there will be adequate initial pile capacity. The long-term settlement problem can be resolved by requiring the applicant to hold test loads on one or more piles for a long period of time. Details of the so-called long-term (LT) load test requirements will be developed by COE for presentation by NRC to the applicant. The LT load tests can be performed on production piles.

2. The indicator pile program results (driving resistance and load test data) may not be representative of production piles. Some of the test piles were cased down to proposed mat subgrade elevation to eliminate overburden friction. Nevertheless, the confining pressure contributed by the overburden was present on embedded portions of the piles. Thus, production piles may have to extend deeper than anticipated, may have different load carrying characteristics and may require splicing which could cause problems with the onset of freeze and concomitant restrictions on splicing near the top of the pile.

   R. Load tests on production piles will resolve any concerns with capacity. If greater depths are needed, the contractor will have to drive longer piles and this issue will be properly handled by the prescribed driving criteria. The COE will review and prepare comments on the load testing procedures to be adopted for production piles.

3. The piles may have a lower than expected capacity after the construction is complete and after the groundwater level is permitted to rise to its natural level. This concern relates to the reduced effective stresses in the soils which are initially above groundwater during installation and ultimately below ground water during service of the plant. This concern also relates to possible "floating" of the slabs after the ground water level rises but before full dead load is applied.

   R. We agreed that this concern probably is not significant but needs studied. The COE will review and resolve the concern with the effects of raising the groundwater level after installation of the piles.

4. Dynamic loading of the soils during the SSE or OBE may cause soil liquefaction and loss of pile capacity, particularly lateral and uplift capacity.

   R. The COE consultant from WES, Dr. Hadala, will resolve this issue.

5. The proposed treatment of the so-called preconstruction areas disturbed by jetting needs to be studied further. The jetting may have washed large voids in clay layers. Also, the pipe piles proposed for installation in these areas may not adequately densify the disturbed areas, particularly if the pipe piles cannot be driven to the full depth of jetting. There is an additional concern that the locations of preconstruction areas may not be defined with sufficient accuracy to allow placement of the pipe pile into the jetted hole.

R. It was agreed that the compaction (pipe) piles together with production (H) piles will eliminate any voids in the clay. The adequacy of the proposed pipe pile densification program will be evaluated by COE. It was agreed that the locations of disturbed areas are sufficiently well established to permit locating the initial compaction pile in each disturbed area. Additional compaction piles in each disturbed area will establish the lateral extent of disturbed areas based on driving resistance logs.

6. The artesian condition in the lower aquifer may cause upward flow of water along production piles and loss of friction between the soil and the piles.

   R. There has been no evidence of this phenomenon in the indicator pile program because pulled piles have shown excellent bond between soil and the H-piles. The COE will review this condition and may request additional analyses by the applicant.

7. Settlement of soil under or beside the mat may be greater than the settlement of the pile supported mat. This differential settlement could be detrimental to soil-supported pipes, conduits, etc. under the mat.

   R. This issue is not relevant to the acceptability of continuing pile driving; however, the support conditions for appurtenances will be reviewed in detail by COE prior to preparing the SER. In addition, the settlement monitoring program will be reviewed by the COE prior to preparation of the SER. We agreed that the program should include installation of at least 4 permanent bench marks anchored in rock and located outside the construction area. Also, settlement records should provide documentation of differential settlements occuring at significant stages of foundation construction, i.e. readings should be made and benchmarks transferred each time a significant portion of foundation mat is poured.

8. Pile driving vibrations may cause instability of the excavation exterior slopes.

   R. Thisissue is not considered to be a safety item with respect to plant operation and should be addressed by the contractor. No review by NRC or the COE is considered to be necessary.

9. Pile driving vibrations may cause additional settlement of adjacent existing structures.

   R. Settlement of adjacenet structures probably have no impact on safety of the nuclear plant, but this item will be reviewed by COE prior to preparing the SER. This issue is not relevant to the acceptability of continuing pile driving.

10. Closely spaced piles may heave beyond criteria established and then not be accessible for re-driving.

    R. Heave criteria have been established and the accessibility to any heaved piles will be the contractor's concern. No additional review of this item is considered to be necessary.

11. The detailed review of the penetration and anchoring of the pile butts into the pile caps has not been completed.

    R. The penetration and anchoring details do not need further review prior to continuing pile driving. However, the COE, the Structural Engineering Branch and Dr. W. Hall will evaluate the pile cap details prior to the preparation of the SER.

12. The pile tolerances on plumb, rotation and location may not be appropriate.

    R. It was agreed that field bending of mat steel which does not meet applicable codes and specifications would not be permitted. This condition may limit pile tolerances. It was agreed that the tolerance criteria should include unconditionally acceptable values together with additional allowable (conditional) deviations which can be accepted by the Architect-Engineer's Chief Structural Engineer on a case-by-case basis. Dr. Davisson will recommend to NRC tolerances on plumb, rotation and location for both conditional and unconditional acceptability. It was further agreed that out-of-tolerance piles driven more than about 10 to 20 ft into the ground should not be pulled because of possible damage to subgrade soils or other piles. The COE will recommend criteria for piles which can be pulled.

13. The "bonnet" type driving helmet causes some damage to pile butts and some eccentric loading during driving. It is possible that a "shoe" type helmet which fits the H-piles may be desirable.

    R. The convenience of pile driving will be significantly reduced with a shoe-type helmet because the crane would need to be squared to each pile. Thus, Dr. Davisson will provide recommended pile butt damage tolerances appropriate to the use of the bonnet-type helmet, probably a maximum stress criterion.

14. The inspection and testing program for pile installation has not been completely reviewed.

    R. We believe that the applicant has revised the QA/QC manual. The COE will complete the review of the latest QA/QC manual on inspection and testing. We agreed that the requirements should include full time inspection on each driving rig by a qualified and trained inspector. In addition, NRC should provide a similarly trained inspector at the site full time during pile driving.

15. The present driving criteria include requirements that piles should be driven to a resistance of 500 blows in the last 5 ft, 100 blows in the last 1 ft, and 10 blows in the last inch. At an adjacent site (Cargill grain elevator,

Burns Harbor, Port of Indiana) essentially identical piles are being installed, except the criteria require 18 blows in the last inch. However, these piles reportedly have a higher design capacity than the piles for the Bailly project. Also, the Burns Harbor piles penetrate a significant depth of dredged fill. We have not determined whether or not the requirement for 18 blows in the last inch should also be used at Bailly.

R. The adjacent project will be more fully investigated by NRC and the COE. The criteria for Bailly will then be re-evaluated based on this additional information. Dr. Davisson also will provide additional recommendations for driving resistance in the last few inches.

16. The construction sequences and methods for backfilling have not been adequately described by the applicant. It is our understanding that the applicant plans to excavate the entire plant area to lowest slab subgrade elevation and then to backfill to the various final subgrades. The method of backfilling around piles at about 3 ft spacing is unclear.

    R. The COE will prepare questions for us to submit to the applicant which will address these concerns.

17. The review of the applicant's analyses of the soil-pile-structure system during dynamic loading has not been completed.

    R. The Structural Engineering Branch, Dr. Hall and Dr. Hadala will complete the review of the dynamic analyses of the soil-pile-structure system prior to preparation of the SER. Dr. Hall will recommend to NRC whether or not the applicant should be permitted to continue driving piles before the review of the applicant's seismic design methods is completed.

    Dr. Davisson will make similar recommendations to NRC regarding the uplift and lateral load capacity of piles and pile groups.

Future Review Schedule

The input needed from the various consultants, as discussed above, will be incorporated into a set of requests for additional information and staff positions which will be submitted to the applicant. We anticipate that a draft

submittal to the applicant will be completed before April 14, 1980. Thus, we expect to meet with the applicant the week of April 14 or April 21. Contingent on the applicant's timely response to our questions and acceptance of our positions, our review of the acceptability of continuing pile driving is expected to be completed early in May, 1980.

Owen O. Thompson

Owen O. Thompson, Geotechnical Engineer
Geotechnical Engineering Section
Geosciences Branch, DSS

Attachment:
As stated

cc: w/attachment
D. Muller
R. Vollmer
D. Ross
D. Vassallo
S. Varga
L. Rubenstein
M. Lynch
J. Knight
G. Lear
F. Schauer
J. Ma
E. Gallagher, R-III
P. Barrett, R-III
L. Heller
O. Thompson
N. Gehring COE, Detroit
P. Hadala, COE, WES
M. Davisson, Consultant
W. Hall, Consultant
C. Beachem, Consultant
PDR
Local PDR

NRC Attendance List
March 10, 1980

Owen Thompson	Geosciences Branch, DSS
Richard Sause	Geosciences Branch, DSS
John Grundstrom	C of E, Detroit Dist.
William Otto	" " "
James W. Simpson	Corps of Engineer, N.C.D.
John F. Norton	Corps of Eng. North Cen. Division
W. J. Hall	NRC Consultant
Lyman Heller	NRC/GSB
M. T. Davisson	NRC Consultant
P. F. Hadala	USAEWES
John S. Ma	Structural Engr/NRC
Gene Gallagher	NRC RIII I:E
Paul Barrett	" " "
M. D. Lynch	NRC/DPM