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October 1, 1996

Dr. Andrew J. Murphy
Chief, Structural and Geological Engineering Branch
Division of Engineering Technology
Office of Nuclear Regulatory Research
U. S. Nuclear Regulatory Commission
Mail Stop TWFN 10 L1
Washington, DC 20555-0001

Dear Dr. Mruphy:

**Revised Pages for ORNL Review of Information Relative to Millstone-3 Plant Sump Discharge**

Two revised pages for the subject review are attached. The last paragraph of the text in the review submitted to you on September 26 was incomplete. The revised pages complete that paragraph and should replace the last two pages of that earlier document.

Mr. C. B. Oland led the review and prepared the completion to the subject paragraph. If you have questions, his telephone and telefax numbers are (423) 574-0659 and (423) 574-0651, respectively.

Sincerely,

Claud E. Pugh

Claud E. Pugh, Director
ORNL NRC Programs

Attachment

c: C. B. Oland
D. J. Naus
W. E. Norris, NRC/RES-SGEB
File-RC

C001

ability of this subbase layer to support the applied loads from the containment has not changed since it was constructed.

### Interactions between Portland and High-Alumina Cement Concretes

Degradation of the portland cement mortar located below the high-alumina cement concrete layer, and degradation of the portland cement concrete base slab located above the high-alumina cement concrete due to chemical interaction between the cementitious materials is not considered likely. The high-alumina cement concrete is not a source of alkalis that could contribute to alkali-aggregate reactions of the portland cement concrete or mortar. In addition, the alkalis in the low-alkali portland cement concrete and mortar should not attack the high-alumina cement concrete because these cementitious materials only have one common interface.

Although high-alumina and portland cement were not used in the same concrete mixture, casting the portland cement base slab concrete directly on top of the sealed, porous high-alumina cement concrete subbase layer may have resulted in an inadvertent interaction between the two concretes. Heat produced by the hydration of the portland cement and the presence of moisture in the fresh concrete may have accelerated the conversion of the high-alumina cement concrete making the high-alumina cement paste on the surfaces of the aggregate particles soft and loose at an early stage in the plant's life. Based on the assessment described in the previous section, the ultimate bearing capacity of the porous concrete subbase layer does not dependent on the presence or magnitude of the bond between the high-alumina cement paste and the aggregate particles. Therefore, degradation of the high-alumina cement paste by conversion should not adversely affect the ability of the containment to perform its intended safety functions or result in detectable settlement of the containment.

## REFERENCES

### Information Provided for Review

1. Letter to R. Y. Schonenberg, Northeast Nuclear Service Co., Hartford, Connecticut, from P. E. House, ABB Combustion Engineering Nuclear Operations, Windsor, Connecticut, Subject: Analyses Results of Cement Samples, August 2, 1991.

2. Document from Northeast Utilities to the NRC addressing questions about Millstone, Unit 3, July 22, 1996, 22 pages.

3. Figures from an unknown source: (1) Key plan, (2) Containment structure, (3) Detail containment mat and ring girder, (4) Detail of membrane and foundation mat, (5) Plan el. (-)37'-6" layout of sump drainage, (6) Plan at el. (-)26'-0" cross section of ring girder, (7) Aggregate interlock and cement coating, and (8) Detail of membrane and foundation mat.

4. McIntire, M., "Millstone Plant's Cement Received NRC Approval," *The Hartford Courant*, July 7, 1996.

5. Memo from R. Y. Schonenberg to G. Swider, Northeast Utilities, Subject: PA 86-261, Analysis of Debris Found in MP3 ESF Sumps, September 19, 1991.

6. Letter to Mr. David Dakers, Northeast Nuclear Energy Co., Waterford, Connecticut, from ABB Combustion Engineering Nuclear Operations, Windsor, Connecticut, Subject: Analysis of Millstone-3 Containment Sump and Mockup Samples, July 9, 1996.

**Other Documentation Considered**


7. "Standard Specification for Portland Cement," ASTM Designation: C 150, *1991 Annual Book of ASTM Standards*, Vol. 04.02, American Society for Testing and Materials, Philadelphia, Pennsylvania, 1991, pp. 92–96.

8. Peck, R. B., Hanson, W. E., and Thornburn, T. H., *Foundation Engineering*, John Wiley and Sons, Inc., New York, New York, 1953.

9. Terzaghi, K. and Peck, R. B., *Soil Mechanics in Engineering Practice*, Second Edition, John Wiley and Sons, Inc., New York, New York, 1967.

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14. "Assessment of Chemical Attack of High Alumina Cement Concrete," IP 22/81, Building Research Establishment, Garston, Watford, United Kingdom, November 1981.

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16. Collins, R. J. and Gutt, W., "Research on Long-Term Properties of High Alumina Cement Concrete," *Magazine of Concrete Research*, Vol. 40, No. 145, Building Research Establishment Information, Garston, Watford, United Kingdom, December 1998, pp. 195-208.