UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO FACILITY OPERATING LICENSE

NOS. DPR-53 AND DPR-69

BALTIMORE GAS AND ELECTRIC COMPANY

CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NOS. 1 AND 2

DOCKET NOS. 50-317 AND 50-318

1.0 INTRODUCTION

By letter dated July 29, 1993, Baltimore Gas and Electric Company submitted a proposed plan for installation of a permanent neutron shield/pool seal over the reactor vessel annulus in Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2 (CCNPP1/2). The purpose of the new shield is to reduce the personnel radiation exposure rates by reducing the time and the number of personnel required to perform the refueling task. The licensee anticipates that the new design will be implemented in the spring 1994 outage for unit 1 and in the spring 1995 outage for unit 2. In support of the neutron shield installation, the licensee proposed to use the leak-before-break (LBB) analysis of primary coolant loop piping to comply with General Design Criteria (GDC) 4, "Environmental and Dynamic Effects Design Bases." In particular, leak-before-break analyses were proposed as the bases for eliminating the need to evaluate postulated loss-of-coolant accident (LOCA) loads on the permanent neutron shield/pool seal.

2.0 EVALUATION

The refueling pool is located above the reactor vessel for both CCNPP-1/2. During normal operation, a gap exists between the reactor vessel and the refueling pool floor. This gap is partially covered by a neutron shield, which consists of water bags supported by a steel frame. The neutron shield is arranged so that the reactor cavity is adequately ventilated. During refueling operations, the neutron shield is removed and the gap is sealed to prevent the refueling pool water draining into the reactor vessel cavity. The pool seal is a circular ring made of stainless steel plate with rubber gaskets attached. After the refueling is completed and the refueling pool is drained, the pool seal is removed and the neutron shield is reinstalled.

The proposed design uses a neutron shield/pool seal ring that will close off the top of the reactor vessel annulus permanently. The ring consists of borated concrete, enclosed in a carbon steel assembly. Removable hatches are designed in the seal ring providing a pathway for ventilation air and containment spray water to reach the sump and allowing access to excore instrumentation.

GDC 4 requires that structures shall be protected against dynamic effects from missiles, pipe whipping, and discharging fluids. However, dynamic effects associated with postulated pipe ruptures may be excluded from the design basis when analyses reviewed and approved by the Commission demonstrate that the probability of fluid system piping rupture is extremely low. In the current neutron shield arrangement, given a LOCA event, the fluid/steam discharged from the pipe break location releases energy through the reactor vessel annulus without generating dynamic impingement loads on containment structures. In the proposed design, given a LOCA, the permanent neutron shield would block the exit path of the discharged fluid/steam. The shield would not sustain the dynamic impingement loads from a LOCA and GDC 4 would not be satisfied. For this case, GDC 4 allows the use of the LBB analysis to justify eliminating dynamic loads from the design basis of the shield.

In a letter dated November 20, 1987, the Combustion Engineering Owners Group (CEOG) submitted for NRC review the topical report, "Leak-Before-Break Evaluation of Primary Coolant Loop Piping in Combustion Engineering Designed Nuclear Steam Supply System," CEN-367-A. The staff approved the topical report in a safety evaluation dated October 30, 1990, with a condition. The staff condition specifies that "...when referencing the CEOG topical report as a technical basis for applying LBB to primary loop piping, licensees must submit information to demonstrate that leakage detection systems installed at the specific facility are consistent with Regulatory Guide 1.45."

The licensee proposed to use the LBB analysis in the CEOG Topical Report as a technical basis to qualify the proposed neutron shield for GDC 4 because the report included the LBB analysis of primary coolant piping in CCNPP-1/2. The licensee has reviewed the current primary coolant piping layout in both units to ensure that there are no additional piping which should have been included in the topical report. The licensee concluded that the LBB analysis in the CEOG Topical Report applies to both Calvert Cliffs units.

The leakage detection system for the reactor coolant system is described in Section 4.3 of the Updated Final Safety Analysis Report of CCNPP1/2. In the submittal, the licensee compared the detection system with the guidance in Regulatory Guide (RG) 1.45, "Reactor Coolant Pressure Boundary Leakage Detection System." Both units have three methods of leakage detection: sump level monitoring, airborne particulate radioactivity monitoring, and airborne gaseous radioactivity monitoring. The system can detect leakages from identified and unidentified sources. For the unidentified sources, the system has an accuracy of determining leakage of one gpm in less than 1 hour. The staff has determined that the leakage detection system in CCNPP1/2 satisfies RG 1.45.

3.0 CONCLUSION

The staff concludes that installation of a permanent neutron shield/pool seal over the reactor vessel annulus at CCNPP1/2 is acceptable because the licensee has demonstrated that the leak-before-break analysis of the primary coolant loop piping in CCNPP1/2 satisfies the NRC leak-before-break criteria; therefore, the neutron shield design satisfies GDC 4.

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