ENCLOSURE 2

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

MAR 0 5 1985

MEMORANDUM FOR: Dennis M. Crutchfield, Assistant Director
for Safety Assessment, DL

FROM: James P. Knight, Acting Director
Division of Engineering

SUBJECT: COMMENTS ON LP&L'S RESPONSE TO STAFF AFFIDAVITS
FILED IN WATERFORD PROCEEDING

This is in response to your memorandum of February 5th. Enclosed is a consolidated set of comments prepared by BNL and myself regarding the LP&L response and the views of Dr. Chen and Dr. Ma with regard to that response.

We have addressed only those comments that we feel are significant with respect to the matters before the ASLAB.

James P. Knight, Acting Director
Division of Engineering

Enclosure: As stated

Staff Comments on Further Submittals
to the ASLAB Regarding Waterford Unit No. 3 Basemat

With regard to the affidavit of J. L. Ehasz, dated January 7, 1985, on behalf of the applicant:

In Mr. Ehasz's answer to Question 10, reference is made to a BNL mistaken impression about the construction sequence (as presented in the July 18, 1984 BNL report). He states, "After learning that the soil backfill was not placed after construction of the superstructure, BNL modified its conclusion....". On page 11 of the July 18, 1984 BNL report (BNL report) a statement is made, "It should be noted that there was, in fact, no period in which the superstructure was fully completed before the backfill was placed....". Therefore the referenced BNL report is based upon the same construction sequence as referred to by Mr. Ehasz and BNL was not "under a mistaken impression" of the construction sequence.

The conclusion on page 26 of the BNL report referenced in Mr. Ehasz's answer refers to the cause of the crack pattern. At the time that the particular statement was written, the primary focus of the BNL work was on cracks outside the RCB. Based on examination of the HEA computed bending moments. BNL concluded that the cracks running at an angle of about 45° to the E-W axis probably occurred during placement of the superstructure (see pgs. 4-12 of the BNL report). Certainly all of the cracks have occurred because of some differential settlement combined with some load acting on the slab. In the staff's view neither differential settlement or load acting alone could have caused the majority of the cracks to occur.

With regard to the memo of Dr. J. T. Chen dated January 27, 1985:

(1) With regard to Dr. Chen's second comment it is important to note that the 10" settlement was a uniform settlement occuring over approximately a two and one half year period and not differential settlement between blocks. Such uniform settlement is not germane to discussion of stresses developed by differential settlement. See (4) below.

(2) Dr. Chen provides a characterization of the basemat shape that does not account for the time sequence of block placement. We believe this provides little useful information regarding the actual basemat curvature.

(3) With regard to Dr. Chen's fourth comment, we believe that the BNL study prepared for the staff was a careful and knowledgeable review of all the information germane to the adequacy of the Waterford basemat. Specifically, as portrayed in the BNL report filed as part of the staff testimony the data presented by the licensee was employed to calculate the magnitude of the immediate settlements that would likely be sustained by a slab block placed on the soil types identified at Waterford. BNL ascertained that the measured immediate settlements agreed with the calculated results. In addition, we believe it evident that if there were any significant variation in immediate block settlements across the site, the discrepancies would have been noted in the measured deflections of the other blocks already placed; no such indications were reported. The conclusions of the staff remain unchanged. The measured immediate settlements, together with calculations based on the laboratory data, the continuous long term settlement measurements that have been taken of the slab, and the measured field and laboratory data, all support the conclusion that the soils at the site are uniform and that all the settlements are caused not by any near surface soft spot but rather by the compression of the entire silt and clay soil under the slab to a depth of about 300 feet as expected.

The term "assumed" with regard to initial settlement measurements is, we believe, a misnomer. Whereas the initial settlements were not all measured directly on each block the licensee has reported that the approximate values of the initial settlement of each block were derived from the measured values on adjacent blocks throughout construction of the basemat.

(4) Dr. Chen's item (5) appears to be a subtle point of little significance.

(5) We believe that both the staff and licensee submittals make a strong showing that the stresses induced by differential settlement are small to insignificant. Comparison of the recent NDT mapping as compared to the older mapping by HEA in 1977 to construe the continued occurrence of cracking is, we believe, of limited use since a direct comparison of the cracks under the reactor building by the same method is impossible. In fact, the NDT has indicated the cracks to all be tight, more indicative of a stable situation with no further growth.

(6) Dr. Chen's last point is addressed in our first response to Dr. Ma's comments.

With regard to the comments of Dr. J. S. Ma dated January 31, 1985:

(1) Dr. Ma implies that the applicant has changed his position regarding the significance of the sidewall forces in developing the shear capacity of the mat. This is not the case. As stated in Mr. Ehasz's affidavit, the shear capacity of the mat in the vicinity of the cracks is more than adequate to resist the required shear force. The ACI code shear friction capacity is cited by the applicant in support of this conclusion. There is no need, for the applicant to rely on the sidewall forces. The sidewall forces do in fact exist and provide significant additional assurance that it is highly unlikely that the cracks in the mat could be of any significant width throughout the service life of the plant.

(2) Dr. Ma indicates that the crack widths are important in evaluating the potential for shear slip across the crack during a seismic event. Everyone agrees with this, the data provided by Dr. Ma (see enclosure 1 of his memo) may be used to show that the potential shear slip is minuscule even for the most pessimistic assumptions. Even if the shear stress in the mat is to be taken 300 psi (most realistic estimates place it at less than 200 psi) and the crack widths to be 0.020 inches (the measured data indicate the widths to be less than 0.010 inches) the maximum shear slip across the crack would be 0.014 inches according to the data provided by Dr. Ma. We believe, it is beyond reason to postulate that a deformation of this order of magnitude could significantly influence the seismic response of structures mounted on the mat.

(3) Dr. Ma stated that Professor Holley's affidavit alluded to crack widths of 0.015 inches. Professor Holley cited this value as the maximum width that could exist in the cracks under the RCB. The measurements taken by Muenow indicated that the cracks were closed to widths on the order of 0.005 inches. Because of the length of the NDT transmission necessary to probe paths under the RCB, there is a relatively large tolerance in the crack width measurements

taken there. To be conservative, Holly adds the tolerance to the measured widths to arrive at the 0.015 inch width. He concludes that even this width would not be of concern.

(4) Dr. Ma in a statement on page 2 of his review states that in the opinion of people he consulted, the response of the cracked basemat and superstructure under seismic excitation would be different from that of an uncracked basemat. There is no fundamental disagreement on this point. The question of course is how much do the two responses differ. The BNL calculations submitted as part of the staffs affidavit, usingan extremely conservative characterization of the loss of shear capacity due to cracking, showed that under horizontal excitation the differences were negligible while for vertical excitation member shear forces differed by a maximum of twenty percent. It should be realized however that responses due to both horizontal and vertical excitations must be combined to yield a total response. Since the vertical excitation response was much lower than that caused by the horizontal excitation, the net result was that the combined (SRSS method) shear forces from the cracked case differed by only 1% from the uncracked case.