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SUBJECT: Responds to NRC 820708 ltr requesting to be advised of schedule for submitting program to address concerns re adequacy of design margins of Mark II containment sys. Next rept will be provided within 60 days of ltr receipt.

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**Washington Public Power Supply System**

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Docket No. 50-397

July 23, 1982
G02-82-622

Mr. A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Schwencer:

Subject: NUCLEAR PROJECT NO. 2
CONCERNS REGARDING THE ADEQUACY OF THE
DESIGN MARGINS OF MARK II CONTAINMENT SYSTEMS

Reference: Letter, July 8, 1982, R. L. Tedesco (NRC) to
R. L. Ferguson (Supply System), same subject

The Reference letter requested the Supply System to advise you of our schedule for submitting a program to address concerns originally raised by Mr. John Humphrey, formerly of General Electric, which may be applicable to WNP-2. We have initiated a detailed review of the concerns raised by Mr. Humphrey, and an evaluation of the applicability of those concerns to WNP-2. These efforts currently involve the Supply System, Burns and Roe, Incorporated, and the General Electric Company. Broadly speaking, this program will involve the following steps:

(a) Gain an understanding of the containment design issues raised by Mr. Humphrey through review of the available information which has been generated and through attendance at meetings with General Electric, Mr. Humphrey, and utilities on July 22, in San Jose and at the ACRS meeting in San Jose on July 29 and 30th.

(b) Review plant design and system design features for applicability of the specific concern to WNP-2.

(c) For those issues which are applicable to WNP-2, identify those which can be resolved with existing information, and those, if any, which may require additional analysis.

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(d) For any issues which may require additional analysis, initiate actions to perform the analysis.

(e) Document the results of the evaluations described above in a final report to the NRC.

(f) Provide interim status reports to the NRC, as required, if final resolution cannot be completed in a timely manner.

Within 60 days of the date of this letter, we will provide either (1) an interim status report on the issues identified in the Reference, including our position and rationale for resolution of each issue for which our evaluation is completed and a description of actions being performed to resolve the remainder of the issues; or (2) a final report providing our position and rationale for resolution of each issue.

Based on our reviews to date, it is our opinion that the issues raised by Mr. Humphrey do not represent significant unresolved safety concerns for the WNP-2 plant. Our preliminary assessment of the issues identified in the enclosure to the Reference letter is given in the Attachment.

Very truly yours,

G. D. Bouchey
Deputy Director, Safety and Security

EAF:kjf

Attachment: Concerns Regarding the Adequacy of the Design Margins of Mark II Containment Systems

cc: R. Auluck - NRC
WS Chin - BPA
R. Feil - NRC Site
M. Humm - NRC
H. Chau - LILCO
JC Herman - CG&E
ER Klein - NMPC
AW Metzger - PP&L
R. Ralph - CECO
HW Vollmer - PECO

## CONCERNS REGARDING THE ADEQUACY OF THE DESIGN MARGINS OF MARK II CONTAINMENT SYSTEMS

(Refer to NRC letter to Supply System, dated July 8, 1982)

3. ECCS Relief Valve Discharge Lines Below the Suppression Pool Level

3.1 RHR steam condensing mode is used only during a controlled isolation, not during or following a postulated accident. Two RHR relief valves are provided with each RHR heat exchanger to comply with the ASME Code requirement for overpressure protection. The pressure control valve for the RHR heat exchanger in steam condensing mode is a fail-closed valve. In the extremely unlikely event that the pressure control valve failed open, allowing a high pressure to occur in one of the heat exchangers, the relief valves would be actuated. The maximum RHR relief valve discharge flow that occurs is comparable to that which occurs in each of the 102 downcomers during an intermediate break LOCA. Any condensation oscillation or chugging loads that may be produced by the RHR discharge flow will be bounded by that produced during an intermediate break LOCA for which the containment is designed. Also, only one line is involved, so the resulting loads would be localized. In addition, Class 1E flow instrumentation in the RCIC steam supply line to the RHR heat exchanger will detect the open relief line and flow to the suppression pool will automatically be terminated before the pool heats up to the point where unstable steam condensation or pool temperature stratification becomes a concern. An effort has been initiated in the Mark II Owners group to quantify the magnitude of these postulated loads, based on previous test data. RHR relief valve failure and discharge of high energy fluid to the suppression pool during the shutdown cooling mode of RHR operation is not considered credible because such an event would also require a simultaneous check valve failure between the RHR heat exchanger and the relief line.

3.2 Not applicable for WNP-2. The suppression pool level in a Mark II containment will not be drawn down as in a Mark III containment.

3.3 See 3.1. It is expected that MSRV discharge loads on submerged structures would bound RHR relief valve discharge loads.

3.4 See 3.1. Because Class 1E flow instrumentation would terminate flow through the relief valve, the potential for subsequent actuation of RHR relief valves is extremely unlikely and the consequences (back pressure on RHR heat exchangers, damage to relief valve, increased loads on submerged structures, potential damage to relief valve discharge line) need not be considered.

3.6 See 3.1.

3.7 The only other relief lines which discharge to the pool are for thermal relief valves which are much smaller in capacity than the RHR steam condensing relief valves. Therefore, for this general concern, the RHR relief valves are controlling.

4. Suppression Pool Temperature Stratification

4.1 Not applicable for Mark II containments. No drywell pool can be formed in a Mark II containment.

4.2 Not applicable. See 4.1.

4.3 The existing pool temperature analysis will be reviewed to evaluate whether this is a concern. Conservatisms in existing analyses (high initial pool and service water temperatures, low heat exchanger heat transfer coefficients, high decay heat curves, and no credit taken for heat sinks) are probably more than sufficient to offset a potential pool temperature stratification effect.

4.4 Mark II containment analyses conservatively account for pool stratification and effect on wetwell airspace temperature and pressure by (a) overestimating total energy input to the suppression pool, (b) ignoring structural heat sinks, and (c) assuming lower heat exchanger capability than actually exists. At peak pool temperature, the long term peak suppression chamber pressure is 18.3 psi, which is substantially less than the design pressure for containment (45 psig).

4.5 Of the four causes of pool thermal stratification identified for Mark III containments, only one, containment spray operation, is applicable to a Mark II containment. Since containment spray in WNP-2 is a manual operation (rather than automatic as in a Mark III) and can be terminated easily following drywell depressurization, and also because of the conservatisms identified in 4.4, the effect of containment spray in causing pool stratification is not a significant concern for WNP-2. In addition, containment spray heated in the drywell is added to the suppression at a depth of 12 feet, via flow through the downcomers (not near the pool surface as in a Mark III containment).

4.6 This is a plant availability concern, not a safety issue.

4.7 The RHR suction and discharge locations in WNP-2 are separated approximately 96$^{\circ}$ in azimuth, and 13 feet in elevation. The RHR return lines terminate in opposing open-ended pipes directed circumferentially around the wetwell boundary. Thus, the RHR suction and discharge lines are considered to be sufficiently separated, and flow patterns are such that pool mixing is adequate.

4.8 Not applicable for WNP-2. Operation in containment spray mode will not decrease the heat transfer rate through the RHR heat exchangers. In WNP-2, the RHR system is designed so that flow rates through the RHR heat exchanger are the same in suppression pool cooling mode and containment spray mode.

4.9 Not applicable. See 4.8.

4.10 See 4.7

5. <u>Drywell to Containment Bypass Leakage</u>

5.1 For WNP-2, the SBA has been determined to be the governing suppression pool bypass leakage case. Refer to 6.2.1.1.5 of the FSAR.

5.2 Refer to FSAR question 031.070 and FSAR section 6.2.1.1.5. The Technical Specification limit for $A/\sqrt{K}$ is 10% of the value assumed in the analysis. When wetwell pressure reaches 30 psig following an accident resulting in bypass leakage, containment spray will be manually actuated to prevent containment overpressurization. The operator then has 41 minutes from the time wetwell pressure reaches 30 psig, to manually actuate containment spray, before containment pressure reaches 45 psig.

5.3 Not applicable for WNP-2. See 4.8.

5.4 Not applicable for WNP-2. WNP-2 has an inerted containment, and no drywell purge compressors. The CAC system in WNP-2 can take suction from the wetwell airspace. In normal operation of the CAC system, hydrogen which leaked to the wetwell airspace would return to the drywell through the drywell-to-wetwell vacuum breakers.

5.5 Not applicable for WNP-2. No safety related equipment vulnerable to high local temperature conditions resulting from bypass leakage is located in the wetwell airspace.

5.8 The possibility of high temperatures in the drywell (above design basis post-accident temperatures) without reaching the 2 psig high pressure signal does not appear possible. However, this is being further evaluated.

6. <u>RHR Permissive on Containment Spray</u>

6.1 At WNP-2, drywell mixers come on automatically following the DBA. With inerted containment, operator has more than six hours to start hydrogen recombiners.

6.2 Not applicable for WNP-2. Mark II containments do not have interlocks to require containment sprays prior to starting the recombiners.

6.3 Not applicable for WNP-2. WNP-2 uses catalytic recombiners with after-coolers to cool hot recombiner effluent gas to below 150°F before being returned to the containment.

6.4 Not applicable for WNP-2. The air monitoring system used in WNP-2 uses heat tracing to prevent condensation of steam in the equipment.

6.5 Not applicable for WNP-2. See 6.3.

7. Containment Pressure Response

7.1 See 4.4.

7.2 See 4.4.

7.3 See 4.4. Adiabatic compression effects are considered in the pool swell analysis for WNP-2, which is used to calculate conservative wetwell airspace compression for diaphragm floor uplift pressure. For long term suppression chamber pressure response, assuming equilibrium conditions between the suppression pool and the wetwell airspace is justified since the peak long term wetwell airspace pressure (18.3 psi) is substantially less than design capacity (45 psig).

8. Containment Air Mass Effects

8.1 The containment negative pressure analysis for WNP-2 is currently being reevaluated and addresses sensitivity to assumed initial conditions. This analysis will be documented in the FSAR when it is finalized.

8.2 The reactor building to wetwell vacuum breakers in WNP-2 limit initial negative differential pressure between reactor building and containment to 0.5 psi. The effect of worst case initial conditions is considered in the negative pressure calculation described in 8.1.

8.3 Not applicable for WNP-2.

8.4 The causes and consequences of low initial air mass inside containment are addressed in the analysis mentioned in 8.1. This will be documented in a future revision to the FSAR.

9. Final Drywell Air Mass

9.1 With cold water being injected into the RPV with full ECCS flow, condensation occurs which draws air back into the drywell from the wetwell airspace. If saturated steam is coming from the vessel due to reduced ECCS flow, the containment pressure would be higher, but would be less than what has been analyzed.

9.2 Not applicable for WNP-2. The concern raised by Mr. Humphrey is that with automatic drywell sprays it is difficult to get out of the spray mode and into pool cooling. In WNP-2, the drywell sprays are manually operated, so this is not a concern.

9.3 Later.

11. Operational Control of Drywell to Containment Differential Pressures

This concern is translated into water level difference between suppression pool and water inside the downcomers, for a Mark II plant. The minor differentials in water level which could occur (limited by vacuum breaker pressure set points) was accommodated in the 4T and 4TCO tests, upon which the hydrodynamic load definitions for WNP-2 are based.

14. RHR Backflow Through Containment Spray

Not applicable for WNP-2. WNP-2 does not have automatic sprays and the valves are interlocked to prevent LPCI and containment spray valves from being open simultaneously.

15. Secondary Containment Vacuum Breaker Plenum Response

Any postulated air mass deficit in the containment prior to initiation of containment sprays would be very small in comparison to reactor building air mass, so the depressurization of the secondary containment is not expected to be significant. However, this effect will be analyzed.

16. Effect of Suppression Pool Level on Temperature Measurement

Not applicable for WNP-2. There is no suppression pool drawdown for a Mark II containment. Also, WNP-2 has pool temperature sensors at two elevations.

17. Emergency Procedure Guidelines

Not applicable for WNP-2. Mark II containments have no upper pool dump. There is no transient or plant operating condition for a Mark II containment that would result in a rapid increase in suppression pool water level, (which could conceivably increase hydrodynamic SRV discharge loads, or increase backpressure in the SRV discharge lines.) Conservatisms in the SRV load definition for WNP-2, and in design of the SRV discharge line piping and supports would account for any credible suppression pool water level fluctuation. No modification to EPG's are considered necessary.

18. Effect of Insulation Debris

18.1 The effect of pipe insulation debris in blocking entrance to downcomers has been considered, and is not credible. See FSAR section 6.2.1.1.2 d.

18.2 Stainless steel insulation is used exclusively inside containment. It is possible for some pieces of insulation from smaller piping (less than 4-inch) to work their way down through the grating and into a downcomer vent and into the suppression pool. However, suction strainers for WNP-2 are designed to permit 50% blockage, so ECCS performance would not be adversely affected.

21. Containment Makeup Air for Backup Purge

Not applicable for WNP-2 because containment is not purged for containment atmosphere control following a LOCA.

22. Miscellaneous Emergency Procedure Guideline Concerns

EPG's are reviewed to assure they are compatible with plant safety.

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