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

MAY 16 1980

Docket No.: 50-367

Northern Indiana Public Service Company
ATTN: Mr. H. P. Lyle
Vice President - Electric
Production and Engineering
5265 Hohman Avenue
Hammond, Indiana 46325

Dear Mr. Lyle:

SUBJECT: NRC STAFF POSITIONS AND REQUEST FOR ADDITIONAL INFORMATION
REGARDING THE BAILLY PILE PROPOSAL

In the course of our review of your proposal submitted on March 8, 1978, to install shorter safety-related piles as part of the foundation of the Bailly facility, we have developed positions regarding the implementation of your proposed pile design. These regulatory staff positions (RSP's) are contained in Items 362.01 through 362.19 of the attachment to this letter. We have also identified a need for additional information; our questions are contained in Items 362.20 through 362.29 of the attachment.

These positions and questions were developed from the draft positions and questions which served as the agenda for our meeting with you on April 17, 1980. There have been a number of modifications and additions to our draft positions and questions reflecting both our discussions on April 17th, the subsequent advice of our consultants and further review by us. Accordingly, the attached positions and questions supercede all other draft positions and questions previously transmitted to you.

We do not require a response to all parts of the attached questions (e.g., compaction criteria for backfilling slopes between buildings, Item 362.28) prior to reaching a decision on the acceptability of your proposed implementation of the pile criteria at the CP stage. However, we do encourage you to respond to such items in an expeditious manner so as to complete this phase of our review. Accordingly, please indicate your schedule for responding to the attached positions and questions.

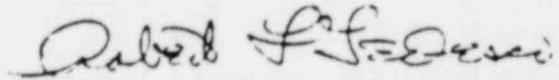
Mr. H. P. Lyle

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If you have any questions regarding our positions and requests for additional information, please contact us immediately.

Sincerely,



Robert L. Tedesco, Assistant Director
for Licensing
Division of Licensing

Enclosure:
As stated

cc w/enclosure:
See next page

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STATEMENT OF REGULATORY STAFF POSITIONS

AND

REQUEST FOR ADDITIONAL INFORMATION

360. HYDROLOGICAL AND GEOTECHNICAL ENGINEERING BRANCH362.0 Geotechnical Engineering Section

- 362.01 (RSP) 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 and re-driving.
- 362.02 (RSP) We require that your estimated contours of the top of the bearing layer be revised daily during the course of pile driving. The intent of our position is to have available the most accurate estimate of the contours of the bearing layer.
- 362.03 (RSP) We require that any pile which exhibits relaxation during re-driving be cited in a non-conformance report (NCR) by your QA organization. We further require that these NCR's be reviewed by your geotechnical and structural engineers and that their evaluation be submitted to the OIE, Region III, with copies provided to NRR for our review and acceptance.
- 362.04 (RSP) Prior to beginning driving production piles in the areas you have designated as preconstruction areas, we require that you perform the pipe pile densification program proposed in your submittal dated August 14, 1979, for these areas. However, verification borings that involve removal of soil should not be performed. Accordingly, 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 belief 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. Finally, we require that your evaluation of the satisfactory densification of each area be submitted to the on-site NRC pile inspector and that the NRC inspector's review and acceptance be completed, prior to beginning driving of the production piles in these areas.
- 362.05 (RSP) While we will accept slightly greater pile placement tolerances than those you have proposed (i.e., ± 4 inches in horizontal location, ± 10 degrees in rotation and 2 percent out of plumb)

on no more than ten percent of all safety-related piles, we require you to have each of the piles exceeding the above specified placement tolerances cited in an NCR by your QA organization and reviewed and approved by your structural engineer. In no foreseeable instance, however, will we accept pile placement tolerances which exceed + 12 inches in horizontal location, + 20 degrees rotation or 4 percent out of plumb; such piles must be replaced. The additional piles which replace those piles that are abandoned because they exceed the proposed tolerances, are not to be included in determining whether you have exceeded the ten percent limitation.

- 362.06
(RSP) We require that a description of the technical background and experience of your structural and geotechnical engineers who will review NCR's related to pile replacement under safety-related structures, be submitted to OIE, Region III, with copies to NRR for our review and approval prior to the start of pile driving.
- 362.07
(RSP) We require that you provide a minimum vertical separation of at least 3 feet for splices in adjacent piles. In addition, splices should not be made in the upper 20 feet of safety related piles. In the event a splice is required in the upper 20 feet of a pile, an NCR shall be issued and its disposition approved by your structural engineer. In such cases, we require that you place longer piles adjacent to the pile spliced in the upper 20 feet so that no further splicing in the upper 20 feet of adjacent piles will be necessary.
- 362.08
(RSP) 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.
- 362.09
(RSP) We require that you abandon rather than pull, any pile which is driven below an elevation of - 10 feet or into the clay layer, but which does not comply with any of the required criteria for pile placement. In abandoning such piles, we require you to cut the abandoned piles off at an elevation at least 12 inches below the bottom grade of the foundation mat. For this position, the elevation of the clay layer is to be estimated from the stratigraphy determined by your on-site borings.

- 362.10 (RSP) 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 on-site NRC pile inspector for review and approval prior to any driving of safety-related piles.
- 362.11 (RSP) 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 an NCR by your QA organization, reviewed by your geotechnical engineer and your structural engineer. Their evaluation of each NCR must be submitted to OIE, Region III, with copies provided 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 we will require either redriving or load testing prior to acceptance of that pile.
- 362.12 (RSP) We require that you monitor the settlements of all portions of the foundation mat during the construction of the Bailly plant. In this regard, we request that you provide a description of your proposed settlement monitoring program. 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 OIE, Region III, with copies provided 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.
- 362.13 (RSP) 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: (1) the rate of settlement is determined to be less than 0.01 inches per day measured over at least a 24 hour period; (2) or you determine that the pile being tested has failed. We require that the load in this particular test be 300 tons. In this regard, provide the details of your proposed method of conducting these long-term load tests, including your proposed methods of measuring the settlement of the test piles.

362.14
(RSP)

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

- a. At least two piles with Type "A" driving records (i.e., a rapid increase in driving resistance near final tip elevation), one of which is to be located in the northern portion of the site and one located in the southern portion.
- b. At least two piles with Type "B" driving records (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 of which is to be located in the northern portion of the site and one located in the southern portion.
- c. At least two piles in those areas affected by preconstruction activities.
- d. At least two piles that heaved significantly (i.e., more than 0.5 inch); these piles are to be load tested before redriving so that the effect of heave on pile capacity can be further checked; one of these test piles should be a shorter pile (i.e., less than about 40 feet in length) and one should be a longer pile (i.e., more than about 60 feet in length).
- e. At least two of the original indicator piles placed during 1978 which were not redriven at least one year prior to the present load test; one of these load 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. The latter should include a short Type "A" pile, a short Type "B" pile and one in an area designated by you as a preconstruction area. We require that you submit your bases for selecting the short piles for the uplift load tests to the OIE, Region III, with copies to NRR for our review and approval prior to the start of this particular test.

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- 362.15 We require that the pile cushion (i.e., the wire rope assemblage) behavior be documented in the pile driving records.
(RSP)
- 362.16 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 Bailly site for these activities.
(RSP)
- 362.17 We require that if there is a delay during driving of a pile, all of the driving resistance criteria be met after driving is resumed.
(RSP)
- 362.18 During pile driving, we require you to monitor piezometric and groundwater levels. In particular, piezometers must be: (1) installed prior to pile driving; (2) located in the zone of influence of the pile driving, with one placed at the estimated pile tip elevation and at least two others at appropriate elevations in the upper clay layers; and (3) established at a minimum of four locations with one in an area designated by you as a preconstruction area and one in the area of the maximum anticipated heave. The purpose of these piezometers is to monitor pore pressure buildup as the result of pile driving. We further require you to periodically submit reports of the piezometer readings to the OIE, Region III, with copies provided to NRR. These reports must contain the water levels, any changes during construction activities, and other pertinent information including which piles were driven during the reporting period, the rig location, and dewatering activities. In this regard, provide details of your proposed piezometer installation and groundwater monitoring program.
(RSP)
- 362.19 We require that your QA/QC manual be revised to incorporate the regulatory staff positions, discussed above (i.e., 362.01 through 362.18 of this attachment). In this regard, provide copies of your revised QA/QC manual reflecting our positions and responding to our questions (i.e., 362.20 through 362.29).
(RSP)
- 362.20 Provide your analyses which show that the depth of penetration of piles into the bearing layer is significant to pile capacity. Specifically, provide justification for the criteria you proposed at our meeting with you on April 17, 1980, that all safety-related foundation piles penetrate at least 3 feet into the bearing layer. We understand that this latest proposed driving criterion is an addition to the previously proposed driving resistance criteria of 500 blows for the last five feet or less, 100 blows for the last one foot or less, and 10 blows per inch for each of the last 3 inches or less of penetration.

- 362.21 Provide a list of all indicator piles presently in the ground which did not meet your proposed driving criteria during the indicator pile program. Additionally, provide separate lists for each safety-related structure, of all indicator piles which will be redriven.
- 362.22 Provide analyses of the behavior of pile numbers SF-31, SF-63, and SF-66 whose driving resistance records indicate apparent relaxation after redriving. Accordingly, show whether relaxation could occur with a consequent reduction of pile load capacity with time for piles at the Bailly site.
- 362.23 Provide your proposed criteria which will be used during redriving to determine whether relaxation has occurred; i.e., indicate how you will identify relaxation from the data obtained during redriving piles.
- 362.24 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. Additionally, provide your proposed driving and load testing sequence.
- 362.25 Provide your criteria and describe your procedures to recompact soil disturbed by the process of pulling out a pile
- 362.26 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, surcharge effects (i.e., the increased effective confining pressures) were present on the embedded portion of these cased piles but will not be present during plant service. Additionally, groundwater levels have been lowered during the indicator pile program and will be similarly lowered during placement of production piles. Accordingly, provide your analyses which estimate the reduction in pile capacity after removal of the surcharge loading and after the rise of groundwater levels when dewatering operations are halted.
- 362.27 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.

- 362.28 Provide details of your proposed construction sequences for the Bailly foundation. In particular, provide details of the excavation sequences for the safety-related structures. Describe any constraints you will place on the pile contractor (e.g., protection of piles, types of equipment and dewatering plans). Indicate the locations where sheeting will be required. Provide your proposed criteria for the design of sheeting and its lateral support. Indicate whether the sheeting will be removed when it is no longer needed. Discuss the probability of piles driven close to slopes "walking" down the slope. Describe the steps you will take if this happens. Provide details of your proposed method of compaction when backfilling slopes between buildings, including descriptions of the type of compaction equipment, type of material and the acceptance criteria for the degree of compaction you propose to achieve. Describe in detail, your proposed mat construction sequence, including whether the contractor for the foundation mat will be required to place segments of the mats in any particular order. Indicate whether there will be any restrictions regarding the maximum height of concrete pours.

- 362.29 (This question was previously asked in our letter to you dated March 28, 1980, and is repeated here for the sake of completeness.)

Indicate the methods used to measure the values of the soil pH and resistivities listed in Table 1 and 2 of Cornet's report, dated July 20, 1978, on the corrosion potential of the Bailly piles. Specifically, indicate whether standard ASTM tests (i.e., Standard G 57-78, Part 10, page 902, of the 1978 ASTM Annual Book of Standards) were used or whether you used standard NACE tests. Additionally, provide a brief description of the tests which were used.