

ENCLOSURE

Review of Foundation Construction
and Water Control Measures

Background

On November 2 & 3, 1979, the site received heavy rainfall of 5 3/4 inches which caused severe erosion around and possibly under seismic Category I foundations of the control building, and containment units 1 and 2. Other parts of the site also were damaged.

On November 14, 1979, NRC became aware of the problems during a routine site visit by J. Harris, I&E Region II inspector. As a result, backfilling and concreteplacement in affected areas were halted, as described by I&E Region II in a Confirmation of Action Letter dated Nov. 15, 1979, from J. O'Reilly, I&E, to J. H. Miller, GPC. Resumption of limited work was approved by I&E Region II on Nov. 13, 1979, in a Confirmation of Concurrence letter from J. O'Reilly, I&E, to J. H. Miller, GPC. Following a conference call between NRR and I&E on November 27, 1979, we requested that the limited work authorized should be modified to include restrictions on removal of disturbed material until subsurface water levels have been established.

Our observations of the water problems are described in the attached trip report. We find that there are two, related problems:

surface water problems -- intermittent problems caused by inadequate grading and drainage and which resulted in erosion damage after a heavy storm.

subsurface water problems -- ongoing problems along the north wall of the auxiliary building. The source of the water is not, at this time, known and no damage has resulted but construction has been delayed. The seepage under containment unit 2 may be a subsurface water problem and may have caused damage.

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Recommendations

Based on our observations of the water problems at the site, we recommend that the design and construction of foundations should be carefully reviewed by NRR and I&E.

1. The existing subsurface water conditions and future changes in these conditions must be determined -- probably from piezometric installations. The critical area extends north of the auxiliary building to the fill under the turbine generator building, and encompasses containment units 1 and 2, and the control building. The subsurface water study should be designed to show the probable source of water near the auxiliary building, within containment unit 1, and under containment unit 2 tendon gallery, i.e., whether the source is rainfall within the excavation or seepage across the perimeter drain (around the edges of the excavation).
2. After the subsurface water conditions are understood, a method(s) for handling this water during construction must be developed by the licensee and submitted to NRC for review and approval.
3. Surface grading and drainage must be corrected to handle rainfall and to mitigate any further erosion.
4. Foundations which possibly have been damaged must be evaluated to determine the extent of damage. Corrective measures must then be developed by the licensee and submitted to NRC for review and approval.
5. Special attention must be given to monitoring the performance of foundations in the vicinity of the erosion damage. The monitoring settlements and piezometric levels should continue at least through the completion of construction.

6. There are indications that the foundation details may have been modified since the PSAR was submitted in 1972. Since it is likely that a temporary dewatering system will be needed in the vicinity of seismic Category I structures, any variances from the PSAR submittal will need to be updated and reviewed in conjunction with the review of the proposed dewatering system.
7. We have informally notified Hydrology-Meteorology Branch, DSE, and Structural Engineering Branch, DSS, of the recent events relating to foundations at the Vogtle plant. We recommend that these branches continue to be informed of developments and to perform reviews in their areas, as appropriate.

Requests for Information from the Licensee

In order for us to proceed with our review of the safety of the foundations at the plant we need the following information from the licensee.

1. Submit the results of subsurface water level determinations as obtained from piezometer installations or other methods. Include an interpretation of the source of water, and estimated direction and rate of flow.
2. Provide details of criteria and method(s) proposed for handling subsurface water, to NRC for our review and approval before commencing dewatering operations.
3. Provide cross sections showing (as of mid-November, 1979) marl elevations, foundation elevations, existing ground surface elevations, estimated locations of disturbed materials, and subsurface water levels. Include cross sections at least along the following lines.
 - A. east-west extending beyond both containments
 - a) at the wall north of auxiliary building
 - b) at the centerline of containment units 1 and 2
 - c) at the toe of the slope on the south side of turbine generator building
 - d) at the top of the slope on the south side of turbine generator building

- B. north south from turbine generator building to auxiliary building
 - e) at centerline of containment unit 1
 - f) at centerline of plant
 - g) at centerline of containment unit 2
- C. oblique directions, as necessary to show details of potentially disturbed areas at the southwest corner of containment unit 1, southeast corner of control room electrical tunnel, northwest corner of containment unit 2, and northeast corner of control building.

These cross sections may also be used to show actual areas of disturbed materials as such information becomes available. The cross sections generally should have equal vertical and horizontal scales.

- 4. Provide a detailed foundation plan of the area bounded by the north side of the auxiliary building, east side of containment unit 1, west side of containment unit 2, and east-west centerline of turbine generator building. Show (as of mid November, 1979) existing foundations, existing mud mats, contours at 1 ft intervals, notes indicating in general terms the extent of existing construction above the foundations, the estimated areal extent of disturbed materials, location of settlement monuments, and location of piezometers (indicating which are temporary and which are permanent). This plan may also be used to show actual areas of disturbed materials as such information becomes available.
- 5. For foundation construction, identify all areas of departure from the details specified in the PSAR and amendments.

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6. When the subsurface water regime has been established, provide details of the corrective measures which will be adopted to replace or repair any damage to existing mud mats or foundation soils. Include the methods to be used to handle contingencies such as loose or disturbed materials extending close to or below foundation elevation, and such as ground water closer than 2 ft to firm, suitable material remaining after removal of unsuitable soil. Describe in detail the inspection and testing procedures to be adopted as criteria for acceptance of suitable material. Include, in addition to visual inspection and field density/moisture testing, a method of probing or evaluating materials 3 to 4 ft below exposed suitable surfaces. Provide a commitment to notify NRC in advance of your intention to expose critical areas identified in request #3 above so that inspection can be made.
7. For the area delineated in request #4, above, provide available results and details of the settlement monuments and settlement measuring program. Include the location and type of settlement monuments, frequency of measuring, program for analyzing settlement data and accuracy of readings.
8. Provide details of the piezometer installations. Include the location and installation details of piezometers and their identification as temporary (in foundation areas) or permanent (outside foundation areas and thus unseable at least throughout construction). Indicate the proposed frequency of measuring piezometric levels and the program for analyzing piezometric data.

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9. Provide a plan showing details of the surface water management program. Explain how this program will channel surface water away from foundations and slopes so as to preclude a recurrence of damaging erosion.
10. Provide the design basis for construction slopes around seismic Category I structures. Specify the minimum acceptable building set-back distances from the top of slopes and maximum acceptable slopes. Include a discussion of the effects of lateral strain near the face of slopes on the integrity of footings above slopes. Specify the minimum acceptable factor of safety for construction slopes and show that all construction slopes around seismic Category I structures have met and continue to meet these criteria.
11. Provide details of the perimeter drainage system around the edges of the main excavation and within the excavation. Show the locations of structures and their foundation elevations in relation to the drains. Describe the decommissioning proposed for temporary drains.

These requests for information are preliminary and we expect that additional information will be needed for us and for Hydrology-Meteorology and Structural Engineering branches.

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