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

November 24, 1982

Docket No. 50-155
LS05-82-11-080

Mr. David J. VandeWalle
Nuclear Licensing Administrator
Consumers Power Company
1945 W. Parnall Road
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Dear Mr. VandeWalle:

SUBJECT: SEP TOPIC VI-1, ORGANIC MATERIALS AND POST-ACCIDENT CHEMISTRY
BIG ROCK POINT NUCLEAR POWER PLANT

Enclosed is our evaluation of SEP Topic VI-1, "Organic Materials and Post-Accident Chemistry" for the Big Rock Point Nuclear Power Plant. This review was based on the licensee's safety assessment report dated March 16, 1982. The staff has concluded that the Big Rock Point plant does not meet current licensing criteria for this topic.

This evaluation will be a basic input to the integrated plant safety assessment for your facility unless you identify changes needed to reflect the as-built conditions at your facility. This assessment may be revised in the future if your facility design is changed or if NRC criteria relating to this subject are modified before the integrated assessment is completed.

Sincerely,

Dennis M. Crutchfield

Dennis M. Crutchfield, Chief
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Enclosure:
As stated

cc w/enclosure:
See next page

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SYSTEMATIC EVALUATION PROGRAM

TOPIC VI-1

BIG ROCK POINT NUCLEAR POWER PLANT

TOPIC: VI-1, Organic Materials and Post-Accident Chemistry

I. INTRODUCTION

The design basis for selection of paints and other organic materials is not documented for most operating reactors. Topic VI-1 is intended to review the plant design to assure that organic materials, such as organic paints and coatings, used inside containment do not behave adversely during accidents when they may be exposed to high radiation fields. In particular the possibility of coatings clogging sump screens should be minimized.

Low pH solutions that may be recirculated within the containment after a Design Basis Accident (DBA) may accelerate chloride stress corrosion cracking and increase the volatility of dissolved iodines. The objective of Topic VI-1 is to assure that appropriate methods are available to raise or maintain the pH of solutions expected to be recirculated within the containment after a DBA.

Organic Materials: An assessment of the suitability of organic materials in the containment includes the review of paints and other organic materials used inside the containment including the possible interactions of the decomposition products of organic materials with Engineered Safety Features (ESF), such as filters.

Post-Accident Chemistry: An assessment of post-accident chemistry includes a determination of proper water chemistry in the containment spray during the injection phase following a DBA and that appropriate methods are available to raise or maintain the pH of mixed solution in the containment sump.

II. REVIEW CRITERIA

Organic Materials: The plant design was reviewed with regard to General Design Criterion 1, "Quality Standards and Records" of Appendix A to 10 CFR Part 50, "General Design Criteria for Nuclear Power Plants" which requires that structures and systems important to safety be designed and tested to quality standards commensurate with the importance of the safety function to be performed. Also, contained in the review was Appendix B to 10 CFR 50, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants." This guide describes an acceptable method of complying with the Commissions quality assurance requirements with regard to protective coatings.

Post Accident Chemistry: The design was reviewed with regard to General Design Criterion 14, "Reactor Coolant Pressure Boundary" of Appendix A to 10 CFR Part 50. This requires that the reactor coolant pressure boundary be designed and erected so as to have an extremely low probability of abnormal leakage and gross rupture. Also, regarded in the review was General Design Criterion 41, "Containment Atmosphere Cleanup," of Appendix A to 10 CFR Part 50. This requires that systems to control substances released in reactor containment be provided to reduce the concentration and quality of fission products released to the environment following a postulated accident.

III. RELATED SAFETY TOPICS

The effectiveness of the iodine removal system is evaluated as part of Topic XV-19, for a spectrum of loss-of-coolant accidents.

Topic VI-7.E reviews the ECCS in the recirculation mode to confirm the effectiveness of the ECCS.

IV. REVIEW GUIDELINES

Organic Materials: Current guidance for the review of organic materials in containment is provided in Sections 6.1.1, "Engineered Safety Features Materials" and 6.1.2, "Organic Materials" of the Standard Review Plan and in Regulatory Guide 1.54, "Quality Assurance Requirements for Protective Coatings Applied to Water-Cooled Nuclear Power Plants." Regulatory Guide 1.54 endorses the requirements and guidelines described in detail in ANSI N101.4-1972, "Quality Assurance for Protective Coatings (Paints) for the Nuclear Industry" and ANSI N5.12-1974, "Protective Coatings (Paints) for the Nuclear Industry."

Post-Accident Chemistry: Guidance for the review of post-accident chemistry is provided in Sections 6.1.1 and 6.5.2 of the Standard Review Plan. Section 6.1.1 is related to assuring that appropriate methods are available to raise or maintain the pH of the mixture of the containment spray, ECCS water, and chemical additives for reactivity control and iodine fission product removal in the containment sump during the recirculation phase and to preclude long term corrosion problems after the accident. Section 6.5.2 is related to providing proper water chemistry in the containment spray and sump during injection phase following a Design Basis Accident.

V. EVALUATION

Organic Materials: The design basis for selection of paints for the Big Rock Point Plant is not documented. Topic VI-1 is intended to review the plant design to assure that organic materials such as the organic paints and coatings used inside containment do not behave adversely during accidents (LOCA and DBA) and also when they are exposed to high radiation fields in conjunction with the accident. In particular, the possibility of coatings clogging the emergency spray system especially the sump screens and spray nozzles should be minimized. The assessment of the suitability of the paint coatings inside containment included in this review is based on a review of the coating schedule for the plant along with the specified coating materials applied to surfaces under unknown conditions and also questionable materials as to the exact manufacturer and catalogue numbers. However, these are being reviewed generically.

Protective coatings systems in the containment comprise the bulk of the materials (outside of the electrical cable insulation) of concern in the containment, in case of a design basis accident (DBA) or a loss of coolant accident (LOCA) and the subsequent safe shutdown of the facilities. Three generic-type coatings were used inside containment for coating surfaces, both steel and concrete (See drawing No. 0740G10219 Rev. A, dated September 1965). The inside of the sphere is coated with a system consisting of a zinc dust metal primer and an alkyd semi-gloss enamel topcoat except for an area from the floor to 6' above the floor which was coated with an epoxy system. Other systems used on steel consisted of an epoxy block filler or concrete filler plus epoxy topcoats. Some of the concrete floors were sealed with Sonneborn-sonamar sealer in a light gray or a clear color. These materials are of a urethane type. All coating materials inside of containment are being reviewed against current criteria for materials for the same type of application to assure that any degradation of the paint materials under accident conditions will not interfere with the operation of the engineered safety features, such as excessive flaking, peeling of the paint from the containment surfaces following a LOCA which might plug safety-related screens, filters, pumps, and valves and nozzles. Excessive generation of volatile organic compounds which saturate the charcoal filters in the containment purge system and thereby interfere with the trapping of radioactive organic iodines is also being investigated.

Generically, the coatings of the inorganic zincs and epoxy types have been subjected to DBA test exposure in combination with radiation at Oak Ridge National Laboratories. In evaluating the resistance of the coatings during DBA, we used the results of recent DBA tests run at Oak Ridge National Laboratories on coatings for the Midland Project. Test results showed that epoxy-type coatings used in containment remained serviceable even after being exposed to large radiation doses and subsequent exposure to a DBA test. On this basis, we conclude that the radiation damage to these types

of coatings does not pose a significant hazard to the operation of the engineered safety features during a DBA and are acceptable. The alkyd enamel coatings which were used on steel and much of the concrete have an unknown serviceability during and immediately after a DBA. Also, the urethanes are questionable as to their adequacy during a DBA. Another factor that enters into the evaluation concerns coatings applied over the original floor coatings for sealing in contamination and also for repairing large areas where the coating had been damaged. It is believed that alkyd enamel coatings from several manufacturers were used in these instances, and as many as two and three additional coats have been applied in some floor areas. It is likely that these floor coatings would not successfully pass the DBA and radiation exposure tests. The walls appear to have had no additional coatings applied subsequent to the original painting of the facility. The licensee has stated because the original application has needed no subsequent coating applied to the walls and the tenacity by which the wall coatings have adhered to the substrate surface, they would expect that these coatings would successfully withstand a DBA test under the time, temperature and pressure conditions of the plant (significantly less severe than standard coating test conditions under ANSI N101.2).

However, this is not an adequate basis for the staff to conclude that any paints of the generic alkyd and urethane types are acceptable inside containment. For alkyd and urethane coatings, we need evidence based on qualification testing, repair of coatings in critical repair areas, or other corrective measures, to provide reasonable assurance that the degradation of the coatings under DBA conditions will not interfere with the operation of engineered safety features. Also, the plant does not have a surveillance program to monitor the condition of the plant protective coatings. For other SEP plants, we have accepted an inspection every three years according to the guidelines of ANSI N101.2-1972, ANSI N101.4-1972, and ANSI N5.12-1974.

Post Accident Water Chemistry: The plant uses the water directly from Lake Michigan for emergency core cooling. The water is not sampled for chemical impurities. There is no provision to control the water chemistry to within the acceptable limits of Standard Review Plan Section 6.1.1 for boiling water reactors. There is also no provision to control or analyze the chloride content of the sodium pentaborate solution in the Standby Liquid Control System. The plant Technical Specifications do not provide chemical impurity limits and surveillance requirements for the emergency core cooling water.

We determined that Lake Michigan's water can have a chloride concentration in excess of 0.5 ppm, the limit delineated in acceptance criterion II.B.1.b of Standard Review Plan Section 6.1.1. The absence of any control, sampling and surveillance requirements for this body of water and the Standby Liquid Control fluid means that, at the onset of an accident, there is no assurance that the water to be used for emergency core cooling and containment spray will be maintained within acceptance Criterion II.B.1.b. Thus, proper water chemistry cannot be maintained in the containment spray during recirculation to mitigate the probability of chloride-induced stress corrosion cracking of austenitic stainless steel components.

Offsite doses with post-accident iodine releases are evaluated under Topic XV-19 as part of the Systematic Evaluation Program.

Hydrogen generation from chemical reactions between metals inside containment and the containment and core spray water will be evaluated, independent of the Systematic Evaluation Program, under the TMI Task Action Plan (Task II.B.7 in NUREG-0660) and Unresolved Safety Issue A-48 in NUREG-0705.

VI. CONCLUSION

Organic Materials: The staff has concluded that all paints of the generic alkyd and urethane types are unacceptable inside containment unless it can be demonstrated by qualification testing, repair of coatings, or other corrective measures, that the degradation of the coatings under DBA conditions will not interfere with the operation of engineered safety features. Also, the plant does not have a surveillance program to monitor the condition of the plant protective coatings.

Post-Accident Chemisty: On the basis of the above evaluation, we conclude that the post-accident water chemistry does not meet the acceptance criterion of II.B.1.a in the Standard Review Plan Section 6.1.1 (NUREG-0800), July 1981.