LILCO LONG ISLAND LIGHTING

LONG ISLAND LIGHTING COMPANY

SHOREHAM NUCLEAR POWER STATION

P.O. BOX 618, NORTH COUNTRY ROAD • WADING RIVER, N.Y. 11792

December 9, 1982 SNRC-808

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Concerns Regarding the Adequacy of the Design Margins
of the Mark I and II Containment Systems
Shoreham Nuclear Power Station - Unit 1
Docket No. 50-322

Reference (1): Robert L. Tedesco letter to
M. S. Pollock dated July 8, 1982

Dear Mr. Denton:

Reference (1) requested that the Long Island Lighting Company provide a proposed program to respond to the subject concerns that were identified as being potentially applicable to Shoreham.

In response to this request, enclosed please find forty (40) copies of a report entitled "Concerns Regarding the Adequacy of the Design Margins of the Mark II Containment Systems at Shoreham Nuclear Power Station." This report addresses all items in reference (1) with the exception of items 3.3 and 3.4. A submittal will be made on these items by mid-January, 1983.

Should you have any questions, please contact this office.

Very truly yours,

J. L. Smith

J. L. Smith
Manager, Special Projects
Shoreham Nuclear Power Station

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Enclosure

c.c.: J. Higgins
All Parties

Concerns Regarding the Adequacy of the Design Margins of the Mark II Containment Systems at Shoreham Nuclear Power Station

Issue

1. (1.1 thru 1.7) These issues are related to pool swell in Mark III containments - they are not applicable to Mark II containments. This position is in accordance with the NRC.

2. (2.1 thru 2.3) These issues are related to the SRVDL configuration in Mark III containments - they are not applicable to Mark II containments. This position is in accordance with the NRC.

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

3.1 The design of the STRIDE plant did not consider vent clearing, condensation oscillation, and chugging loads which might be produced by the actuation of these relief valves.

Response

At Shoreham Nuclear Power Station (SNPS), the ECCS relief valve discharge into the suppression pool contributes little to the integrated pool boundary loads or to the overall building response. Of the three (3) relief valves which discharge into the pool, only the full-size relief valve to the RHR heat exchanger (located on the steam supply line from the HPCI turbine) could release a potentially significant steam flow; which is true only in the event of an RHR system failure during the steam condensing mode. In contrast, the discharge from the other two relief valves would be of considerably lower energy and/or volumetric flow rate, and therefore can be ignored (see response to Issue 3.7).

During the steam condensing mode, there would be no discharge from the main steam relief valves into the suppression pool. On a global level then, a pool load combination which included discharge from the RHR heat exchanger relief valve, clearly would be bounded by pool load combinations which included discharge from either the main steam relief valves or the downcomer vents.

Four system failures could result in the RHR heat exchanger relief valve lifting: (1) the PCV upstream of the heat exchanger fails open, (2) the flow path downstream of the heat exchanger is isolated, (3) the service water flow to the heat exchanger (tube side) fails, or (4) the relief valve itself fails open. The resulting heat input to the suppression pool could cause steam-quenching vibrations or other condensation instabilities if local pool temperatures were not limited to less than approximately 150°F.

Following any of the first three faults listed above, the RHR heat exchanger pressure would increase rapidly to the relief valve setpoint pressure; the corresponding saturation temperature of which is greater than the setpoint of the heat exchanger high temperature alarm. Upon actuation of this alarm, the SNPS Station Procedures require that the operator either reduce the system pressure or isolate the effected heat exchanger. A conservative analysis of this transient shows that the operator would have at least 30 minutes in which to isolate the effected heat exchanger before local pool temperatures exceeded 150°F. Due to the operator intensive nature of the steam condensing mode, this time scale is more than adequate to ensure corrective action.

If the relief valve were to fail open, the steam input to the suppression pool would cause the temperature of the pool surface to rise above the setpoint of the suppression pool high temperature alarms located near the surface of the pool. Upon actuation of these alarms, the station procedures require that the operator isolate all sources of heat input to the pool. Since the steam flow from the failed relief valve would be significantly less than that assumed in the analysis refered to above, the operator would have sufficient time to isolate the relief valve as a heat source before local suppression pool temperatures exceeded 150°F.

The local effects of the RHR heat exchanger relief valve discharge on submerged structures are considered in the response to Issue 3.3.

3.2 The STRIDE design provided only 9 in of submergence above the RHR [heat exchanger] relief valve discharge lines at low suppression pool levels.

Response

At SNPS, the RHR heat exchanger relief valve discharge line exit is submerged a minimum of four (4) feet at the suppression pool low water level. Analysis shows that this configuration is sufficient to condense the maximum steam flow from the relief valve.

3.5 This issue is not applicable to Mark II containments in accordance with the NRC.

3.6 If the RHR heat exchanger relief valves discharge steam to the upper levels of the suppression pool following a design basis accident, they will significantly aggravate suppression pool temperature stratification.

Response

This issue has significance only when the RHR heat exchangers are receiving flow directly from the reactor; either in the shutdown cooling mode or the steam condensing mode. The steam condensing mode is used only to maintain hot shutdown conditions within the RPV (e.g., constant pressure) while it is isolated from the main condenser, and therefore would not be applicable to an accident analysis. In the case of the shutdown cooling mode, system characteristics indicate that it would not be possible for the system pressure to exceed the RV setpoint of 450 psig. Even if the relief valve were to fail open, the energy content of the steam which would be input to the suppression pool would be too low to effect temperature stratification of any significance. (For further discussion of temperature stratification, see the response to Issue 4.4.)

3.7 The concerns related to the RHR heat exchanger relief valve discharge lines should also be addressed for all other relief lines that exhaust into pool. (p. 132 of 5/27/82 transcript)

Response

Three (3) RVs discharge into the suppression pool:

1. 1E11*RV152 (A and B)
2. 1E11*RV157 (A and B) and
3. 1E11*RV155

Relief valves 1E11*RV152A and B (RHR heat exchanger, HPCI steam supply) and 1E11*RV157 A and B (RHR heat exchanger thermal-relief) all discharge into the suppression pool through a common 10 inch line. The maximum rated flow through *RV152 is 110,605 lb/hr of saturated steam at full lift, and the maximum rated flow through *RV157 is 2800 lb/hr of saturated steam at full lift.

Since the RHR heat exchanger thermal-relief discharges into the suppression pool through the same line as the RHR heat exchanger (full-sized) relief valve, and since the full-open flow rate through the former is substantially less than that through the latter, the effects of *RV157 discharging into the suppression pool clearly are bounded by the effects of *RV152.

Relief valve 1E11*RV155 (RCIC pump suction) discharges into the suppression pool through a 16 inch pool cooling line. The maximum flow rate through *RV155 is 71 gpm of water at 85 psig, 200°F. The hydrodynamic effect of this discharge has been analyzed and determined to be of no consequence.

4. Suppression Pool Temperature Stratification

4.1 The present containment response analyses for drywell break accidents assume that the ECCS systems transfer a significant quantity of water from the suppression pool to the lower regions of the drywell through the break. This results in a pool in the drywell which is essentially isolated from the suppression pool at a temperature of approximately 135°F. The containment response analysis assumes that the drywell pool is thoroughly mixed with the suppression pool. If the inventory in the drywell is assumed to be isolated and the remainder of the heat is discharged to the suppression pool, an increase in bulk pool temperature of 10°F may occur. (1)*

Response

Water potentially held up on the Shoreham drywell floor would be at most 3 percent of the total pool volume. If this water were to experience a heatup to only 135°F, the bulk temperature of the pool would increase by approximately 2°F. The effect of water on the drywell floor is already included in SBA Case 3A presented in the DAR, Revision 5, Section 10.

4.2 The existence of the drywell pool is predicated upon continuous operation of the ECCS. The current emergency procedure guidelines require the operators to throttle ECCS operation to maintain vessel level below Level 8. Consequently, the drywell pool may never be formed. (2)

*Parenthetical superscripts refer to notes on page 24.

Response

This issue is in fact not applicable to Mark II containments since formation of the "drywell pool" is not required for plants without an upper pool dump.

4.3 All Mark III analyses presently assume a perfectly mixed uniform suppression pool. These analyses assume that the temperature of the suction to the RHR heat exchangers is the same as the bulk pool temperature. In actuality, the temperature in the lower part of the pool where the suction is located will be as much as 7 1/2°F cooler than the bulk pool temperature. Thus, the heat transfer through the RHR heat exchanger will be less than expected.

Response

Since the RHR pump suctions are located near the top of the suppression pool (5 to 6 ft from the pool surface with a pool depth of 17 to 13 ft), this is not an issue for SNPS. The RHR heat exchanger inlet temperature will be very close to the bulk pool temperature as assumed in the pool temperature transient analysis.

4.4 The long-term analysis of containment pressure/temperature response assumes that the wetwell airspace is in thermal equilibrium with the suppression pool water at all times. The calculated bulk pool temperature is used to determine the airspace temperature. If pool thermal stratification were considered, the surface temperature, which is in direct contact with the airspace, would be higher. Therefore, the airspace temperature (and pressure) would be higher.

Response

In a Mark II containment, the peak pressure is established in the short term by blowdown dynamics rather than in the long term by pool airspace heatup. Pool stratification is therefore of no significant concern in containment peak-pressure analysis. The maximum airspace temperature, which is used for equipment qualification, is determined using steam bypass analysis. The steam bypass analysis does not assume the airspace and pool to be in equilibrium; heat transfer between the airspace and the pool may be included (or neglected for conservatism). For the range of break sizes important to steam bypass, chugging will exist for the duration of the transient and will provide excellent pool mixing. Therefore, the assumption of an unstratified pool in containment analysis is acceptable.

In general, the containment analysis for SNPS assumes the airspace temperature to be equal to that of the pool (i.e., a single thermodynamic system). In order for the pool to drive the airspace air mass temperature at a rate of approximately 50°F rise per hour (typical for the system), approximately 200,000 Btu/hr must be transferred from the pool to the airspace air. With a heat transfer coefficient of 2.0 Btu/hr-ft^2-°F (typical for the pool/airspace), and a pool surface area of approximately 4000 ft^2, a temperature difference of 25° would have to exist between the airspace and the pool to yield this rate of heat transfer. This is equivalent to saying that the pool surface would have to be 25°F hotter than the bulk pool temperature in order for the airspace temperature to follow that of the bulk pool. This is greater than any reasonable estimate of pool stratification.

4.5 A number of factors may aggravate suppression pool thermal stratification. The chugging produced through the first row of horizontal vents will not produce any mixing from the suppression pool layers below the vent row. An upper pool dump may contribute to additional suppression pool temperature stratification. The large volume of water from the upper pool further, submerges RHR heat exchanger effluent discharge which will decrease mixing of the hotter, upper regions of the pool. Finally, operation of the containment spray eliminates the heat exchanger effluent discharge jet which contributes to mixing. [3]

Response

None of these issues are significant for Mark II containments. In a Mk II, the wetwell sprays would not be operated without simultaneous operation of suppression pool cooling. Drywell spray water returns midplane to the pool through the widely dispersed downcomers; thus providing mixing as good or better than operation of pool cooling.

4.6 The initial suppression pool temperature is assumed to be 95°F while the maximum expected service water temperature is 90°F for all Grand Gulf Nuclear Station (GGNS) accident analyses as noted in [the GGNS] FSAR Table 6.2-50. If the service water temperature is consistently higher than expected, as occurred at Kuosheng, the RHR system may be required to operate nearly continuously in order to maintain the suppression pool temperature at or below the maximum permissible value.

Response

For SNPS, the maximum service water temperature of 77°F is 13°F below the pool technical specification limit of 90°F. The RHR heat exchangers were designed assuming a service water temperature of 80°F. Therefore, only intermittent use of the RHR system in the pool cooling mode will be required to maintain the pool temperature below the technical specification limit.

4.7 All analyses completed for the Mark III are generic in nature and do not consider plant specific interactions of the RHR suppression pool suction and discharge.

Response

The SNPS suppression pool cooling and quencher arrangement is designed to promote CCW pool circulation. There will be no adverse interactions of the SNPS pool cooling suction and discharge. The RHR "B" loop (east side) includes an elbow on the discharge to direct the flow away from the companion suctions and to induce CCW pool circulation. On the RHR "A" loop (west side), the discharge has been extended vertically downward to within approximately 5 ft of the pool bottom. This configuration takes advantage of stratification in the immediate vicinity of the discharge due to the return of colder water from the RHR heat exchanger. Operation of both loops, either singly or in tandem, will be compatible with the CCW pool circulation induced by the quencher discharge.

An in-plant test was conducted to demonstrate the ability of the RHR pool cooling system "A" loop to mix the pool and avoid excessive short-circuiting without simultaneous "B" loop operation or quencher discharge. The pool was heated to approximately 125°F using RHR pump heat and then cooled in approximately 3 1/2 hr to under 80°F using the "A" loop only. The maximum spatial pool temperature variation during the cooldown was on the order of 2°F, and the suction temperature was only slightly lower than the pool bulk temperature.

4.8 Operation of the RHR system in the containment spray mode will decrease the heat transfer coefficient through the RHR heat exchangers due to decreased system flow. The FSAR analysis assumes a constant heat transfer rate from the suppression pool even with operation of the containment spray.

Response

The SNPS suppression pool cooling and drywell spray flow rates are very nearly the same; the drywell spray flow being less than 4 percent lower than the pool cooling flow. The wetwell sprays would not be operated without simultaneous operation of suppression pool cooling. In the case of wetwell spray operation, rated flow through the RHR heat exchanger would be maintained by throttling the pool cooling return-line valve to direct the excess flow to the pool. It follows that the heat removal rate of the RHR heat exchanger is independent of the RHR system mode of operation.

4.9 The effect on the long-term containment response and the operability of the spray system due to cycling the containment sprays on and off to maximize pool cooling needs to be addressed. Also provide and justify the criteria used by the operator for switching from the containment spray mode to pool cooling mode, and back again. (pp. 147-148 of 5/27/82 transcript)

Response

For SNPS, cycling of the containment sprays to achieve maximum pool cooling is not required (see response to Issues 4.5 and 4.8). The Emergency Procedures as developed from the BWR Owners Group EPGs provide the operator with the criteria necessary for operation of the sprays.

4.10 Justify that the current arrangement of the discharge and suction points of the pool cooling system maximizes pool mixing. (pp. 150-155 of 5/27/82 transcript)

Response

See response to Issue 4.7.

5.0 Drywell to Containment Bypass Leakage

5.1 The worst case of drywell to containment bypass leakage has been established as a small break accident. An intermediate break accident will actually produce the most significant drywell to containment leakage prior to initiation of containment sprays.

Response

For SNPS, it has been found that the critical break size varies with the particular set of conservative assumptions used in the analysis. For any given set of assumptions, a complete spectrum of breaks was considered, thereby ensuring that the "critical" break was analyzed. In any event, little difference in bypass capability was observed for rather large variations in break size around the critical value.

5.2 Under Technical Specification limits, bypass leakage corresponding to $A/\sqrt{K} = 0.1\ ft^2$ constitutes acceptable operating conditions. Smaller-than-IBA-sized breaks can maintain break flow into the drywell for long time periods because the RPV would be depressurized over a 6 hour period. Given, for example, an SBA with $A/\sqrt{K} = 0.1\ ft^2$, projected time period for containment pressure to reach 15 psig is 2 hr. In the latter 4 hr of the depressurization, the containment would presumably experience ever-increasing over-pressurization. (4)

Response

For SNPS, the acceptance criterion for the value of the maximum bypass leakage is $A/\sqrt{K} = 0.005\ ft^2$. With this leak size, it is estimated that more than 8 hr would be required to exceed the containment design pressure without operation of either the wetwell or drywell sprays. Operation of the wetwell sprays with this size leak would be sufficient to prevent the wetwell pressure from reaching the value requiring actuation of the drywell sprays. If the drywell sprays were actuated, the containment pressurization would most certainly be terminated.

5.3 Leakage from the drywell to containment will increase the temperature and pressure in the containment. The operators will have to use the containment sprays in order to maintain containment temperature and pressure control. Given the decreased effectiveness of the RHR system in accomplishing this objective in the containment spray mode, the bypass leakage may increase the cylical duty of the containment spray.

Response

See response to Issues 4.8, 4.9, and 5.2.

5.4 Direct leakage from the drywell to the containment [wetwell] may dissipate hydrogen outside the region where the hydrogen recombiners take suction. The anticipated leakage exceeds the capacity of the drywell purge compressors. This could lead to pocketing of hydrogen which exceeds the concentration limit of 4 percent by volume. (5)

Response

This issue is not applicable to Mark II containments because Mark II containments are inerted, which makes hydrogen control relatively unimportant. With regard to the use of recombiners for the purpose of oxygen control, SNPS recombiners can take suction from either the wetwell or the drywell. If the recombiner suction is taken from the drywell, then the flow is returned to the drywell, and if the recombiner suction is taken from the wetwell, then the flow is returned to the wetwell. The oxygen concentrations in the drywell and wetwell are monitored and displayed independently. The SNPS Station Procedures advise the operator that one recombiner can be used to process the drywell atmosphere while the second recombiner is used to process the wetwell atmosphere. It follows that any "bypass" leakage from the drywell to the wetwell would have no effect on the operation of the system.

5.5 Equipment may be exposed to local conditions which exceed the environmental qualification envelope as a result of direct drywell to containment bypass leakage.

Response

For SNPS, only two environmentally qualified types of equipment are located in the wetwell airspace. The pieces of equipment closest to the drywell floor are the vacuum breakers (with Namco position switches) which are located nearly 10 ft below the floor. All equipment in the wetwell airspace is qualified for a temperature of 250°F - local conditions will not exceed this limit.

5.6 & 5.7 These issues are related to the upper pool dump in Mark III containments - they are not applicable to Mark II containments. This position is in accordance with the NRC.

5.8 The possibility of high temperatures in the drywell without reaching the 2 psig high pressure scram level because of bypass leakage through the drywell wall should be addressed. (pp. 168-174 of 5/27/82 transcript)

Response

The concern here seems to be that a leak in the drywell will slowly purge the air from the drywell and increase the temperature without initiating a SCRAM. A conservative analysis of this transient indicates that because of the relatively small air volume of the primary containment, the drywell pressure would increase rapidly (in less than 7 minutes) to the reactor SCRAM setpoint. The maximum calculated drywell temperature at the time of the SCRAM would be far below the environmental qualification requirements of the equipment located in the containment.

6. RHR Permissive on Containment Spray

6.1 We understand that GE has recommended for Mark III containments that the combustible gas control systems be activated if the reactor vessel water level drops to within 1 foot of the top of the active fuel. Indicate what your facility is doing in regard to this recommendation.

Response

This issue is not applicable to a Mark II containment because a Mk II is inerted, and short-term hydrogen control is not a significant concern. No such recommendation has been made at SNPS.

6.2 General Electric has recommended that an interlock be provided to require containment spray prior to starting the recombiners because of the large quantities of heat input to the containment. Incorrect implementation of this interlock could result in inability to operate the recombiners without containment spray. (5)

Response

As stated above, such an interlock could, if it failed, prevent the use of an otherwise operable recombiner. Therefore, LILCO, in conjunction with the Mk II Owners Group, neither recommends nor has implemented an interlock which would require containment spray initiation prior to starting the recombiners. However, the SNPS Station Procedures do specify that the containment sprays be actuated as soon as possible following a LOCA (for hydrogen mixing), and prior to starting the recombiners.

6.3 The recombiners may produce "hot spots" near the recombiner exhausts which might exceed the environmental qualification envelope or the containment design temperature.

Response

Rockwell/AI recombiners, such as those used at SNPS, contain an aftercooler which precludes an excessively high recombiner exhaust temperature. Under normal operating conditions, the return gas temperature is approximately 150°F. The maximum return gas temperature is 250°F. Equipment in the wetwell airspace is qualified to 250°F and that in the drywell is qualified to 340°F. In the event the return gas temperature is higher than 250°F, there is an alarm and warning light in the control room, and the recombiner is automatically shut down.

6.4 For the containment air monitoring system furnished by General Electric, the analyzers are not capable of measuring hydrogen concentration at volumetric steam concentrations above 60 percent. Effective measurement is precluded by condensation of steam in the equipment.

Response

With an inerted containment, measurement of hydrogen concentration is of interest only until the concentration exceeds 4 percent (a high range monitor, however, provides indication availability up to 30 percent). Above 4 percent hydrogen, dual-range oxygen monitors are used to aid in controlling the oxygen concentration below 5 percent.

Heat tracing is present on the inlet lines of the hydrogen and oxygen analyzers. The heat tracing is designed to be available one-half hour after a LOCA to maintain the temperature of the inlet gases to 275°F; this is higher than the saturation temperature for containment pressures one-half hour after a LOCA and later. As added precautions, the analyzers contain internal "hot boxes" to maintain the temperature of the inlet gases prior to the sampling reaction, and water traps to remove any moisture that might be present in the inlet gases. Therefore, the oxygen analyzers will not be adversely affected by volumetric steam concentrations of 60 percent, or more.

6.5 Discuss the possibility of local temperatures due to recombiner operation being higher than the temperature qualification profiles for equipment in the region around and above the recombiners. State what instructions, if any, are available to the operator to actuate containment sprays to keep this temperature below design values. (pp. 183-185 of 5/27/82 transcript) [5]

Response

For SNPS, the recombiners are located in an open area on El 112 ft 9 in. of the reactor building (a shield wall separates the two units); they are not located inside the primary containment. Adequate post-accident ventilation is provided by the RBSVS to maintain local temperatures due to recombiner operation below the environmental qualification limits of the safety-related equipment located in the vicinity of the recombiners; this is considering the heat load of the recombiners.

7. Containment Pressure Response

7.1 The wetwell is assumed to be in thermal equilibrium with a perfectly mixed, uniform temperature suppression pool. As noted under topic 4, the surface temperature of the pool will be higher than the bulk pool temperature. This may produce higher than expected wetwell temperatures and pressures.

Response

See response to Issue 4.4.

7.2 The computer code used by General Electric to calculate environmental qualifications parameters considers heat transfer from the suppression pool surface to the containment atmosphere. This is not in accordance with the existing licensing basis for Mark III environmental qualification. Additionally, the bulk suppression pool temperature was used in the analysis instead of the suppression pool surface temperature. [6]

Response

The concern here appears to be that GE is taking credit in equipment qualification calculations for the lag of the airspace temperature transient (Mk III containment) behind that of the pool. For SNPS, the airspace temperature is generally assumed in containment analysis to be the same as that of the pool; except in steam bypass analysis where the airspace temperature is much greater than that of the pool. The environmental qualification parameters for equipment in the wetwell airspace were calculated using a methodology which does not take credit for any heat transfer to the pool surface. (Pool temperature stratification effects on steam bypass analysis are discussed further in the response to Issue 4.4.)

7.3 The analysis assumes that the wetwell airspace is in thermal equilibrium with the suppression pool. In the short term, this is nonconservative for Mark III due to adiabatic compression effects and finite time required for heat and mass to be transferred between the pool and wetwell volumes. [6]

Response

The maximum theoretical increase in the peak wetwell (and drywell) pressure due to adiabatic compression effects would be on the order of 2 to 3 psi. However, if the short-term airspace vapor pressure were properly modeled as well, the net effect would be to increase the pressure on the order of only 1 to 2 psi. This slight deficiency in the containment analysis was more than compensated for by other more substantial conservatisms in the LOCTVS computer code. In the SNPS response to the NRC's Question 020.68, DAR Revision 5, Appendix D, Table 020.68-2, comparisons were provided between the 4T-test-facility measured peak drywell pressures and those predicted by LOCTVS. The latter were based on vapor blowdowns which tend to minimize the inherent conversatisms of the LOCTVS program; thus providing the least favorable comparisons to measured values. The effects of adiabatic compression were included automatically in the measured pressure values; evidenced by the fact that the short-term temperature response of the wetwell airspace was typically 50°F greater than that of the pool. The smallest margin between the measured pressure values and the predicted pressure values was 0.5 psi, while a margin of 2.0 psi was typical.

For SNPS, the peak drywell pressure is established by the recirculation suction break (liquid line); the model of which contains even more conservatism than that of the vapor blowdown break described above. Accordingly, it can be stated with certainty that sufficient conservatism was used in the SNPS containment analysis to more than compensate for omitting the effects of short-term adiabatic airspace compression.

8. Containment Air Mass Effects

8.1 This issue is based on consideration that some technical specifications allow operation at parameter values that differ from the values used in assumptions for FSAR transient analyses. Normally, analyses are done assuming a nominal containment pressure equal to ambient (0 psig), a temperature near maximum operation (90°F), and do not limit the drywell pressure equal to the containment pressure. The technical specifications operation under conditions such as a positive containment pressure (1.5 psig), temperature less than maximum (60 or 70°F), and drywell pressure can be negative with respect to the containment (-0.5 psid). All of these differences would result in transient response different from the FSAR descriptions.

Response

For SNPS, Technical Specification 3.6.1.6 has been prepared to limit the mass of the drywell noncondensibles to that assumed in the FSAR peak drywell pressure analysis. During plant operation, the wetwell pressure will most likely be somewhat less than that of the drywell (due to drywell heatup), but is conservatively assumed to be the same. The pool temperature is conservatively assumed to be at the maximum operating technical specification limit of 90°F. Although the wetwell airspace temperature will most likely be higher than that of the pool (due to downcomer heat transfer), it is conservatively assumed to be the same, thereby maximizing the mass of noncondensibles in the wetwell. In summary, the SNPS FSAR containment peak pressure analysis uses the limiting technical specification values for the drywell and wetwell initial conditions.

8.2 The draft GGNS technical specifications permit operation of the plant with containment pressures ranging between 0 and -2 psig. Initiation of containment spray at a pressure of -2 psig may reduce the containment pressure by an additional 2 psig which would lead to buckling and failures in the containment liner plate.

Response

Based on the discussion in the SNPS FSAR, Section 6.2.1.3.2, the greatest possible depressurization for SNPS under nonaccident conditions is (-) 3.2 psi. The minimum operating technical specification (3.6.1.6) limit for containment pressure is 14.0 psia (-0.7 psig). This provides a minimum margin of 0.8 psi to the design negative pressure of 10.0 psia (-4.7 psig). Removal of even a moderate degree of conservatism from the analysis described above would result in a margin in excess of 1 psi. Therefore, operation of the SNPS containment at (-) 0.7 psig, even though extremely unlikely, would not constitute a hazard to the integrity of the structure.

8.3 If the containment is maintained at -2 psig, the top row of vents could admit blowdown to the suppression pool during an SBA without a LOCA signal being developed. (7)

Response

This issue is not applicable to Mark II containments in accordance with the NRC.

8.4 Describe all of the possible methods both before and after an accident of creating a condition of low air mass inside the containment. Discuss the effects on the containment design external pressure of actuating the containment sprays. (pp. 190-195 of 5/27/82 transcript).

Response

During normal operation, the only way to create a low mass of noncondensibles in the containment is to vent the containment following steam leakage or pool heatup; each of which places a large mass of water vapor in the containment atmosphere. Subsequent condensation of this water vapor could then create a negative containment pressure. However, to create a negative pressure approaching the design value of (-) 4.7 psig, the saturation temperature of the water vapor in the air would have to exceed 150°F. Since during normal operation the pool temperature is limited to 120°F (hot shutdown) and the drywell temperature is limited to 150°F, this condition could not exist.

During an isolation/SCRAM or stuck-open relief valve (SORV) transient, it is possible for the pool temperature to approach 200°F, creating a condition in which both the wetwell airspace and drywell vapor pressures increase by several psi due to pool evaporation. The vapor pressure increase in the wetwell airspace would, of course, be greater than that in the drywell; the drywell pressure increase being caused by both air and water vapor flow through the vacuum breakers. Under these circumstances, venting of the wetwell arispace would be performed in accordance with station procedures designed in part to limit to acceptable levels the wetwell airspace vapor pressure prior to venting. This would minimize the loss of noncondensibles.

Following a LOCA, containment venting would not be utilized except to control the concentration of oxygen in the containment, or as part of the recovery process. By the time containment venting would be required, both the suppression pool and the reactor coolant system temperature would be less than 150°F, eliminating the concern for negative pressures due to condensation. Recombination of hydrogen could lower the mass of noncondensibles in the containment, but if recombination were necessary (or possible), it would be performed prior to containment venting, and the final pressure would not be less than atmospheric. Even if all the hydrogen were in the wetwell airspace and the use of recombination decreased the wetwell airspace pressure, the downcomers would clear to relieve the pressure decrease well before the negative design pressure of(-) 4.7 psig could be exceeded. Therefore the post-LOCA loss of containment non-condensibles is not a problem.

9. Final Drywell Air Mass

9.1 The current FSAR analysis is based upon continuous injection of relatively cool ECCS water into the drywell through a broken pipe following a design basis accident. Since the operator is directed to throttle ECCS operation to maintain the reactor vessel water level to about the level of the steam lines, the break will be releasing saturated steam instead of releasing relatively cool ECCS water. Therefore, the drywell air which would have been purged and then drawn back into the drywell, will remain in the wetwell, and higher pressures than anticipated will result in both the wetwell and the drywell.

Response

For a Mark II containment, short term dynamics, not long-term effects, establish the peak containment pressure. Nevertheless, the case refered to above has been analyzed for SNPS and the results are presented in the SNPS FSAR, Section 6.2.1.3.1, Case D (sprays not actuated). The SNPS bypass analysis does not assume that ECCS injection or spillage from the break will terminate reactor steaming.

It is important to note: the drywell air remains in the wetwell airspace until the drywell sprays are actuated.

9.2 The continuous steaming produced by throttling the ECCS flow will cause increased direct leakage from the drywell to the wetwell. This could result in increased wetwell pressures.

Response

This is in fact not applicable to a Mark II containment because the concern relates specifically to a Mark III containment: with continued steaming, the post-LOCA containment pressure may never get below the 9 psig spray setpoint, and therefore the automatic spray mode may continue indefinitely. If the spray mode represents degraded containment heat removal, then the degraded containment heat removal may continue indefinitely. None of this applies to a Mark II containment.

9.3 It appears that some confusion exists as to whether SBA's and stuck open SRV accidents are treated as transients or design basis accidents. Clarify how they are treated and indicate whether the initial conditions were set at nominal or licensing values. (pp. 202-205 of 5/27/82 transcript)

Comment

The SNPS pool temperature transient analysis has been conducted in accordance with draft-NUREG 0783, as described in Section 10 of the DAR, Revision 5. The initial conditions were set at licensing values as required by the NUREG.

10.1 & 10.2 These issues are related to the upper pool dump in a Mark III containment - they are not applicable to a Mark II containments. This position is in accordance with the NRC.

11. Operational Control of Drywell to Containment Differential Pressures

Mark III load definitions are based upon the levels in the suppression pool and the drywell weir annulus being the same. The GGNS technical specifications permit elevation differences between these pools. This may affect load definition for vent clearing. [8]

Response

For SNPS, the drywell-floor vacuum breakers have a setpoint of 0.25 psid. This amounts to a potential increase of 7 inches in the level of the water in the downcomers. Such a variation in downcomer water level would have a negligible effect on vent clearing, drywell pressure, or pool dynamic loads.

Note that depression of the initial downcomer water level (as was done on an interim basis in the Mk I hydrodynamic loads program) has a beneficial effect on the drywell pressure and associated pool dynamics.

12. This issue is related to the upper pool dump in a Mark III containment - it is not applicable to a Mark II containment. This position is in accordance with the NRC.

13. This issue is related to automatic spray actuation in a Mark III containment - it is not applicable to a Mark II containment. This position is in accordance with the NRC.

14. RHR Backflow Through Containment Spray

A failure of the check valve in the LPCI line to the reactor vessel could result in direct leakage from the pressure vessel to the containment atmosphere. This leakage might occur as the LPCI motor-operated isolation valve is closing and the motor-operated isolation valve in the containment spray line is opening. This could produce unanticipated increases in the containment spray.

Response

The RHR system has been designed to permit simultaneous, single-loop operation of the LPCI and containment spray mode - backflow is not an inherent problem with this alignment. However, such operation is classified in the station procedures as abnormal, and is therefore avoided by the operator.

In the event the system were aligned for single-loop operation, a multiple failure - which included failure of the LPCI isolation check valve and both of the pumps servicing the loop - would be required to establish backflow from the RPV to the wetwell spray headers. Because of the low probability of this multiple failure, backflow is considered to be an extremely unlikely event.

Even if there were backflow from the RPV to the wetwell sprays, the increase in the energy input to the wetwell airspace would have no effect on the peak wetwell airspace temperature. A conservative analysis shows that the maximum wetwell airspace temperature calculated assuming an increase in the spray flow in combination with a LOCA, would be less than 1°F higher than that calculated assuming a LOCA only. Regardless, the peak wetwell airspace temperature is established by the steam bypass analysis, not by the LOCA analysis.

15. Secondary Containment Vacuum Breaker Plenum Response

The STRIDE plants had vacuum breakers between the containment and the secondary containment. With sufficiently high flows through the vacuum breakers to containment, vacuum could be created in the secondary containment.

Response

This issue is not applicable to SNPS because SNPS has no such vacuum breakers.

16. Effect of Suppression Pool Level on Temperature Measurement

Some of the suppression pool temperature sensors are located (by GE recommendation) 3 to 12 inches below the pool surface to provide early warning of high pool temperature. However, if the suppression pool is drawn down below the level of the temperature sensors, the operator could be misled by erroneous readings and required safety action could be delayed.

Response

The SNPS suppression pool temperature monitoring system has 16 sensors located at El 25 ft 6 in and 8 sensors located at El 24 ft 6 in. The technical specifications require that the pool water level be maintained between El 26 ft 0 in and El 27 ft 0 in.

In the event the suppression pool water level were to fall to an elevation of 25 ft 0 in or less, there would be an alarm in the control room. Since the SNPS Station Procedures require that the operator initiate pool make-up upon actuation of the low-water-level alarm, the pool level will be maintained above at least the lower set of temperature sensors.

17. Emergency Procedure Guidelines

The EPGs contain a curve which specifies limitations on suppression pool level and reactor pressure vessel pressure. The curve presently does not adequately account for upper pool dump. At present, the operator would be required to initiate automatic depressurization when the only action required is the opening of one additional SRV. (9)

Response

The SNPS Technical Specifications require that the suppression pool water level be maintained between El 26 ft 0 in and El 27 ft 0 in. If the water level exceeds the specified limits, and if it cannot be restored to within these limits within one (1) hour, then the plant is to be in at least hot shutdown within the next 12 hours and in cold shutdown within the following 24 hours.

The above notwithstanding, if the suppression pool water level rises above El 27 ft 0 in, the SNPS Emergency Procedures direct the operator to either maintain the reactor pressure and pool level within a region of acceptable values (below the suppression pool load limit) as defined in the procedure, or actuate the ADS. During the operational training program, operators are thoroughly instructed on how to avoid the suppression pool load limit; the manual operation of one or more SRVs is one of several control actions available to the operator.

18. <u>Effects of Insulation Debris</u> [10]

18.1 Failures of reflective insulation in the drywell may lead to blockage of the gratings above the weir annulus. This may increse the pressure required in the drywell to clear the first row of drywell vents and perturb the existing load definitions.

<u>Response</u>

Pre-filed testimony for the ASLB Hearing for Suffolk County Contention 9 demonstrates that the amount of insulation that would be freed by a pipe break in the drywell is small. What little insulation did come loose would not cause significant blockage of the drywell grating or downcomer inlets.

18.2 Insulation debris may be transported through the vents in the drywell wall into the suppression pool. This debris could then cause blockage of the suction strainers.

<u>Response</u>

Pre-filed testimony for the ASLB Hearing for Suffolk County Contention 9 is directly applicable to this issue (see response to Issue 18.1)

19.1 & 19.2 These issues are related to the upper pool dump in a Mark III containment - they are not applicable to a Mark II containment. This position is in accordance with the NRC.

20. This issue is related to the suppression pool drywell reflood loads associated with a Mark III containment - it is not applicable to a Mark II containment. This position is in accordance with the NRC.

21. Containment Makeup Air For Backup Purge

Regulatory Guide 1.7 requires a backup purge H_2 removal capability. This backup purge for Mark III is via the drywell purge line which discharges to the shield annulus which, in turn, is exhausted through the standby gas treatment system (SGTS). The containment air is blown into the drywell via the drywell purge compressor to provide a positive purge. The compressors draw from the containment; however, without hydrogen-lean air makeup to the containment, no reduction in containment hydrogen concentration occurs.

It is necessary to assure that the shield annulus volume contains a hydrogen-lean mixture of air to be admitted to the containment via containment vacuum breakers. For Mark I and II facilities, discuss the possibility of purge exhaust being mixed with the intake air which replenishes the containment air mass.

Response

At SNPS, the backup purge hydrogen removal capability is provided by the primary containment inerting system which supplies nitrogen gas directly to the primary containment. There is no common volume in which the containment purge effluent mixes with the hydrogen free purge gas prior to the purge gas being introduced into the containment.

22. Miscellaneous Emergency Procedure Guideline Concerns [2]

The EPGs currently in existence have been prepared with the intent of coping with degraded-core accidents. They may contain requirements conflicting with design basis accident conditions. Someone needs to carefully review the EPGs to assure that they do not conflict with the expected course of the design basis accident.

Response

The SNPS Emergency Operating Procedures are being developed by LILCO in accordance with the EPGs of the BWR Owners Group. The accompanying Station Procedures are also being developed at this time. A review of these procedures to confirm their consistency with accident analyses is being conducted as part of the development process.

TABLE OF FOOTNOTES APPLICABLE TO
MARK I AND MARK II CONTAINMENTS

Footnote	Comment
1.	This concern is related to the trapping of water in the drywell.
2.	This issue applies only to those facilities for which EPGs are in effect.
3.	For Mark I and II facilities, confine your response on this issue to those concerns which can lead to pool stratification (e.g., operation of the containment spray).
4.	For Mark I and II facilities, refer to Appendix I to Section 6.2.1.1c of the Standard Review Plan (SRP).
5.	This concern applies to those facilities at which hydrogen recombiners can be used.
6.	This issue as phrased applies only to a Mark III facility. However, the concern can be generalized and applied to the earlier containment types. For Mark I and II facilities, indicate what methodology was used to calculate the environmental qualification parameters including a discussion of heat transfer between the atmosphere in the wetwell and the suppression pool.
7.	Not applicable to Mark II facilities.
8.	For Mark I and II facilities, consider the water in the downcomers.
9.	This issue as phrased applies only to a Mark III facility. However, the concern can be generalized. Accordingly, discuss what actions the reactor operator would take in the event that the limitations on the suppression pool level and the pressure in the reactor vessel are violated.
10.	This issue as phrased applies only to a Mark III facility. However, the concern can be generalized. Accordingly, discuss how the effects of insulation debris could perturb existing load definitions or could block suction strainers. In responding to this

issue, you may refer to existing generic studies; e.g., the study done for the Cooper facility.