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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO.160TO FACILITY OPERATING LICENSE NO. NPF-14

AMENDMENT NO.131 TO FACILITY OPERATING LICENSE NO. NPF-22

PENNSYLVANIA POWER & LIGHT COMPANY

ALLEGHENY ELECTRIC COOPERATIVE, INC.

SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2

DOCKET NOS. 50-387 AND 50-388

1.0 INTRODUCTION

By letter dated February 26, 1996, as supplemented by letter dated June 28, 1996, the Pennsylvania Power and Light Company (the licensee) submitted a request for changes to the Susquehanna Steam Electric Station, Units 1 and 2, Technical Specifications (TSs). The proposed amendments would revise TS surveillance requirement 4.6.2.1d by changing the frequency of the drywell-to-suppression chamber bypass leakage test from 40 ± 10 months to the interval for the Type A (integrated) primary containment leakage rate test under 10 CFR Part 50, Appendix J, Option B. Option B of Appendix J requires a Type A test every 48 months with the potential to increase the test interval to at least once in 10 years based on satisfactory performance of the two previous consecutive tests. The licensee has also proposed actions for the condition that a drywell bypass test is not passed, as discussed below.

By amendments 129 for Unit 1 and 98 for Unit 2, dated August 11, 1993, the NRC approved a reduction in the drywell bypass leakage rate testing frequency for Susquehanna Steam Electric Station from 18 months to 40 ± 10 months. These amendments also added a requirement to test the drywell-to-suppression chamber vacuum breakers when a drywell-to-suppression chamber bypass leakage rate test is not performed. The licensee has proposed retaining this requirement to ensure that the most likely potential source of drywell-to-suppression chamber leakage is adequately monitored.

The June 28, 1996, letter provided clarifying information that did not change the initial proposed no significant hazards consideration determination.

2.0 BACKGROUND

Susquehanna Steam Electric Station, Units 1 and 2 are both General Electric BWR/5 plants with Mark II containments. In this design, steam generated in the drywell during a design basis loss-of-coolant accident (LOCA) is directed to the suppression chamber through 87 vertical downcomers that pass through the diaphragm slab that separates vertically the drywell and suppression chamber. Water in the suppression chamber (i.e., the suppression pool or wetwell) condenses the steam to limit internal containment pressure to less than the design value of 53 psig. The effectiveness of the pressure suppression design requires that an excessive amount of steam does not bypass the downcomers via unintended drywell-to-suppression chamber leakage pathways. Such leakage would bypass the suppression pool and increase the pressure of the suppression chamber airspace, possibly exceeding the design pressure of the containment.

The current requirements given in TS 4.6.2.1d regarding bypass leakage state:

> The suppression chamber shall be demonstrated OPERABLE:
>
> d. By conducting a drywell-to-suppression chamber bypass leak test at an initial differential pressure of at least 4.3 psi and verifying that the $A/(k)^{1/2}$ calculated from the measured leakage is within the specified limit. The bypass leak test shall be conducted at 40 ± 10 month intervals during shutdown, during each 10 year service period. If any drywell-to-suppression chamber bypass leak test fails to meet the specified limit, the test schedule for subsequent tests shall be reviewed and approved by the Commission. If two consecutive tests fail to meet the specified limit, a test shall be performed at least every 18 months until two consecutive tests meet the specified limit, at which time the above test schedule may be resumed.

The licensee has proposed the following revision to this requirement (revisions are underlined):

> The suppression chamber shall be demonstrated OPERABLE:
>
> d. By conducting a drywell-to-suppression chamber bypass leak test at an initial differential pressure of at least 4.3 psi and verifying that the $A/(k)^{1/2}$ calculated from the measured leakage is within the specified limit. The bypass leak test shall be conducted at the same frequency as the 10 CFR 50 Appendix J Type A test in accordance with Specification 6.8.5, Primary Containment Leakage Rate Testing Program. If any drywell-to-suppression chamber bypass leak test fails to meet the specified limit, the test schedule for subsequent tests shall be reviewed and approved by the Commission. If two consecutive tests fail to meet the specified limit, a test shall be performed at least every refueling outage until two consecutive tests meet the specified limit, at which time the above test schedule may be resumed.

3.0 EVALUATION

The basis for the current testing requirements is to maintain bypass leakage within the limits assumed in design basis analysis for the most limiting steam bypass scenario to ensure that containment design pressure is not exceeded. The current TS leakage limit of $A/\sqrt{K}$ = .00535 ft^2 is 10% of the design value of $A/\sqrt{K}$ = .0535 ft^2.

To arrive at the design value, a spectrum of small design basis LOCAs was considered. Larger breaks result in rapid depressurization of the reactor coolant system, allowing for a larger bypass leakage flow, whereas smaller breaks result in slower depressurization, thus establishing the limiting value of leakage. As presented in Section 6.2.1.1.5 "Suppression Pool Bypass Effects" of the Susquehanna Steam Electric Station Final Safety Analysis Report (FSAR), the most limiting drywell bypass event that Susquehanna Units 1 and 2 are designed to mitigate is a small-break LOCA inside containment. The analysis assumes that the operator is alerted to the accident when the suppression chamber pressure reaches 30 psig. The operator then actuates the wetwell sprays. The containment pressure is maintained below the containment design pressure limit of 53 psig.

The NRC staff's evaluation of the proposed changes focused on the licensee's complete identification and analysis of potential leakage paths to the suppression chamber; historical bypass leakage test results; and the ability to mitigate a suppression chamber steam bypass event should one occur.

3.1 Identification and Analysis of Potential Leakage Pathways

The potential leakage paths between the drywell and the suppression chamber in a Mark II containment are: 1) piping which passes through the suppression chamber, 2) the diaphragm slab and the seal between it and the suppression chamber, 3) downcomer penetrations, 4) safety relief valve (SRV) discharge line penetrations, and 5) drywell-to-suppression chamber vacuum breakers. The licensee's original submittal and request for additional information (RAI) responses addressed these leakage pathways.

3.1.1 System Piping Passing Through the Suppression Chamber

With regard to various system piping which passes through the suppression chamber, the licensee identified the containment vent and purge lines, drywell and suppression chamber spray lines, N_2 pressurization lines, H_2 and O_2 analyzer lines and containment instrument gas lines.

The licensee indicates that these lines are isolable from containment by containment isolation valves which are subject to the local leak rate test criteria of 10 CFR Part 50, Appendix J. The licensee provided an analysis of the safety significance of bypass leakage from these lines. The analysis separately analyzed the vent and purge valves and the remaining flow paths since the vent and purge valves have a separate TSs allowed leakage. In both cases, the equivalent leakage at the TSs limit of $0.05L_a$ for the vent and purge valves and $0.60L_a$ for the remaining valves corresponded to less than 1% of the TS allowable drywell-to-suppression chamber bypass leakage at the peak calculated containment pressure following a LOCA (P_a, as defined in Appendix J, which is 45 psig for Susquehanna).

Additionally, much of the subject piping is constructed in accordance with American Society of Mechanical Engineers (ASME) Section III, Class 2 or 3 standards. This provides reasonable assurance that the structural integrity of the piping in these systems will remain intact.

The staff has reviewed the licensee's identification of piping passing through the suppression chamber and, based on the results of the evaluations provided in its submittals, concludes that leakage through cross-connected piping systems which penetrate the suppression chamber does not constitute a significant source of potential bypass leakage for Susquehanna.

3.1.2 Leakage Through Diaphragm Slab Penetrations

All pressure boundary penetrations between the drywell and suppression chamber (including downcomer and SRV discharge lines) and the drywell floor liner plate are welded and have been fabricated, erected, and inspected in accordance with ASME Section III. The liner is anchored to the pedestal wall and welded to all penetrations. These fabrication and construction techniques provide reasonable assurance of structural integrity and leaktightness. The licensee's February 23, 1996, submittal provides more information on the design of the liner to preclude leakage.

Susquehanna TS 4.6.1.5.1 requires that a visual inspection of the exposed accessible interior and exterior surfaces of the primary containment shall be performed as required by Regulatory Guide (RG) 1.163, "Performance-Based Containment Leak-Test Program," which is included by reference in TS 6.8.5. RG 1.163 specifies a visual inspection of the containment 3 times in 10 years. TS Section 4.6.1.5.1 specifies that the containment liner shall be included in this inspection. In addition, the licensee's February 23, 1996, submittal describes a program for visual inspection of the accessible drywell and suppression chamber surfaces of the diaphragm slab floor and floor penetrations. This inspection would be conducted 3 times in 10 years, consistent with RG 1.163.

The downcomer and SRV discharge line penetrations above the drywell floor are fully visible for inspection. In its RAI, the staff requested that the licensee identify any areas that could affect drywell bypass leakage that are inaccessible and, therefore, not readily inspected or not inspected at all. In its response, the licensee indicated that all areas of the liner plate over the diaphragm slab are accessible except for the drywell sumps and areas under the support base plates that are seal welded to the liner plate surface.

Inside the drywell, the inside of the vent pipe assemblies are not accessible. In the suppression chamber, the outside of the vent pipe assemblies and SRV tailpipes can be accessed by using permanently installed platforms in the suppression chamber.

Modifications to the drywell/suppression chamber interface are controlled by TSs and administrative procedures, including a safety evaluation of the modification by the appropriate engineering disciplines.

The staff finds that the inspection requirements, component quality and fabrication standards, and the administrative procedures in place provide reasonable assurance against leakage through the diaphragm floor or its non-vacuum breaker penetrations and justify the 10-year bypass leakage rate test interval.

3.1.3 Drywell-to-Suppression Chamber Vacuum Breakers

Susquehanna Units 1 and 2 each have five sets of vacuum breakers. Each set consists of two vacuum breakers in series. The licensee's submittal identifies these as the most likely source of potential bypass leakage. As discussed above, the NRC has previously approved license amendments for Susquehanna Units 1 and 2 which required testing of the drywell-to-suppression chamber vacuum breakers at each refueling outage for which a drywell-to-suppression chamber bypass leakage rate test was not performed as part of an extension of the test interval to 40 ± 10 months.

Since the vacuum breakers are active components, there exists the possibility that a vacuum breaker may inadvertently be in the open position or that excessive wear may occur on the sealing surface of the valves, either of which scenarios represents the potential for excessive leakage. The staff, therefore, considers it important that there exist reliable means to detect an open vacuum breaker, to ensure that a breaker in the closed position remains closed unless called upon, and to monitor, over time, leakage through the vacuum breakers.

The staff has reviewed the vacuum breaker design and proposed surveillance, and finds them adequate for detecting, in a timely manner, the potential for excessive leakage through the vacuum breakers. These features are discussed on pages 11 and 12 of the licensee's February 23, 1996, submittal.

3.2 Past Test Results

The licensee provided results from past bypass leakage tests to support this proposal. The tests are conducted by pressurizing the drywell, approximately 4.3 psig above the suppression chamber pressure. Eight Unit 1 and seven Unit 2 low pressure drywell-to-suppression chamber bypass tests have been conducted and successfully passed with low leakage rates. The licensee pointed out that although these tests include leakage from both vacuum breaker and non-vacuum breaker sources, the tests were conducted following maintenance on the vacuum breakers. The results do not, therefore, indicate as-found conditions. The staff finds that past test results indicate that bypass leakage through passive potential leakage pathways (i.e. non-vacuum breaker pathways) have consistently been small, and thus provide a reasonable basis to conclude that these pathways constitute a minor source of bypass leakage. In addition, the TSs require testing of the vacuum breakers during each refueling for which the drywell-to-suppression chamber bypass test is not conducted. The staff finds that this, together with the previous test results, provides justification for revising the test interval to 10 years.

3.3 Ability of Plant Systems to Mitigate Excessive Steam Bypass

The design basis analysis for the most limiting steam bypass scenario takes credit for the suppression chamber sprays for mitigation. The suppression chamber sprays consist of two one-hundred percent capacity (redundant) subsystems of the Residual Heat removal (RHR) system and are safety related. They are assumed to be initiated 30 minutes following the onset of a small-break LOCA, and an allowable leakage of .0535 ft^2 is assumed in the design basis calculation.

In response to a staff request to address the potential increase in risk due to extending the drywell to suppression chamber bypass leakage rate test interval to 10 years, the licensee discussed the mitigation measures included in the emergency operating procedures. The operator would be directed to initiate wetwell sprays. If that did not prevent a further increase in pressure, drywell sprays would be actuated. The licensee states that "operation of the drywell sprays is sufficient to terminate any pressure rise associated with drywell-to-suppression pool bypass leakage." If, however, the pressure continued to rise, the emergency operating procedures direct the operator to depressurize the reactor pressure vessel. Once the reactor pressure vessel pressure drops below the shutdown cooling interlocks, the operator will initiate shutdown cooling or alternate shutdown cooling, terminating the primary containment pressure rise.

The licensee also states that a review of the containment response demonstrates that in the absence of gross diaphragm failure, that is, failure in excess of design basis leakage, suppression pool bypass can only result in containment overpressure failure when coupled with loss of decay heat removal. Since the drywell to suppression pool bypass test does not involve decay heat removal equipment, extending the test interval to 10 years does not affect containment overpressure failure.

In conclusion, the staff finds the proposal to change the drywell-to-suppression chamber bypass leakage test frequency from once every 40 ± 10 months to a frequency in accordance with Appendix J, Option B, acceptable on the bases that bypass leakage through passive components has historically been much lower than the TS limit, that such components/penetrations have a relatively low potential for leakage, and that the most credible source of potential bypass leakage, the drywell-to-suppression chamber vacuum breakers, will be tested on a frequency sufficient to identify, in a timely manner, excessive leakage through these components.

3.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Pennsylvania State official was notified of the proposed issuance of the amendments. The State official had no comments.

4.0 ENVIRONMENTAL CONSIDERATION

The amendments change a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding (61 FR 15992). Accordingly, the amendments meet eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

5.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

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