

From: Chester Poslusny Jr. (CXP1)
To: M. Banerjee
Date: Tuesday, October 24, 1995 4:05 pm
Subject: Tac 91650: Vessel Level Measurement

I have attached a summary of the 50.59 evaluation I performed in 1994 along with a summary of the evaluation that was done by BNL regarding the design and testing of the passive water level modification installed at both SSES units for your information. I have also provided an electronic copy of this attachment to Norm Blumberg who conducted an inspection of this modification this month for his use in his inspection report.

Based on this input, I am closing out the above TAC for the record and am placing a copy of this message and the attachment in the TAC file, docket file and in the PDR.

CC: AEC

Files: P:50.59R

Docket Number: 50-388

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On August 9, 1994, NRR staff from projects and reactor systems branch visited the corporate office of Pennsylvania Power & Light (PP&L) Company in Allentown, Pennsylvania to conduct an inspection of the design change and supporting files for the passive reactor vessel (condensing chamber) instrumentation modification. The inspection included a review of the following documents: Design Inputs and Considerations Checklist, discussion of performance requirements, applied loads, compliance with R.G. 1.97, discussion of redundancy, diversity and separation, SLARA design review records, a detailed design description change, design review checklists, a FSAR change request package, a safe shutdown compliance review, supporting calculation worksheets and summaries, design criteria for the modification, pre-, and post- test requirements, review comment sheets and dispositions, and the safety evaluation report for the modification.

Based on its review, the staff found the design change package to be complete, comprehensive, and in conformance with PP&L's procedure for developing safety evaluations, NDAP-QA-0726. Specific observations included:

- The applied loads analyses determined that the lower condenser pots could be subjected to a potential feedwater or core spray LOCA and the upper pots could be subjected to a break in the RHR head spray or head vent breaks. In the documents reviewed, the design was shown to accommodate such breaks or have sufficient diversity to maintain the required safety functions given the potential for potential breaks in the vicinity of installations.
- PP&L determined that the modification would not reduce the range or reliability of post accident monitoring instrumentation and the RG 1.97 instrumentation redundancy would not be affected.
- Redundancy is provided by employing 2 upper and 2 lower condensate pots.
- Separation is achieved by locating the lower pots at opposite sides of the vessel. Diversity is achieved by having the lower and upper pots rely on a different mechanism to prevent the buildup of non-condensable gases.
- PP&L's ALARA reviews were performed well and were updated to reflect an increase in the total estimated dose based on additional effort required for installation in excess of that originally expected. Because of the location of the upper pot modification, it was identified by the licensee that work would have to be done before or after fuel movement because tasks would have to be performed by staff above the biological shield.
- The design description packages reflected an accurate description of the modifications which were carried forth to a FSAR change package.
- Design review checklists reflected detailed reviewer comments which were effectively tracked and disposed of by design and system staff.
- PP&L completed extensive calculations: flow rates within the modified

paths, the hydraulic time delay in the system, the vent line water levels, the ratios of surface areas of condensate chambers and vent lines.

- A detailed set of test criteria were developed with sufficient conservatisms.
- The safety evaluation provides a detailed description of the system modifications with a sound rationale for the system changes and functions. In Section D of the report, PP&L considers potential effects on safety functions and provides an adequate discussion of each scenario and sound justification for its finding of no safety impact with no need to modify the operating license.

In addition to the review effort described above, a member of Brookhaven National Laboratory staff under contract with the Commission conducted an independent review of the modifications, test descriptions and data, and selected analyses. The results of this review are discussed below.

PP&L modified the upper and lower condensing chambers of their level instrumentation to reduce the concentration of non-condensable gas in the condensing chambers, thereby reducing the concentration of non-condensable gas dissolved in the water in the reference legs. The modification to the lower condensing chambers provides an uninsulated vent path to the variable leg. The steam condensation in the vent leg induces flow from the condensing chamber to the vent path, which transfers non-condensable gases to the vent leg. The non-condensable gases accumulate near the interface in the vent leg and dissolve in the vent leg. There is a small flow of water from the vent leg to the variable leg which convects the dissolved non-condensable gases back to the reactor vessel. This configuration prevents interaction between the incoming steam from the Reactor Pressure Vessel (RPV) to the condensing chamber and the condensate returning from the chamber. This avoids stripping of non-condensable gases from the condensate return which could occur in the previous configuration causing the accumulation of non-condensable gases in the condensing chambers and reference legs.

The modification to the upper condensing chambers provides a continuous supply of steam through the condensing chamber which is vented to the steam line. This continuous flow of steam entrains non-condensable gases in the condensing chamber and transports them to the steam line which prevents accumulation of non-condensable gases in the condensing chamber and in the reference legs.

Analyses and tests were performed by PP&L and their contractors to support the modifications. Sol Levy Inc. (SLI) provided an analysis of the current level instrumentation and the mechanism of non-condensable gas buildup, and proposed the vent modification to eliminate this concern. SLI also performed an analysis to predict the performance of this new concept. These analyses were independently reviewed by two professors, Dr. R. Lahey and Dr. P. Griffith. In addition, tests in support of the modifications were performed by Continuum Dynamics Inc. (CDI). These analyses and tests were reviewed by the NRC contractor, and were found to be acceptable.