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AUTH.NAME AUTHOR AFFILIATION
BYRAM,R.G. Pennsylvania Power & Light Co.
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SUBJECT: Responds to RAI re 960223 amend request 152 to extend drywell-to-suppression chamber bypass leakage testing interval.

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PP&L Pennsylvania Power & Light Company
Two North Ninth Street • Allentown, PA 18101-1179 • 610/774-5151

Robert G. Byram
Senior Vice President-Nuclear
610/774-7502
Fax: 610/774-5019

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

SUSQUEHANNA STEAM ELECTRIC STATION
RESPONSE TO NRC
REQUEST FOR ADDITIONAL INFORMATION:
DRYWELL TO SUPPRESSION CHAMBER BYPASS TESTING — **Docket Nos. 50-387 and 50-388**
PLA-4475 — **FILES R41-1/A17-2**

Reference: 1) Letter, PLA-4424, R.G. Byram to NRC Document Control Desk, "Proposed Amendment No. 194 to License NPF-14 and Proposed Amendment No. 152 to License NPF-22: Drywell To Suppression Chamber Bypass Testing," dated February 23, 1996.

2) Letter, C. Poslusny to R.G. Byram, "NRC Request For Additional Information Regarding Request By Pennsylvania Power And Light Company To Extend The Test Interval For Drywell Bypass Leakage Tests To 10 Years For Susquehanna Steam Electric Station, Units 1 And 2 (TAC NOS. M94922 and M94923)," dated June 14, 1996.

The purpose of this letter is to respond to the NRC's Request for Additional Information concerning Pennsylvania Power & Light (PP&L) Company's February 23, 1996 amendment request. PP&L requested to extend the drywell-to-suppression chamber bypass leakage testing interval from 40 ± 10 months to an interval which corresponds with the Primary Containment Integrated Leak Rate Testing under 10 CFR 50 Appendix J Option B. In a separate action, the NRC is currently reviewing PP&L's request to adopt the 10 CFR 50 Appendix J Option B requirements. Please find the attached question responses.

Any questions regarding this submittal should be directed to Mr. Terence Bannon at (610) 774-4019.

Very truly yours,

R. G. Byram

Attachment

A001

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copy: NRC Region I
Ms. M. Banerjee, NRC Sr. Resident Inspector
Mr. C. Poslusny, Jr., NRC Sr. Project Manager

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REQUEST FOR ADDITIONAL INFORMATION
DRYWELL BYPASS LEAKAGE TEST INTERVAL

NRC RAI #1

Provide a discussion of the potential increase in risk due to extending the drywell to suppression pool bypass test interval to 10 years. Address such issues as:

(1) increase in risk of overpressurizing containment due to bypass leakage following a severe accident,

(2) increase in the source term for various events due to bypass of the suppression pool followed by containment failure, and

(3) the possibility of bypass leakage of a large amount of hydrogen to the suppression pool.

PP&L Response #1

1) Extending the drywell-to-suppression pool bypass test interval to 10 years will not result in an increase in the calculated Containment Overpressure Failure (COPF) frequency. As shown in the table below, COPF is dominated by loss of decay heat removal (DHR), not loss of vapor suppression. The small fraction of COPF resulting from loss of vapor suppression is a result of vacuum breaker failure not wetwell air space bypass. Technical Specification 4.6.2.1.e requires that a separate leakage test be conducted on the vacuum breakers during each refueling outage for which the drywell bypass leakage test is not conducted. This test ensures that the vacuum breaker leakage area remains significantly below the Technical Specification bypass leakage area. The vacuum breaker test frequency is not changed under the proposed change in test frequency for the drywell-to-suppression chamber bypass test. Therefore, the most probable source of bypass leakage, the vacuum breakers, will continue to be tested at the current frequency under the proposed Technical Specification change. Thus, the proposed change does not have an adverse affect on the capability to detect vacuum breaker leakage, and will not impact the COPF frequency resulting from a failure of either the DHR equipment or vacuum breakers.

COPF - No Core Damage

Event Class	Loss of Heat Removal	Loss of Vapor Suppression	Total COPF
Transients	18.39%	0.00%	18.39%
TAWS	0.92%	0.00%	0.92%
Small LOCA	69.15%	4.07%	73.22%
Medium LOCA	6.71%	0.04%	6.75%
Large LOCA	0.67%	0.04%	0.71%
Total	**95.85%**	**4.15%**	**100.00%**

One may postulate that COPF may occur as a result of suppression pool bypass, due to failure modes other than vacuum breaker fails open. However, a review of the containment response, as described in subsequent paragraphs, demonstrates that in the absence of gross diaphragm failure, that is failures that are in excess of design basis leakage, suppression pool bypass can only result in COPF when coupled with a loss of decay heat removal. Since the drywell-to-suppression pool bypass test does not test the functionality of the decay heat removal equipment, extending the test interval to 10 years will not impact the COPF frequency.

Pressure suppression containments rely on steam condensation in the suppression pool for pressure suppression. Steam that bypasses the suppression pool will not be condensed and will contribute to containment pressurization. Pool bypass can occur as the result of the following failures modes:

- rupture of an SRV tail pipe in the wetwell air space,
- failure of a pair of vacuum breakers open,
- leakage through the drywell floor, downcomers, or vent pipe assemblies into the wetwell air space.

The drywell-to-suppression pool bypass leakage test is concerned with the last item of this list.

Concerns associated with drywell-to-suppression pool bypass leakage are limited to the small break LOCA accident. In transients and ATWS events reactor coolant is not released to the drywell, but is transported directly to the suppression pool via the SRV tailpipes. In large break LOCAs and steamline breaks, the release of reactor coolant is so rapid, that the drywell pressure transient is over within a few hundred seconds when cold water begins to spill out the break, thus performing the vapor suppression function. In small break LOCAs, the release of coolant from the primary coolant pressure boundary is much slower. In this situation drywell-to-suppression pool bypass leakage can contribute to containment pressurization since a significant amount of steam may flow directly into the wetwell air space instead of the suppression pool. However the plant design and operating procedures prevent COPF from drywell-to-suppression pool bypass leakage.

Primary coolant discharge into the drywell will cause the drywell to pressurize. Steam will begin to flow to the suppression pool once the pressure difference between the drywell and wetwell is sufficient to clear the downcomers. This pressure is nominally 5 psid. If a leak path exists which allows the suppression pool to be bypassed, the wetwell will begin pressurizing before the vacuum breakers clear. If the leak is substantial enough, the pressure difference between the drywell and wetwell may never exceed 5 psid. In this case vapor suppression would be lost.

The plant design and Emergency Operating Procedures (EOPs), however, prevent the potential containment challenges from drywell-to-suppression pool bypass leakage. Primary coolant discharge into the drywell will cause the drywell to pressurize. Once the drywell pressure exceeds 1.72 psig, the primary containment control procedure EOP, EO-1/200-103, instructs the operator to initiate wetwell sprays. Wetwell spray operation will cause the vapor bypassing the suppression pool to condense. If the containment pressure continues to rise, for whatever reason including a large bypass of the suppression pool, the operator will initiate the drywell spray system once the containment pressure exceeds 13 psig. Operation of the drywell sprays is sufficient to terminate any pressure rise associated with drywell-to-suppression pool bypass leakage.

If the drywell pressure continues to rise, the operator will depressurize the RPV once the containment pressure exceed the pressure suppression pressure of between 30 to 34 psig. Once the RPV pressure drops below the shutdown cooling interlocks, the operator will initiate shutdown cooling or alternate shutdown cooling, terminating the primary containment pressure rise. Thus COPF from drywell-to-suppression pool bypass leakage cannot occur if decay heat removal is available. Containment failure from loss of decay heat removal is already captured as identified in the above table and is not sensitive to this test. Therefore COPF frequency is unaffected by extending the drywell-to-suppression pool bypass test to 10 years.

2) Increasing the drywell-to-suppression pool bypass test interval to 10 years will not increase the radioactive source term should the containment fail on overpressure. As described in the response to the first part of this question, drywell-to-suppression pool bypass leakage is only a concern for small break LOCAs with loss of decay heat removal. Of the containment failure sequences that contribute to core damage, failure is expected to occur in the drywell at the head flange. Therefore any gases in the drywell or wetwell air space will be available for release, independent of the amount of bypass leakage.

If containment failure occurs as a result of core damage and vessel failure, the size of a potential bypass leak is irrelevant since molten core debris in the absence of drywell sprays will fail the drywell to wetwell downcomer creating a large pool bypass. Therefore the severe accident source term is unaffected by the interval chosen for the drywell-to-suppression pool bypass test.

3) Increasing the drywell-to-suppression pool bypass test interval to 10 years will not create the possibility of bypass leakage of large amounts of hydrogen to the suppression pool. Due to its low solubility, hydrogen will accumulate in the suppression pool air space as long as the drywell pressure exceeds the wetwell air space pressure. Once the wetwell air space pressure exceeds the drywell pressure all gases in the wetwell air space will begin to flow into the drywell. Therefore the hydrogen concentration in the wetwell air space is unaffected by the test interval chosen for the drywell-to-suppression pool bypass test.

NRC RAI #2

Are there areas which could affect the drywell bypass leakage which will be inaccessible and therefore not readily inspected visually or not inspected at all?

PP&L Response #2

All areas of the liner plate over the diaphragm slab are accessible except for:

1) the drywell sumps that are covered with diamond plate or grout and are a source of contamination, and

2) areas under support base plates that are seal welded to the liner plate surface.

In the drywell, the inside of the vent pipes assemblies are not accessible. In the suppression chamber, the outside of vent pipe assemblies and SRV tailpipes can be accessed by using the permanently installed platforms inside the suppression chamber, alternate access can be provided by scaffold or boat in the suppression pool which permits visual inspection from a distance.

NRC RAI #3

What controls are there over modifications to the drywell / suppression pool interface that could affect leakage?

PP&L Response #3

PP&L maintains the following modifications controls relative to containment:

(1) Technical Specification 3/4.6.2 (3.6.2.1) identifies the acceptable drywell-to-suppression chamber bypass leakage. Since this is a Technical Specification requirement, and PP&L Design Input 1 (Codes, Standards, & Requirements) and PP&L Design Consideration 52 (Technical Specification impact) require a Technical Specification review by the lead modification engineer, this issue is considered to be within the "modification program". Any proposed modification affecting containment would require a review of all applicable Technical Specifications.

(2) PP&L Design Input 3 (Operational Requirements) requires a complete review of the FSAR with regards to any modification. Since this issue is discussed in the FSAR, it would be evaluated.

(3) PP&L Design Consideration 52 (Dynamic Qualification) requires a review of the Design Assessment Report (DAR) which includes the response of containment (drywell & suppression pool) during design basis events. Again, for a modification in which this interface may be impacted, this design consideration would apply.

If a repair or modification to the diaphragm slab, or other component, which could impact drywell-to-suppression pool bypass leakage is planned, appropriate post maintenance / modification testing will be performed to ensure the continued leak integrity of the barrier. PP&L maintains programs to define the proper post maintenance / modification testing depending on the type of repair or modification planned. In the case of the diaphragm slab, the guidance provided in Regulatory Guide 1.163 via NEI 94-01 discusses repair and modifications that affect containment leakage integrity. Consistent with PP&L's approach to apply the risk and performance based aspects of Regulatory Guide 1.163 to the diaphragm slab, the Regulatory Guide would be an appropriate input in determining the post maintenance / modification testing for the diaphragm slab if work on the slab is performed.

NRC RAI #4

Is there a backup to containment spray? If there are procedures governing the use of spray backup, describe them.

PP&L Response #4

For the drywell-to-suppression pool bypass leakage concern, both wetwell sprays and drywell sprays can be used to mitigate the containment pressurization caused by the bypass leakage. See response to RAI #1 for a discussion of the alternatives for mitigating containment pressurization.

NRC RAI #5

Verify that the list of cross-connected piping systems on page 9/16 of the February 23, 1996, submittal is complete. List all lines or penetrations between the drywell and the suppression pool which are not subject to Appendix J leak testing requirements. What assurance is there that these are not potential leak paths?

PP&L Response #5

The list of cross-connected piping is complete as shown in our February 23, 1996 submittal. The cross-connected piping in the list includes only those systems that are potential air leakage pathways between the drywell and suppression chamber airspace. All lines and penetrations between the drywell and the suppression pool are subject to Appendix J leak testing in the form of Type A, B, or C tests as noted in SSES Technical Specifications and the leakage rate testing program.

NRC RAI #6

The Final Safety Analysis Report demonstrates that the wetwell sprays will maintain the pressure below the containment design pressure for the design basis bypass leakage. How much larger could the leakage be before the containment sprays become ineffective?

PP&L Response #6

The response to this question requires that a sensitivity study be performed that examines the wetwell pressure response as a function of size of small break, the drywell to wetwell $A/\sqrt{k}$, suppression pool temperature, etc. However, the plant design and EOPs as described in the response to RAI #1 are designed to nullify the impact of any drywell-to-suppression pool bypass leakage. The operator will initiate wetwell sprays when the drywell pressure exceed 1.72 psig. If the wetwell sprays are unable to terminate the containment pressurization, the operator will initiate the drywell sprays when the containment pressure reaches 13 psig. The drywell flow rate

of 10,000 gpm is a factor of 20 greater than the wetwell spray flow. If the drywell sprays are unable to terminate the pressurize rise the operator will depressurize the RPV and initiate either shutdown cooling or alternate shutdown cooling, either of which is sufficient to terminate the containment pressurization. Therefore, the plant design and procedures are effective at terminating containment pressurization from drywell-to-suppression pool bypass leakage well before the containment pressure exceeds the containment design pressure.

From an operating perspective, the amount of drywell-to-suppression pool bypass leakage affects the required response time for an operator to take mitigating actions in response to containment pressurization. PP&L's February 23, 1996 submittal identified that at the design bases drywell-to-suppression pool bypass leakage area ($A/\sqrt{k}$ = 0.0535 ft^2) the operator has 27 minutes from the onset of the LOCA until the containment design pressure of 53 psig is reached. This is the timeframe in which the operator would need to respond to the containment pressurization. Given the relationship between response time and drywell-to-suppression pool bypass leakage area, the design basis leakage area could increase by 100% and still provide the operator adequate time (13.5 minutes) to respond before reaching the containment design pressure. It should be noted that the design basis leakage area is ten (10) times the Technical Specification allowable drywell-to-suppression pool bypass leakage area. Measured leakage areas at Susquehanna, based on previous bypass tests, are a small fraction of the Technical Specification allowable. The maximum measured leakage area for Unit 1 and Unit 2 during previous testing was 4.81% and 1.17% of the Technical Specification limit respectively.

NRC RAI #7

Describe the frequency and type of any non-destructive testing of the liner plate over the diaphragm slab at the penetrations and at the circumference where the diaphragm slab intersects the containment wall.

PP&L Response #7

Eight (8) Unit 1 and seven (7) Unit 2 low pressure drywell-to-suppression chamber bypass tests have been completed to date. Apart from this testing, non-destructive testing has not been performed since original construction completion and is not required on the liner plate over the diaphragm slab.