



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

MAY 5 1980

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MEMORANDUM FOR: Robert L. Todesco, Assistant Director for Licensing  
Division of Licensing

FROM: George Lear, Chief  
Hydrologic and Geotechnical Engineering Branch  
Division of Engineering

SUBJECT REGULATORY STAFF POSITIONS AND REQUESTS FOR INFORMATION

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 Applicant's Response

Following our meeting with the applicant on April 17, 1980, we have revised our draft Regulatory Staff Position and draft Requests for Information which R. Jackson sent to L. Rubenstein on April 10, 1980. The Hydrologic and Geotechnical Engineering Branch (formerly Geosciences Branch) has developed (final) Regulatory Staff Positions and Requests for Information, as attached to this memorandum.

Please transmit this information to the applicant immediately and request a timely response to our questions so that we can maintain our review schedule. This review has been made by Dr. Owen Thompson, Geotechnical Engineering Section, with assistance from Corps of Engineers (Detroit) and Dr. M. T. Davisson, consultant.

George Lear, Chief  
Hydrologic and Geotechnical Engineering  
Branch  
Division of Engineering

Attachment:  
As stated

cc: w/o attachment  
H. Denton  
D. Eisenhut  
R. Vollmer  
H. Thornburg  
(Cont'd)

8065230037

cc: w/enclosure  
J. Knight  
D. Lynch  
L. Heller  
F. Schauer  
J. Ma  
G. Lear  
R. Shewmaker  
E. Gallagher  
P. Barrett  
S. Goldberg  
P. Crane  
O. Thompson  
N. Gehring, COE Detroit  
M. Davisson, Consultant  
W. Hall, Consultant  
PDR  
Local PDR  
R. Jackson

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PREPARED BY: Owen O. Thompson, Geotechnical Engineering Section, HGB, DE

SUBJECT: REGULATORY STAFF POSITIONS AND REQUESTS FOR INFORMATION  
(QUESTIONS)

RSP #1 We require that you submit daily records of production pile driving and re-driving to the on-site NRC pile inspector within 24 hours of driving or re-driving.

RSP #2 We require that your estimated contours of the top of the bearing strata be revised daily during the course of pile driving so as to continuously provide the most accurate estimate of the contours of the top of the bearing strata.

RSP #3 We require that any pile which exhibits relaxation during re-driving will be cited in a non-conformance report (NCR) by your QA organization, reviewed by your geotechnical and structural engineers, and that their evaluation will be submitted to NRC with copies to NRR for our review and acceptance.

RSP# 4 We require that you complete the pipe pile densification program for preconstruction areas as described in your submittal dated August 14, 1979, except that verification borings that involve removal of soil should be eliminated. Thus, in preconstruction area D, in lieu of additional borings, we require that you drive at least four densification piles within the area bounded by the four jetted piles to verify your position that additional densification in this area is not necessary.

We also require you to drive one pipe pile outside the area of any possible disturbance to provide comparative driving records. We also require that your evaluation of the satisfactory densification of each area be submitted to the NRC pile inspector and that the inspector's review and acceptance be completed prior to beginning driving of the production piles in these areas.

RSP# 5 While we will accept slightly greater pile placement tolerances than those proposed (i.e.,  $\pm 4$  inches in horizontal location  $\pm 10$  degrees in rotation and 2 percent out of plumb) on no more than ten percent of all safety-related piles (except replacement piles), we require you to have each of the piles exceeding the above specified placement tolerances cited in a non-conformance report (NRC) by your QA organization and reviewed and approved by your on-site structural engineer. In no foreseeable instance, however, will we accept pile placement tolerances which exceed  $\pm 12$  inches in horizontal location,  $\pm 20$  degrees rotation or 4 percent out of plumb; such piles must be replaced.

RSP #6 We require that a description of the technical background and experience of your on-site structural and geotechnical engineers who will process NCR's be submitted to NRC with copies to NRR for our review and approval prior to the start of pile driving.

RSP #7 We require that you provide a minimum vertical separation of at least 3 ft. for splices in adjacent piles. In addition, splices should not be made in the upper 20 ft. of safety related piles.

If such a splice is necessary, then an NCR shall be issued and its disposition approved by the on-site structural engineer. Furthermore, in such cases, longer adjacent piles must be furnished so that adjacent piles are not spliced in the upper 20 ft.

- RSP #8 We require that you perform field bending of reinforcing steel bars in the foundation mat, if this is necessitated by pile placement tolerances, in accordance with approved structural codes.
- RSP #9 We require that you abandon rather than pull, any pile which is driven below El.-10 or into the clay layer, but which does not comply with any of the required pile criteria. In abandoning such piles, we require you to cut these piles off at an elevation at least 12 inches below the bottom grade of the foundation mat.
- RSP #10 We require that you have a qualified inspector on duty, as described in your QC manual, for each pile driving rig in operation. We further require that you submit the qualifications and experience of each such inspector(s) to the NRC pile inspector for review and approval prior to any driving of safety-related piles.
- RSP #11 We require that safety related foundation piles be redriven in such a manner that the heave on any pile at the completion of pile driving is less than 0.5 inches. Each pile showing heave equal to or greater than 0.5 inches shall be cited in a non-conformance report (NCR) by your QA organization, reviewed by your geotechnical engineer and structural engineer, and their evaluation submitted to NRC with copies to NRR for our review and acceptance. If, at the

completion of pile driving, any pile should show heave in excess of 1.0 inches, it is expected that field testing (such as re-driving or load testing) will be required for qualification of that pile

RSP #12 We require that you monitor the settlements of all portions of the foundation mat during the construction of the Bailly plant.

To facilitate unambiguous settlement measurements, we further require that you establish at least four permanent bench marks anchored into the underlying bedrock outside the construction area. The elevations of these bench marks are to be established prior to any pile driving. Finally, we require that you document and submit to the NRC with copies to NRR, periodic settlement measurements at significant stages of the plant's construction; e.g., on each portion of the foundation mat prior to placing of subsequent sections, partial construction of the buildings, placement of major internals such as the reactor pressure vessel and completion of the buildings.

RSP #13 We require that you perform at least two tests designed to determine the long-term load bearing capacity of the safety-related piles. Specifically, we require that you perform these long-term load tests for a time period of at least 96 hours and until the rate of settlement is determined to be less than 0.01 inches per day measured over at least a 24 hour period. We require that the load in this particular test be 300 tons.

RSP #14 We require you to perform a number of load tests on the production piles in the manner presently described in your QC manual. These test piles must include:

- a) At least two piles with a Type "A" driving record (i.e., a rapid increase in driving resistance near final tip elevation), one located in the north part and one located in the south part of the site.
- b) At least two piles with a Type "B" driving record (i.e., an increase in driving resistance, followed by a decrease in driving resistance culminating in an increase in driving resistance near the final tip elevation), one located in the north part and one located in the south part of the site.
- c) At least two piles in those areas affected by preconstruction activities.
- d) At least two piles that heaved significantly (preferably more than 0.5 inch) to be tested before re-driving so that the effect of heave on pile capacity can be further checked; one of these test piles should be a shorter pile (less than about 40 ft length) and one should be a longer pile (more than about 60 ft length).
- e) At least two of the indicator piles which have not been driven or re-driven since the indicator pile program; one of these so-called "not recently re-driven indicator pile" tests should be on a pile in the heave cluster test group, and one should be outside this group.

In addition we require you to perform:

at least two lateral load tests and

at least three uplift load tests, one on a short Type "A"

pile and one on a short Type "B" pile, and one in a preconstruction area.

We require you to submit your basis for selecting the short-term load test piles to NRC with copies to NRR for our review and approval prior to performing these tests. Since additional short-term load tests may be required, depending on our review of the short-term load tests described above, you should provide the capability to perform these additional pile load tests.

RSP #15 We require that the pile cushion (i.e., the wire rope assemblage) behavior be documented in the pile driving records.

RSP #16 We consider it necessary to have a qualified NRC pile inspector on site during pile driving. The staff and its consultants also need to witness both typical and critical items of foundation construction. Accordingly, we require that you provide appropriate support facilities and services on the site for these activities.

RSP #17 We require that if there is a delay during driving of a pile, all of the driving resistance criteria must be met after driving is resumed.

RSP #18 We require that your QA/QC manual be revised to incorporate these regulatory staff positions.

- 362.22 Provide your analyses which show that the depth of penetration of piles into the bearing layer is significant to pile capacity. Thus justify your proposed criteria that all safety related foundation piles will penetrate at least 3 ft into the bearing layer as well as meet the driving resistances of 500 blows for the last 5 ft or less, 100 blows for the last one ft or less, and 10 blows per inch for each of the last 3 inches or less of penetration.
- 362.23 Provide a list of all indicator piles remaining in the ground which did not meet your proposed driving criteria during the indicator pile program. Also, list separately all indicator piles in the reactor, radwaste or other buildings which will be redriven.
- 362.24 Provide analyses of the behavior of pile numbers SF-31, SF-63, and SF-66 whose driving resistance values show apparent relaxation after redriving. Thus, show whether or not there could be relaxation and reduction of pile capacity with passage of time for piles at the Bailly site.
- 362.25 Provide criteria which will be used during redriving to identify relaxation, if such a phenomenon has occurred. That is, define how you will identify relaxation as it relates to data obtained during redriving piles.
- 362.26 Provide a detailed drawing of the site showing the pile locations, the orientation of pile axes, and a unique identification for each safety related pile. Also, show your presently proposed driving and load testing sequence.
- 362.27 Provide your criteria and describe your procedures to be used to recompact disturbed soil after a pile has been pulled.

- 362.28 Provide a description of your proposed settlement monitoring program.
- 362.29 In the pile testing program, some piles were cased from ground surface down to the proposed mat subgrade elevation in order to eliminate frictional resistance in this zone. However, the surcharge effects (i.e., the increased effective confining pressures) on the piles at lower depths were present on these cased piles but will not be present during plant service. Also, dewatering for excavation lowered groundwater levels during pile driving. Provide analyses and calculations which estimate the reduction in pile capacity after removal of the surcharge loading and rise of groundwater levels.
- 362.30 We are concerned that if the flanges of the piles are deformed during driving, the reduction in effective butt area may result in driving stresses exceeding the pile butt yield stress thereby reducing the effective driving energy reaching the pile tip. Accordingly, provide criteria, including justification, which will ensure that during the last five feet of driving, the pile butts will be trimmed if the flanges at the butt are excessively deformed.
- 362.31 Provide details of your proposed method of conducting the long-term load tests in which the maximum load will be held for at least 96 hours. In particular, provide details of the methods you will use to measure settlements.

362.32 Give details of your proposed construction sequence for the Bailly foundation. In particular, provide details of the excavation sequences for the category 1 buildings. Describe any constraints you will place on the contractor (protection of piles, types of equipment, dewatering plans, etc.)

Note the locations where sheeting will be required. Include criteria for the design of sheeting and its support. Describe whether the sheeting will be removed or left in place after it is no longer needed.

Discuss the chances of piles driven close to slopes "walking" down the slope. Describe the steps you will take if this happens.

Provide details of your method of compaction when backfilling slopes between buildings. Include descriptions of the type of compaction equipment, type of material and required results.

Give the details of your mat construction sequence. Include whether the contractor will be required to place segments of the mats in any particular order. Note whether there will be any stipulations about pour heights.

362.33 During pile driving, piezometric and groundwater levels must be monitored. The piezometers should be installed prior to beginning of pile driving and should be located in the zone of influence of the pile driving. Several piezometers should be installed at each location, with one located at the estimated pile tip elevation and others at appropriate elevations in upper clay layers. The piezometers should be monitored for pore pressure buildup as the result of pile driving.

The piezometer reports must include water levels, with changes during construction activities, and other pertinent information such as piles driven, rig location, and dewatering activities.

A minimum of four locations should be checked with one in a disturbed area and one in the area of anticipated maximum heave.

Provide details of your proposed piezometer and groundwater monitoring program.

- 362.34 Provide copies of your QA/QC manual, revised to incorporate your commitments to our Regulatory Staff Positions and your responses to our Requests for Information (Questions).