# PHILADELPHIA ELECTRIC COMPANY

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April 9, 1990

Docket Nos. 50-352
50-353

License Nos. NPF-39
NPF-85

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

SUBJECT: Limerick Generating Station, Units 1 and 2
Technical Specifications Change Request No. 89-09,
"Reduction of the Number of Suppression Chamber-to-Drywell Vacuum Breakers Required to be Operable,"
Response to Request for Additional Information

Dear Sir:

Philadelphia Electric Company (PECo) submitted Technical Specifications Change Request (TSCR) No. 89-09 for the Limerick Generating Station (LGS), Units 1 and 2, by letter dated October 11, 1989. This TSCR proposed to reduce the number of reactor containment suppression chamber-to-drywell vacuum breakers required to be operable. On December 15, 1989, a conference call was held with representatives of the NRC, PECo, and the LGS Architect-Engineer (Bechtel Corporation) that performed the original and current vacuum breaker analyses. During this conference call, the NRC requested additional information. The requests, which were confirmed with the NRC, and our responses are provided in Attachment 1, "Response to NRC Request for Additional Information on LGS Inadvertent Spray Actuation (ISA) Analysis." Attachment 2, "Description of Limerick Inadvertent Spray Actuation Analysis," prepared by Bechtel Corporation provides the following additional information.

1.0 Description of Inadvertent Spray Actuation Analysis

2.0 Discussion of Two and Three Vacuum Breaker Flow Path Study

3.0 Comparison of the Final Safety Analysis Report (FSAR) and the ISA analysis

4.0 References, Figures



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The information in Attachments 1 and 2 is taken from previously completed analyses which provided the justification for our October 11, 1989 TSCR. The analyses are based on assumptions more limiting than the design basis and therefore represent the most limiting accident scenario for specifying the suppression chamber to drywell vacuum breaker requirements. The analyses show that with a minimum of two vacuum breaker assemblies operating, during the accident scenario, the Limerick Generating Station drywell negative pressure stays below the design negative pressure limits.

Should you require further information, please do not hesitate to contact us.

Sincerely yours,

G. A. Hunger, Jr.

G. A. Hunger, Jr.
Manager
Licensing Section
Nuclear Services Department

Attachments

cc: T. T. Martin, Administrator, Region I, USNRC
T. J. Kenny, USNRC Senior Resident Inspector, LGS
T. M. Gerusky, Director, PA Bureau of Radiological Protection

ATTACHMENT 1

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION ON LGS INADVERTENT SPRAY ACTUATION (ISA) ANALYSIS

Question 1a: Provide a description of the vacuum breaker valves based on actual valve test data as to opening times (inertia) and flow capacity.

Response: In the ISA computer analysis,*the vacuum relief flow was calculated based on steady state theoretical flow equations of compressible critical and non-critical flows. To produce results which are conservative in comparison with the test data, the parameters in the theoretical flow equation were conservatively chosen in two areas:

1) A conservative valve opening pressure was selected. In the test, there was measurable flow at around 1.0 psi differential pressure across the two valves in series. In the ISA computer analysis the opening pressure used is 2.81 psid. No flow is assumed to occur until the differential pressure from wetwell to drywell (i.e. across the vacuum breaker assembly) is greater than 2.81 psi.

2) Similarly, based on review of the test data, a conservative pressure differential of 4.48 psi for the fully open valves (wetwell to drywell) was selected. A linear valve opening characteristic was assumed, which results in less mass flow as a function of differential pressure than the test results demonstrate will flow through the two valves in series.

The inertia of the valve disk was not considered in the flow calculation. Neglecting of the inertia is justified since the ISA transient is fairly slow. The modeling of the vacuum breakers is such that they open as a function of differential pressure only and take about six seconds to open. The test data shows that, except for the initial 20° opening, the effect of disk inertia is insignificant. The delay of valve opening through the use of a very conservative opening pressure, and the use of conservative linear ramp opening, is more than adequate to compensate for any effect of valve inertia.

For additional details see the attached Description of the LGS ISA Analysis Section 1.1.

Question 1b: At what ΔP does the valve actually start to open (e.g., 1.81 psid).

Response: In the computer analysis, the valves are assumed to begin to open when the differential pressure across the vacuum breaker assembly (two valves in series) reaches 2.81 psi. Test data indicates that measurable flow will actually occur at approximately 1.0 psid.

Question 1c: Provide a description of the length of time it takes the valve to start opening (e.g. 15 to 16 seconds) and how long it takes to fully open.

Response: Since the opening of the valves is a function of differential pressure across the valves, the length of time it takes for the valves to fully open depends on the drywell and wetwell depressurization transient. In the case of the calculation for two operating vacuum breaker assemblies, the valves start to open at approximately 15 seconds and reach the fully open position at approximately 21 seconds into the transient. In the case of the calculation for the three operating vacuum breaker assemblies, the valves never reach the fully open position since the flow of noncondensible gases through the vacuum breaker assemblies is sufficient to keep the differential pressure between the wetwell and drywell below that required to fully open the valves.

Because conservative values for valve opening pressure and fully open differential pressure are used in the calculation, the vacuum breakers will actually open sooner than is shown in the calculation, and a less severe drywell depressurization would result.

Question 1d: Provide a description of the assumed temperatures in the system, including water sprays.

Response: At the initiation of the ISA event, the following temperature parameters are used:

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|---|---|
| drywell: | 258.33 F |
| wetwell: | 50.00 F |
| service water: | 40.00 F |
| spray: | 47.60 F |

The drywell temperature is the saturation temperature corresponding to a drywell pressure of 34.436 psia. The drywell pressure is equal to the sum of the wetwell noncondensibles and vapor space pressures (which include the noncondensibles carried from the drywell), plus the hydrostatic submergence pressure of the 12.25 foot depth of suppression pool water outside the downcomer.

The initial spray water temperature of 47.6 F is calculated based on a RHR service water temperature of 40 F, RHR suction (suppression pool) water temperature of 50 F and an RHR heat exchanger effectiveness of 0.249. For additional details see the attached Description of the LGS ISA Analysis, Sections 1.2 and 1.3.

Question 2: What are the basis assumptions used in the transient analysis for two vacuum breaker flow paths?

Response: The ISA computer model itself includes conservative basis assumptions which are described in the attached Description of the Limerick ISA Analysis. In addition, conservative assumptions were made regarding initial conditions and other parameters in order to maximize the negative pressure in the drywell. These assumptions are described below:

1. All drywell noncondensibles are assumed to be swept from the drywell prior to the ISA event. A small quantity of noncondensibles is discharged from the primary containment prior to purge valve closure, which conservatively minimizes the quantity of the noncondensibles available to return to the drywell. The remainder of the noncondensibles are carried to the wetwell by steam flow.

2. The wetwell temperature, including suppression pool water, is assumed to be 50 F.

3. The RHR service water temperature is assumed to be 40 F. This minimum service water temperature will cool the RHR spray flow even further and result in very conservative drywell depressurization.

4. One RHR loop spray flow rate of 9500 gpm is assumed.

5. Conservative vacuum breaker flow characteristics are used, as described in the response to Question 1a.

These assumptions are discussed in more detail in the attached Description of the LGS ISA Analysis.