February 21, 1992

Docket Nos. 50-315
and 50-316

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Mr. E. E. Fitzpatrick, Vice President
Indiana Michigan Power Company
c/o American Electric Power Service
Corporation
1 Riverside Plaza
Columbus, Ohio 43216

Dear Mr. Fitzpatrick:

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION, D. C. COOK UNITS 1 AND 2 SPENT FUEL POOL RERACKING (TAC NOS. M80615 AND M80616)

In conducting our review of your July 26, 1991 submittal relating to the above subject for your facilities, the Structural and Geosciences Branch have identified the need for additional information as described in Enclosure 1. In order for us to maintain our review schedule, we request that you respond to our request for additional information within 45 days receipt of this letter.

Sincerely,

/s/

John Stang, Project Manager
Project Directorate III-1
Division of Reactor Projects III/IV/V
Office of Nuclear Reactor Regulation

Enclosure:
As stated

cc: See next page

OFC	LA/PDIII-1	PM/PDIII-1	PD/PDIII-1		
NAME	MShuttleworth	JStang:jkd	LBMarsh		
DATE	02/21/92	02/21/92	02/21/92		

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AA-3

Mr. E. E. Fitzpatrick
Indiana Michigan Power Company

Donald C. Cook Nuclear Plant

cc:

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Enclosure

REQUEST FOR ADDITIONAL INFORMATION
DONALD C. COOK NUCLEAR PLANT
RERACKING THE SPENT FUEL POOL
DOCKET NOS. 50-315, 50-316

1. Page 2-18

With regard to figure 2.2.1 "Cook Spent Fuel Pool Layout," please describe as to what occupies each shaded area by providing size of equipments and machines, if any. Also, provide the elevation of the shaded area with respect to adjacent pool floor. Is the elevation of the shaded area level with the pool floor or recessed? Discuss if there is any barrier around the cask area to restrict translational movement of racks E4 and G.

2. Provide drawings for the racks that depict dimensions including thickness of various members, weld locations and sizes, weight of the racks and fuel assemblies such that one may be able to perform engineering stress calculations. Also provide pool dimension that indicates relative position of racks to pool including water level during operation and, also, during refueling.

3. Page 6-8

In page 6-8, it is stated that the Coulomb friction between the racks and pool liners must be simulated by appropriate piecewise linear spring. Pro vide exact mathematical formulation of model and also discuss theoretical and experimental bases for the model. Discuss your representation of Coulomb friction damping with the model discussed in reference 4 and explain the differences.

4. Page 6-12

Discuss in detail what numerical values are used for the hydrodynamic masses with associated discretized rack mass. Provide a quantitative discussion as to how such values are calculated including supporting experimental bases particularly with regard to multi-mass system and narrow-gaps. Note that the reference 6.5.1 of the submittal only discusses idealized simple objects. One should also note that, in the reference, the model assumes irrotational flow in the derivation whereas some of the experiments performed in the reference 6.5.1 realized turbulence.

5. Page 6-17

The governing equation of the motion presented in page 6-17 is stated to be a representative of a system of twenty-two degree of freedom. Also, they are highly nonlinear because of gap, fluid structure interaction and friction damping. The proprietary code "DYNARACK" is said to perform numerical solution of the equation using a central difference scheme. We have reviewed a similar submittal in Fitzpatrick application and had several questions with regard to the numerical analysis of the finite central difference application. In particular, for a stable system (this is determined by experiments), one should demonstrate that the governing

equation and the numerical scheme is "well posed" in a form discussed in reverence 3. Otherwise, one should define carefully unstable regions of the rack response from experiments and demonstrate that "DYNARACK" simulates unstable response adequately and is able to bound the results such that it can provide a conservative design (reference 1 and 2).

Alternatively, the following information should be provided to resolve the questions:

(a) Two extreme cases of the rack boundary conditions consist of one fully fixed base rack and the other case a rack completely free of friction at the base. Rack response to the fully fixed case may represent the most extremely stressed case where as the case with frictionless base may produce a maximum potential of a rack to pool wall or to an adjacent rack. Understanding of these two extreme cases would provide a confidence in assessing rack responses. Please provide calculations for these cases,

(b) Associated physical experiment performed by you as well as by others which would support the adequacy and engineering validity of your analysis code.

References:

(1) Holems, P. J., and Shaw, S. W., "A Periodically Forces Piecewise Linear Oscillator" Journal of Sound and Vibration 1983.

(2) Thompson, J. M. T., and Ghaffari, R., "Chaos After Period-Doubling Bifarcations in the Resonance of an Impact Oscillator" Physics Letters, 1982 (Vol. 2A, Number 1).

(3) Issacson, E., and Keller, H. B., "Analysis of Numerical Methods" John Wily and Sons, New York, 1966.

(4) Stoker, J. J. "Nonlinear Vibrations," Interscience Publishers, New York, 1966.