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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NOS. 46 AND 9 TO FACILITY OPERATING

LICENSE NOS. NPF-39 AND NPF-85

PHILADELPHIA ELECTRIC COMPANY

LIMERICK GENERATING STATION, UNITS 1 AND 2

DOCKET NOS. 50-352 AND 50-353

1.0 INTRODUCTION

By letter dated October 11, 1989, and supplemented by letter dated April 9, 1990, Philadelphia Electric Company (the licensee) requested an amendment to Facility Operating License Nos. NPF-39 and NPF-85 for the Limerick Generating Station, Units 1 and 2. These proposed amendments would change the Technical Specifications (TSs) to specify the number of suppression chamber to drywell vacuum breaker pairs which are required to be operable as three rather than four pairs.

2.0 DISCUSSION

There are four pairs of vacuum breaker valves provided to equalize the pressure between the suppression chamber and the drywell after reactor blowdown and drywell spray actuation, while preventing bypass of the suppression pool during periods of blowdown. Previous analysis indicated that three of the four pairs were required to provide adequate vacuum relief capability to protect the structural integrity of the containment for all postulated events. The fourth pair provided redundancy in the event that a single active failure prevented one valve in any of the three required valve pairs from opening. A reanalysis performed by the licensee has determined that two pairs, rather than three pairs, of vacuum breaker valves are adequate to protect the structural integrity of the containment. Therefore, the licensee proposes to revise TS Limiting Condition for Operation (LCO) 3.6.4.1 to require a minimum of three pairs of operable vacuum breakers.

3.0 EVALUATION

As discussed in Section 6.2 of the NRC's Safety Evaluation Report (NUREG-0991) for the Limerick Generating Station (LGS), the containment systems for Limerick Units 1 and 2 include the Mark II pressure suppression containment structure (primary containment), the secondary containment structure and supporting systems, the containment heat removal system, the containment isolation system, and the combustible gas

control system. The primary and secondary containment structures and associated containment systems function to prevent or control the release of radioactive material that might be released into the containment atmosphere following a postulated loss-of-coolant accident (LOCA) or fuel handling accident.

The primary containment is in the form of a truncated cone over a cylindrical section, with the drywell the upper conical section and the suppression chamber the lower cylindrical section. These two sections comprise a structurally integrated, reinforced concrete pressure vessel, lined with welded steel plate and provided with a steel domed head for closure at the top of the drywell. The drywell and suppression chamber are divided by a horizontal diaphragm slab of reinforced concrete structurally connected to the containment wall.

As noted previously, the vacuum relief valves are provided to equalize the pressure between the drywell and suppression chamber following blowdown. As discussed in Section 6.2.1.4 of NUREG-0991, the vacuum breakers are primarily sized to prevent excessive drywell floor reverse pressure (i.e., suppression chamber pressure greater than drywell pressure) and to prevent excessive negative pressure in the drywell such as might result from the inadvertent actuation of a drywell spray train during a postulated accident.

The LGS primary containment design values that we are primarily concerned with in evaluating the capacity of the vacuum breakers are the following:

a) Design differential pressure across the diaphragm slab in the upward direction = 20 psid.

b) Design (negative) pressure of the primary containment with respect to the secondary containment = -5 psig.

To ensure that these design values will not be exceeded, vacuum breakers have been provided between the drywell and the suppression chamber (or wetwell). Four flow paths with two vacuum breaker valves in series on each flow path are provided. The valves are set so that a differential pressure of greater than 1 psid between the suppression chamber and the drywell will result in flow from the wetwell to the drywell to equalize the pressure to within 1 psid.

Events which have the potential to result in these design allowables being exceeded are discussed in the LGS Final Safety Analysis Report (FSAR) "Containment Systems," Sections 6.2.1.1.3, 6.2.1.1.4, and 6.2.1.1.5. The vacuum breaker valves may also serve to relieve a pressure differential between the wetwell and the drywell during containment purge operations and hydrogen recombiner operation. As stated in the FSAR, inadvertent actuation of the drywell spray system following a Loss of Coolant Accident (LOCA) was determined to pose the most severe challenge to the diaphragm slab upward differential pressure and primary containment negative pressure design values.

The initial analysis performed to verify the adequacy of the vacuum breaker sizing was based on highly conservative assumptions. One such assumption was that the upward differential pressure across the diaphragm slab should not exceed 3 psid. Additionally, since valve test data was not available at that time, conservative flow assumptions were used for the vacuum breakers. Based on these assumptions, three flow paths (i.e., three vacuum breaker valve pairs) were determined to be required to maintain the differential pressure below the assumed design value of 3 psid. The fourth flow path provided a redundant flow path in the event that one of the other three flow paths was inoperable as a result of a single active failure which prevented a flow path from performing its intended function.

The initial analysis was followed by a computer analysis incorporating flow test data from the valve vendor for the actual valves in the as-built configuration, rather than assumed flow data. The purpose of this computer analysis, however, was not to determine the number of flow paths required, but to confirm that three operable flow paths would be adequate to prevent the drywell from exceeding the -5 psig design value in the event of the postulated inadvertent post reactor blowdown drywell spray actuation. Three flow paths were found to be adequate for this purpose. The maximum differential pressure across the diaphragm slab in this case was determined to be 4.26 psid, well below the 20 psid design value.

The 3 psid diaphragm slab differential pressure used in the initial calculation is not a required design basis value, but was arbitrarily chosen as a value to use while performing the determination of the number of required vacuum breaker valve pairs. Since the 20 psid design differential pressure value must not be exceeded and the 3 psid value was arbitrary, the fact that the actual differential pressure exceeds 3 psid in the more accurate computer calculations is of no consequence.

Recently, the computer analysis was performed again by the licensee utilizing two flow paths instead of three. The analysis showed two flow paths to be sufficient to avoid exceeding the -5 psig design value. A review of the previous analysis (i.e., using three flow paths) showed that the condensation rate in the drywell is the parameter controlling the resulting peak negative pressure reached. The flow rate through the vacuum breaker valves is not the limiting parameter since the valves are not required to fully open during the event to provide the necessary vacuum relief. Essentially the same peak negative pressure is reached in the drywell for any number of flow paths greater than two. The flow rate through the vacuum breakers only becomes controlling when less than two flow paths are available. Hence, with the valves full open, two flow paths are sufficient to provide adequate vacuum relief.

FSAR Section 6.2.1.1.4 notes that if both trains of drywell spray were to be actuated concurrently, in violation of existing plant procedure, the drywell design negative pressure of -5 psig could be exceeded, if the suppression pool temperature is below 105°F. With only two vacuum breaker flow paths operable instead of three, the suppression pool temperature below which the -5 psig design pressure could be exceeded, if both spray trains were actuated concurrently, will be somewhat higher. Since, as discussed in the FSAR "Response to NRC Questions," question 480.4, drywell spray actuation is under strict administrative controls, and concurrent actuation of both spray trains is in violation of plant procedures, this increase in suppression pool temperature below which concurrent spray train actuation could result in exceeding the -5 psig design pressure is still of no consequence, and does not constitute any actual reduction in a margin of safety.

The licensee performed an evaluation of the proposed changes to determine if an unreviewed safety question exists. The evaluation concluded that the proposed change does constitute an unreviewed safety question. This results from the fact that the reduction of required flow paths does decrease the margin of safety as defined in TS Section 3/4 6.4. TS LCO 3.6.4.1 presently requires the operability of four vacuum breaker flow paths. If three of the vacuum breaker pairs operate, the primary containment design values will not be exceeded. Calculation has shown that even if only two vacuum breaker pairs operate, the primary containment design values still will not be exceeded. However, there will be a small increase (from -4.821 psig to -4.845 psig) in the magnitude of the drywell peak negative pressure in the event of the postulated drywell depressurization, even though this value will still be within the -5 psig design primary containment pressure limit. There will also be a small increase (from 4.26 psid to 5.77 psid) in the maximum upward differential pressure developed across the diaphragm slab. This value is still within the 20 psid design differential pressure. Although the resulting drywell negative pressure and diaphragm slab differential pressure are acceptable, they still constitute a small reduction in the margin of safety since they are slightly closer to the design values than for the three vacuum breaker flow path case.

As noted above, the postulated inadvertent activation of a drywell spray by an operator during a small break LOCA was the design basis accident transient resulting in the most rapid condensation of steam in the drywell and thus the maximum differential pressure between the drywell and wetwell. In the submittal of October 11, 1989, the licensee provided the results of this transient analysis but not the detailed analysis and data used in the calculations (e.g., spray water temperature, valve opening times, flow characteristics of valves, etc.). The transient analysis was discussed in a telecom with the licensee on December 15, 1989. The licensee was requested to provide the transient analysis. The analysis was provided by the licensee's letter of April 9, 1990. The letter provided analysis to support the results in the October 11, 1990

application and additional justification for the proposed changes to the TSs. The additional information strengthened but in no way changed the staff's proposed No Significant Hazards Consideration Determination.

We have reviewed the licensee's reanalyzes of the postulated events leading to potentially rapid drywell depressurization with respect to the wetwell and find them conservative. The licensee has demonstrated that two operable flow paths are adequate to prevent exceeding containment design values during the postulated events. Requiring three vacuum breaker flow paths to be operable meets the staff's single active failure criteria. Therefore, the proposed change in the TSs to reduce the number of suppression chamber to drywell vacuum breaker pairs which are required to be operable from four to three pairs is acceptable.

4.0 ENVIRONMENTAL CONSIDERATION

These amendments involve a change to a requirement with respect to the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The staff has determined that these 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 these amendments involve no significant hazards consideration and there has been no public comment on such finding. Accordingly, these amendments meet the 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 nor environmental assessment need be prepared in connection with the issuance of these amendments.

5.0 CONCLUSION

The Commission made a proposed determination that these amendments involve no significant hazards consideration which was published in the Federal Register (54 FR 47607) on November 15, 1989 and consulted with the Commonwealth of Pennsylvania. No public comments were received and the Commonwealth of Pennsylvania did not have any comments.

The staff 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, and (2) such activities will be conducted in compliance with the Commission's regulations and the issuance of these amendments will not be inimical to the common defense and the security nor to the health and safety of the public.

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