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Dalwyn R. Davidson
VICE PRESIDENT
SYSTEM ENGINEERING AND CONSTRUCTION

June 14, 1982

Mr. James G. Keppler
Regional Administrator, Region III
Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, Illinois 60137

RE: Perry Nuclear Power Plant
Docket Nos. 50-440; 50-441
Final Report on Incomplete Fill
Detected in Biological Shield
Wall Concrete, Units 1 and 2
[RDC 42(81)]

Dear Mr. Keppler:

This letter serves as the Final Report required by 10CFR50.55(e) concerning incomplete fill of the biological shield walls of both reactor buildings. Initial notification that this condition was under evaluation by The Cleveland Electric Illuminating Company was made by Mr. E. Riley to Mr. L. McGregor of your office on December 1, 1981. This condition was subsequently detailed in our Interim Report dated December 23, 1981.

This report includes a description of the deficiency, an analysis of the safety implications, method of evaluation, and the corrective action taken.

Description of the Deficiency

During the initial radiation scan it was noted that there were extremely reduced radiation attenuation factors in two cells of the Unit 2 reactor bioshield wall. Access holes were cut through the 1 inch thick carbon steel plate of the bioshield to permit direct visual inspection. This inspection revealed incomplete heavyweight concrete fill of these cells. Additional radiation scans were performed on both Unit 1 and 2 bioshields to determine the extent of incomplete fill. This deficiency was documented on Nonconformance Report P020-0258.

Analysis of Safety Implication

The Biological Shield Wall is a protective shield wall surrounding the reactor vessel designed to limit radiation damage to drywell equipment during operation and permit personnel to work in the drywell during reactor shutdown. If the shield deficiency had gone undetected and the reactor had gone into full power operation, the radiation levels outside the deficient locations would have

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exceeded the drywell environmental design conditions and potentially compromised drywell equipment integrity. However, this eventuality is unlikely because if the deficiency had gone undetected during the plant's construction phase, it would have been discovered during the low power testing radiation survey. This shield deficiency does not compromise the structural integrity of the Biological Shield Wall because the steel portion of the wall does not rely on the interior high density concrete for support.

Method of Investigation

A radiographic survey employing gamma spectrometry techniques has been performed on the Unit 1 and Unit 2 bioshield walls. Measurement location criteria were initially based upon construction joints between concrete pours and points most likely to exhibit reduced concrete densities (i.e., below horizontal stiffener plates, beneath penetrations, etc.). Subsequent measurement locations were specified to account for structurally similar areas which were identified as deficient in the initial radiographic survey.

...Unit 1 Survey Results

A total of 233 measurements were taken at 152 locations on the Unit 1 bioshield wall. Multiple measurements were taken at some locations to envelope areas of reduced density. These measurements indicate that normal attenuation factors and concrete densities are present at 123 of the 152 locations. Attenuation factors greater than those expected are present at 4 locations. Reduced attenuation factors are present at 10 locations and extremely reduced attenuation factors are present at the remaining 15 locations.

...Unit 2 Survey Results

A total of 205 measurements were made at 134 locations on the Unit 2 bioshield wall. These measurements indicate that normal attenuation factors and concrete densities are present at 119 of the 134 locations. Attenuation factors greater than expected are present at 2 locations. Reduced attenuation factors are present at 6 locations and extremely reduced attenuation factors are present at the remaining 7 locations.

The attentuation factors discussed above have been evaluated by the Engineer and the following conclusions have been postulated. Attentuation factors greater than those expected are due to increased steel thickness at the identified locations. Reduced or extremely reduced attenuation factors represent bioshield wall configurations with insufficient densities or quantities of concrete between the inner and outer wall plates.

Corrective Action

This report deals primarily with one aspect of a two-part problem. Specifically, we are defining the plan for repair of areas of the bioshield wall which contain incomplete fill of heavyweight concrete. Another report, RDC 34(81), covering the issue of low density concrete, was issued on June 7, 1982.

Areas of possible incomplete fill have been defined and enveloped for evaluation and specification of appropriate corrective action on the basis of the following criteria:

1. Core Region - a minimum nominal density of 180 lbs./cu. ft. is acceptable. However, a local minimum nominal density of 140 lbs./cu. ft. is acceptable if the area does not exceed 1% of the interior core region surface area (approx. 2,000 sq. ft. area).

2. Outside Core Region - a minimum nominal density of 140 lbs./cu. ft. is acceptable.

Areas in the bioshield walls identified as having less than acceptable minimum nominal density will be repaired by cutting access holes in the one inch steel wall plate, verifying the existing condition and filling it with a high density grout (nominal 210 lbs./cu. ft.).

This grout has been successfully tested at the manufacturer's lab and on-site. Test placements at the manufacturer's lab provided the acceptable ranges for variables such as water percentage, temperature, unit weight (densities), etc. The on-site testing was performed using a mockup of the bioshield wall. Grout pour holes and venting holes were located in the mockup to simulate probable field conditions. The mixing and placement of the grout was controlled and monitored during the tests and the grout was allowed to cure for two days. The forms were then pulled and the grout was shown to have exceptionally uniform coverage throughout the mockup. A radiographic survey was performed on the mockup and the resultant density ranged from 200 to 210 lbs./cu. ft.

Implementation of this corrective action will provide the minimum nominal densities necessary to assure that radiation levels outside the bioshield walls will not exceed the drywell environmental design conditions.

We presently anticipate repairs will be completed by December 31, 1982, for Unit #1, and July 7, 1983, for Unit #2.

Sincerely,

Dalwyn R. Davidson

Dalwyn R. Davidson
Vice President
System Engineering and Construction

DRD:pab

cc: Mr. M. L. Gildner
NRC Site Office

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