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Metropolitan Edison Company
Reading, Pa. 19603
John G. Miller

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Dr. Peter A. Morris

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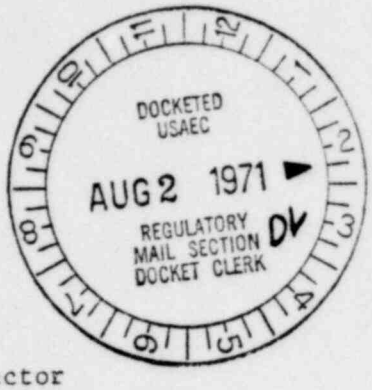

July 30, 1971

Dr. Peter A. Morris, Director
Division of Reactor Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

SUBJECT: THREE MILE ISLAND NUC STATION UNIT 1
DOCKET NO. 50-289

Dear Dr. Morris:

Enclosed please find a summary of the report which evaluated the concrete placed in the TMI #1 fuel pool wall in January 1971. This subject has also been discussed with compliance personnel. The summary was requested by your Mr. Arndt during a DRL meeting held in Bethesda on June 29, 1971.

We trust that this summary will adequately answer your questions concerning this problem.

Very truly yours,

John G Miller
Vice President

JGM:DHR:mw
Enclosure

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THREE MILE ISLAND NUCLEAR STATION

FUEL HANDLING BUILDING CONCRETE WALL
GAI - 4192

On January 8, 1971 concrete was placed in a 5 foot thick reinforced concrete wall in the Fuel Handling Building. The ambient temperature was between 14-18° F. The constructor had scheduled this concrete placement to be done under normal cold weather concrete conditions.

Inadequate heating prior to concrete placement resulted in in-place concrete surface temperatures varying from 28° F. to 34° F. The GAI specification in reference to ACI 306, "Recommended Practice for Cold Weather Concreting", Table 1.4.1 for moderately massive section requires fresh concrete as placed to be not less than 45° F. In addition all surfaces to be in contact with the new concrete should be raised to as close as practical to the temperature of the new concrete, i.e. 45° F.

The west wall of the fuel storage pool is an interior wall and designed for the combined effect of dead load, hydrostatic pressure, and earthquake. This wall will therefore not be exposed to aircraft impact. Specified minimum compressive strength of the concrete is f'_c = 5,000 psi. The maximum compressive bending stress in the concrete at the location of the construction joint is 270 psi. The maximum shear stress at the same location is less than 10 psi.

The concrete was placed with crane and bucket and deposited through 10" diameter chutes located 3' on centers. The temperature of the fresh concrete as mixed varied between 56-67° F.; minimum required is 55° F. The lowest temperature of fresh concrete as placed was 46° F.; minimum required is 45° F. The wall was covered with a tarp tent with propane heaters inside, maintaining a temperature varying between 54-62° F. for the following 3 days; minimum required is 45° F. The form was left in place for an extended period. The concrete placement and curing conformed to the specification.

The critical part of this wall is the construction joint between the old and the new concrete. In order to evaluate the structural effect of the in-place concrete due to the low temperature of the old concrete surface, core drilled specimens were taken at the construction joint, which would be the primary location for any detrimental effect. The core drill specimens, approximately 4" in diameter, were tested in compression and by tensile splitting. In addition microscopic examinations were performed in order to determine any signs of freezing.

The induced compressive stress in the concrete is low. The wall is under-reinforced and therefore not dependent upon developing its ultimate capacity, f'_c = 5,000 psi. The 5 foot wall thickness was required for biological shielding. Compressive strength of the core drilled specimen was 4,050 psi. Core drilled concrete tests made to check adequacy of strength in-place must be interpreted with judgement. The test results cannot be translated in terms of standard concrete test cylinders with any degree of confidence, nor should they be expected necessarily to exceed the specified strength. Section 4.3.5.1 of the proposed revision of ACI 318-63, ACI Journal, February, 1970, states that, " - - no single core should be less than 75% of f'_c". That is 0.75 x 5000 = 3,750 psi. Examining the fractured compressive stress specimen (after testing) showed that about 50% of the construction joint plane was exposed and the remaining fracture were in both the old and new concrete. This would indicate that the low temperature has not affected the compressive strength at this location.

The entire shear can be resisted entirely by the construction joint shear key, without depending upon bond transfer between old and new concrete.

The ability of this concrete to resist tensile stress is not a design requirement. However, any indication of freezing would reduce the tensile bond normal to the construction joint. The tensile splitting test of the core drilled specimen will therefore only be used as a measure of the effect of freezing on this joint. The core drill specimen, with the construction joint

going through the vertical axis, was tested to develop maximum tensile stress normal to the joint. The effect of freezing could reduce or even eliminate the tensile ability through this joint. The tensile splitting strength of the core drill specimen was 395 psi. Examining the fracture of the tensile splitting test specimen showed that a double split occurred during the test simultaneously; one in the construction joint and another approximately 1/2 inch parallel to the construction joint in the adjacent concrete. This would indicate that the low temperature has not affected the tensile bond at this location.

The microscopic examination of core specimens indicated no frost prints or other indications of freezing which would adversely affect the concrete bond.

Bending and shear stresses at the location of this construction joint are small. Therefore, the construction joint as designed far exceeds its functional requirements. Based on the above discussion it is our opinion that the wall will fullfil all the requirements in terms of service, durability and safety.