

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

December 18, 1981



MEMORANDUM FOR: Chairman Palladino
 Commissioner Gilinsky
 Commissioner Bradford
 Commissioner Ahearne
 Commissioner Roberts

FROM: Forrest J. Remick *[Signature]*

SUBJECT: EVALUATION OF IE SUPPLEMENTAL DECISION ON MARBLE HILL
 CONCRETE TESTING PROGRAM (REFERENCE: SECY-81-445)

On December 2, 1981, the Executive Director for Operations forwarded to the Commission a copy of a November 30, 1981 Supplemental Decision by the Director of Inspection and Enforcement concerning the testing program for concrete at the Marble Hill power plant site. The supplement was issued in response to the Commission's request that the staff reevaluate the testing program in light of Save the Valley's addendum and OPE's September 10, 1981 memorandum. This memorandum contains OPE's evaluation of the adequacy of the Supplemental Decision. In addition, we provide our response to Commissioner Bradford's request concerning the conservatism of the acceptance criterion used in the testing program.

Acceptability of Supplemental Decision

Based on its evaluation of OPE's September 10, 1981, memo, the staff has confirmed in its November 30 Supplemental Decision that Sargent and Lundy's (S&L's) sequential sampling plan was in error. Nonetheless, the staff has determined, and OPE agrees, that the results of the testing program performed achieved the stipulated level of assurance (95-percent confidence of 95-percent reliability; the 95/95 criterion) that the concrete quality meets NRC requirements. We agree with the staff's determination that had a single-stage sampling plan been implemented, the observed results would have provided the required assurance. More importantly, we concur that the sampling plan implemented was, in effect, far more stringent, with the result that the test findings (over 1,400 readings in 60 areas with no observed defects) more than achieved the stated criterion. ✓

In summary, the staff's re-examination has confirmed that a calculational error existed in S&L's quality verification plan. In spite of this procedural flaw in the verification plan, no additional testing of the concrete quality appears necessary to meet the NRC staff criterion in light of the test results described in the supplement.

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Conservatism of Staff's Acceptance Criterion

Commissioner Bradford, in his memorandum of October 23, requested OPE to evaluate also I&E's explanation of why it considers the acceptance criterion conservative. OPE agrees with I&E emphasis (Dircks December 2, 1981 memorandum) on the intensive testing steps taken overall to assure the quality of concrete in place at Marble Hill. The 95/95 acceptance criterion was required only at Marble Hill, and has not been used generically for performance verifications at other plants. We believe any future verification programs should be clearer on such quality assurance considerations as what constitutes a defect and what follow-up actions should be taken.

Regarding what I&E calls confidence, we note that in practice 95 percent generally can be characterized as conservative, depending on the consequences of making a wrong decision from the test. Regarding what I&E calls reliability, 95 percent apparently was considered appropriate by NRC concrete experts. Since some 92,000 cubic yards of concrete in Marble Hill Category I safety-related structures were verified, one might conclude that there remains a 5-percent chance that as much as 4,600 cubic yards of concrete could contain defects. Evidently, the staff and its consultants believe that this would not compromise structural integrity or biological shielding, as sampling to assure the homogeneity of internal concrete quality was heavily weighted toward so-called "congested areas."

Two other pertinent factors provide further assurance of the structural adequacy:

1. The selection of the 95/95 acceptance criterion was based on a balance of the amount of internal voiding estimated to be structurally insignificant and the degree of assurance that could reasonably be achieved. The criterion implies there is a 95-percent chance that at least one defective area would occur in the sample, if defects exist in 5 percent of the areas. The report^{1/} prepared by NRC consultants provides evidence that the effect of small voids in the concrete would be compensated for by other structural factors.
2. The American Concrete Institute (ACI) codes for concrete structures (including ACI 318-71, which we understand is applicable to Marble Hill) use statistical analysis and acceptance sampling to determine whether concrete meets specified strength requirements. Concrete strength requirements are based on statistical analyses showing (1) a probability of less than 1 in 10 that a random individual strength test will be below the specific strength, (2) a probability of 1 in

^{1/}A.L. Parme and R.C. Hamm, "Review of Evaluation of Concrete at Marble Hill Nuclear Generation Station Units 1 and 2," prepared for NRC by Parameter, Inc., Report No. IE-124, June 25, 1981, p. 9.

100 that an average of 3 consecutive strength tests will be below the specified strength, and (3) a probability of 1 in 100 that an individual strength test will be more than 500 psi below the specified strength. In light of the requirements for concrete strength, the level of safety assurance in meeting the acceptance criterion was deemed by the staff to be sufficient for determining whether internal voids exists at Marble Hill.

In light of the above considerations, OPE would consider the 95/95 acceptance criterion at Marble Hill conservative. Nonetheless, we would not necessarily consider the 95/95 criterion, as specified in the Immediate Action Letter of June 27, 1979, to Public Service Company of Indiana, Inc., a suitably conservative generic verification standard for future testing programs. If and when any need arises, we believe that the suitability of acceptance criteria should be determined on a case-by-case basis.

Recommendation

Based on OPE's evaluation of the Supplemental Decision, I recommend that the Commission not take review of the Director's Decision as supplemented. OGC has no legal objection.

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