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AUTH.NAME AUTHOR AFFILIATION
BYRAM,R.G. Pennsylvania Power & Light Co.
RECIP.NAME RECIPIENT AFFILIATION
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SUBJECT: Forwards addl info re 120 day GL 96-01 response,requested during 970327 telcon.Util trust response satisfactorily addresses NRC concerns.

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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
Generation and Chief Nuclear Officer
610/774-7502
Fax: 610/774-5019

MAY 0 9 1997

U. S. Nuclear Regulatory Commission
Attn.: Document Control Desk
Mail Station PI-137
Washington, D.C. 20555

SUSQUEHANNA STEAM ELECTRIC STATION
ADDITIONAL INFORMATION RELATED TO
THE 120 DAY GENERIC LETTER 96-06
RESPONSE
PLA-4618 FILE R41-2

Docket Nos. 50-387
and 50-388

Attached is PP&L's additional information related to the 120 day Generic Letter 96-06 response, that was requested during a telephone conversation on March 27, 1997, between members of the NRR staff reviewing the Generic Letter 96-06 response and PP&L.

We trust the response satisfactorily addresses the NRC's concerns. Questions regarding this response should be directed to Mr. R. D. Kichline at (610) 774-7705.

Very truly yours,

R. G. Byram

Attachment

A072
1/1

copy: NRC Region I
Mr. K. Jenison, NRC Sr. Resident Inspector - SSES
Mr. C. Poslusny, Jr., Sr. Project Manager - OWFN

Basis for Continued Operability
Request For Additional Information

Drywell Cooling Water Hammer and Two-Phase Flow

Containment Cooling

The SSES drywell cooling system is a non-safety-related system which is used to maintain containment temperature within acceptable limits during normal plant operations. The drywell cooling system automatically isolates on conditions indicative of a Loss of Coolant Accident (LOCA), and is not required to mitigate these postulated scenarios. Since the drywell cooling system is not credited in the SSES design bases, and is not included in Technical Specifications, the potential for a drywell cooling water hammer or two-phase flow to affect containment cooling is not an Operability concern.

Containment Integrity

Although the drywell cooling system is not related to safety, it nonetheless represents a viable form of containment heat removal during specific plant transients. The SSES Emergency Operating Procedures allow for its restoration and operation under transient conditions. An evaluation was performed to determine if this practice could impact containment integrity, as required by the NRC directives provided to the industry.

That evaluation identified an extremely remote possibility for a hydraulic transient during the restoration of drywell cooling. A calculation was performed, and concluded that the loads induced by that postulated hydraulic transient are relatively mild. Preliminary evaluations subsequently determined that loads of this magnitude would not result in pipe or component stresses above allowable values. The loads induced by a postulated water hammer will not impact containment integrity. Therefore, further consideration with respect to the impact of this practice on containment Operability is not required.

Closed Loop System Overpressurization

An engineering evaluation of containment piping networks revealed that the only systems susceptible to this phenomenon are the non-safety-related Reactor Building Closed Cooling Water (RBCCW) and Reactor Building Chilled Water (RBCW) systems, and the Drywell Floor Drain Sump pump discharge lines.

RBCCW/RBCW

The RBCCW and RBCW systems supply non-safety-related cooling loads. The potential for the rupture of these systems due to overpressurization does not in any way threaten the availability of safety-related equipment needed to mitigate Design Basis Accidents. Further, this piping is assumed to be unavailable during Design Basis Accidents, and is not credited in any SSES safety analyses. The potential failure of this piping due to overpressurization is already an integral part of the SSES design and licensing bases. Therefore, further consideration with respect to the impact of RBCCW and RBCW overpressurization on equipment and containment Operability is not required.

Drywell Floor Drain Sump

The Drywell Floor Drain Sump system is a non-safety-related system and is not required for accident mitigation. The pump discharge piping is subject to thermally induced pressurization between the pump discharge check valves and the inboard containment isolation valve. However, this piping will only pressurize if all four pump discharge check valves are leak tight. This system contains water with a high concentration of particulate matter. These particles collect on the check valve seats and prevent the valves from positively seating. In addition, these valves are neither tested nor maintained as part of the primary containment boundary. Although they prevent gross leakage during sump pump operation, it is unrealistic to expect that they are completely leak tight; this is substantiated by operating experience. It should also be noted that leakage of the associated containment isolation valves would act to offset pressurization. Based on these considerations, the failure of this piping due to excessive pressurization is not expected.

Furthermore, in the unforeseen event that this piping pressurized due to the effects of thermally induced expansion, any failure is likely to occur inside containment. This is due to the fact that the length of pipe inside containment is relatively long compared to the short length of pipe out to the first isolation valve. In addition, the piping inside containment is neither safety-related nor specifically missile protected and there are multiple places which could fail and relieve any excess pressure (i.e., packing failure, etc.). Thus, if this piping did in fact fail due to overpressurization, the creation of a leakage path from primary to secondary containment is not expected. The subject containment configuration is Operable in light of the potential for thermally induced overpressurization.

Containment Penetration Overpressurization

An engineering evaluation of containment penetrations revealed that a total of twelve penetrations (per unit) are susceptible to the thermal pressurization phenomenon. These penetrations are:

1) the RBCCW supply and return lines to the recirculation pump seals and motor oil coolers (X-23 & X-24);
2) the RBCW supply and return lines to the drywell coolers (X-53, X-54, X-55, & X-56);
3) the RBCW supply and return lines to the recirculation pump motor coolers (X-85A, X-85B, X-86A, & X-86B);
4) the Demineralized Water line to the drywell (X-61A); and,
5) the Residual Heat Removal (RHR) head spray line (X-17).

The RBCCW and RBCW containment penetrations support non-safety-related loads and automatically isolate on conditions indicative of a LOCA. The Demineralized Water system provides a source of clean water to the drywell for refueling outage maintenance activities, and is isolated prior to and during postulated accidents. Although the head spray line is part of the RHR system, it does not perform any safety related function. Therefore, the potential for overpressurization of all susceptible penetrations does not in any way threaten the availability of safety-related equipment needed to mitigate Design Basis Accidents. The only safety-related function of these penetration assemblies (i.e., piping and valves) is to act as a containment barrier; in the post accident environment, these penetrations are not required to support any active safety-related function.

Since the RHR system will be operating during the post-accident time frame, the potential for overpressurization of the head spray penetration to impact the RHR system pressure boundary was also evaluated. Various failure modes were considered and it was determined that the worst case rupture induced by overpressurization of this penetration will not result in a breach of the operating system's pressure boundary. As such, RHR system operation, as well as primary containment integrity is unaffected.

Containment Design Evaluation

The effective ASME code for SSES is the 1971 Edition with addenda through Winter 1972. Sub-section NC/ND-3621.2 identifies the effects of fluid expansion as a general design consideration, but in a broad and nondescript fashion. For the faulted conditions, no specific design guidance or acceptance criteria is provided for evaluating isolated sections of ASME Class 1, 2, and 3 piping which is exposed to an external heat source which causes thermal expansion of entrapped fluid. Additionally, although not applicable to the SSES design and licensing bases, ANS 56.2 / ANSI N271-1976 was reviewed for input regarding overpressure protection. This Standard provides overpressure protection guidelines for closed loop systems inside and outside containment, however, the guidelines are less specific for penetration piping.

A review of SSES plant specific design documents, which included the FSAR, as well as GE and Bechtel design specifications indicates that the subject containment penetrations are in compliance with all required design elements. In addition, in the SSES Safety Evaluation Report (NUREG 0776), the NRC accepted the design of SSES containment configuration based on the requirements "set forth in the General Design Criteria, applicable regulatory guides, technical positions, the Standard Review Plan, and industry codes and standards." Based upon the review of these documents it is concluded that the existing SSES containment configuration is in compliance with the applicable existing licensing and design bases.

Although the design of the subject penetrations is in compliance with the existing licensing and design basis requirements, they are potentially susceptible to thermally induced pressurization. However, based on engineering judgment, there are a number of mitigating factors which are likely to limit, or even completely offset a postulated increase in pressure. These include, but may not necessarily be limited to the following:

Valve Leakage (i.e., Seat, Bonnet, Packing, Flange)

Isolation valve leakage rates for all of the affected penetrations are quantified under the SSES Local Leak Rate Test (LLRT) program. Note that in PP&L's original 120-day submittal, as well as this information request, actual leakage rates for each individual penetration are not categorically credited. The reasons for this include: a) "as-found" and "as-left" valve leakage varies with each refueling outage, and it is the intent to put forth an Operability determination which is not fuel cycle dependent; b) LLRTs typically measure leakage in the accident direction and hence do not always verify leakage in the direction of overpressurization; c) most of the affected penetrations are connected to closed loop piping systems which are also susceptible to the effects of thermally induced pressurization; and, d) since the closed loop piping inside containment is not credited as a containment barrier for these penetrations, most of the LLRTs for these penetrations are pneumatic tests, and the test leakage may not be directly comparable to the "water filled" condition.

However, although difficult to quantify, valve leakage in general would be expected to provide a significant effect in mitigating the extent of pressurization for the majority of the susceptible penetrations.

Air Pockets / Voids

The existence of air pockets is possible in vent lines, valve cavities, turbulent areas, and other non-uniform piping geometry. Although the presence of air pockets or voids is difficult to demonstrate, the compressibility of air acts as a "buffer" and can significantly restrain the extent of a pressure increase.

Piping Expansion

The penetration piping will thermally expand when containment temperatures increase post-LOCA. Although the extent of the thermally induced expansion is limited, the associated increase in piping volume will aid in reducing the extent of the overpressure condition. In addition, although no specific ASME Appendix "F" evaluations were performed for SSES, it is possible that plastic deformation of the penetration piping would aid in relieving excess pressure.

Barrier Evaluation

While the mitigating factors discussed above may either partially or totally neutralize any thermally induced increase in pressure, the extent of these effects is difficult to quantify. In addition, throughout the industry's efforts to address Generic Letter 96-06, the use of such arguments has proven to be somewhat controversial. For this reason, as well as the fact that SSES is considered to be in compliance with all applicable design and licensing bases, PP&L elected to demonstrate Operability in light of the new G/L 96-06 design requirements by

evaluating the actual threat for thermally induced pressurization to create a release pathway for the transmission of fission products from the primary to the secondary containment. Therefore, a barrier failure evaluation was deemed the most viable indicator of any potential degradation of safety, and the foremost means to demonstrate that the potential for overpressurization will not result in unacceptable off-site radiological consequences.

An evaluation to assess the impact of an overpressure induced failure of a penetration, coupled with an additional failure due to closed loop overpressurization was performed. In addition, the effects of a single active failure of either the inboard or the outboard isolation valve (to close) were considered. In this evaluation, the relief of an overpressure condition through the simultaneous failure of valves or piping at more than one location in the system was not deemed credible. In all cases, it was concluded that the combined effects of closed loop and penetration overpressurization will not result in a pathway for the release of fission products to secondary containment. The following summarizes the basic rationale used in reaching this conclusion for the affected penetrations.

If an affected containment penetration exhibits a pressure increase during a Design Basis Accident, it is indicative that its isolation valves are extremely leak tight. In the event of excessive pressurization, the pressure would be relieved on either the inboard or outboard side of the penetration. If the overpressure condition resulted in a failure inside primary containment, excessive leakage into secondary containment would not result since the outboard isolation valve would remain as a barrier. Note that this is the more likely case since the subject penetrations have a greater length of piping located inside containment, and this piping is subjected to more severe temperatures than the piping external to primary containment.

If a piping or valve packing failure occurred on the outboard side of the penetration, a release path to secondary containment could potentially be created. However, in the event of such a failure, the worst case leakage through the affected penetration would equal the inboard valve leakage which would be at most, the penetration's "maximum path leakage", as defined in ANSI/ANS-56.8-1994.

As previously stated, both inboard and outboard isolation valve leakage is quantified per PP&L's LLRT program, and is within both administrative and regulatory limits. Hence, even if every susceptible penetration underwent the worst case failure induced by overpressurization, the total resulting containment leakage would still be within the cumulative allowable leakage rate for Type "B" and "C" local leak rate tests (0.6 L_a). The leakage from any "degraded" penetration(s) would nonetheless support the overall cumulative SSES containment leakage requirements. Therefore, it is contended that under design basis conditions, rupture of the penetration would not result in a loss of containment integrity; i.e., leakage would still be within Appendix J allowable limits. Hence, the subject penetrations remain Operable in light of the potential for thermally induced overpressurization, described in Generic Letter 96-06.

Overall Conclusion

The discussions presented above address: 1) the potential for a drywell cooling water hammer and two-phase flow; 2) the potential for thermally induced overpressurization of isolated closed loop containment piping systems; and, 3) the potential for thermally induced overpressurization of containment penetrations. Based on those discussions, it is concluded that the existing SSES containment configuration is Operable in light of the concerns identified in Generic Letter 96-06.