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Response to NRC Inspection Report 91-201,
Systems Based Instrumentation and Control Inspection

This letter is in response to the systems-based instrumentation and control inspection conducted at the Pilgrim Nuclear Power Station. Our assessment of the safety significance of the deficiencies identified in the subject inspection report is provided in Attachment A. The deficiencies, viewed individually or in total, did not indicate a significant weakness in the ability of instrumentation and control equipment to perform intended safety functions. The "vertical slice" inspection approach was valuable. We found its application effective in identifying areas for continued improvement.

We are planning to review and evaluate the Technical Specification setpoints which are associated with an 18 month surveillance interval. This will include a review of approximately 135 instruments. This effort is described more fully in Attachment B and it is consistent with the NRC inspection team recommendations. We will evaluate expanding the review to additional safety-related setpoints based on the results of our effort.

EJWagner for
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RAH/clc/6683

cc: See Page 2

Attachment

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ATTACHMENT A

RESPONSE TO DEFICIENCIES

DEFICIENCY 91-201-01

Deficiency Title:

Inadequate Setpoint for Salt Service Water Discharge Header Low Pressure Switches

Response:

The function of the auto start pressure switches on the SSW pump is to start a standby SSW pump when the discharge pressure is below the pressure switch setpoint. While performing a new setpoint calculation for these pressure switches, we confirmed the existing setpoint was set such that the standby pump would start when required. We also recognized the setpoint was set such that the pump would start under conditions for which it was previously assumed to remain in a standby condition. We conclude that although the setpoint was appropriate for normal plant operating conditions, it would result in the start of the standby SSW pump if the plant were to experience a LOCA coincident with a loss of offsite power at the design basis low tide. This sequence of events was not previously factored into the pressure switch setpoint.

Based on our review of the existing diesel loading calculation during the inspection, we concluded insufficient capacity existed on the limiting diesel generator to accommodate running two SSW pumps during the early stages of a LOCA with a loss of offsite power. The diesel loading calculation conservatively summed all loads expected to be present during the first ten minutes of a LOCA coincident with a loss of offsite power.

Immediately after it was established the SSW pump auto start pressure switch setpoint might be set higher than the expected output pressure of a single SSW pump during a LOCA coincident with a loss of offsite power, corrective actions were taken to determine the expected header pressure assuming worse case with respect to low header pressure. These actions included preparation of a hydraulic model for the SSW system, testing of one loop of the system to gather flow and pressure data which was then used to benchmark the hydraulic model, calculation of the limiting header pressure (i.e., lowest) during single SSW pump operation, and calculation of a new pressure switch setpoint. The new pressure switch setpoint was implemented prior to restart. The new setpoint will ensure only one SSW pump will start automatically on each diesel generator following a LOCA coincident with a loss of offsite power.

A more detailed review of the diesel loading sequences demonstrated the motor-operated valve loads associated with LPCI (187 kw) would terminate 19 seconds before the standby SSW pump start and sufficient diesel generator capacity would be available for the standby SSW pumps (166 kw required for two additional SSW pumps). Based upon this determination, we concluded the system would perform its intended function. The original SSW pump auto start switch setpoint did not jeopardize plant safety, as sufficient diesel capacity existed to accommodate running two or three SSW pumps on each diesel. The setpoint has been revised to ensure only a single SSW pump starts. This reflects the SSW System design basis as described in the FSAR.

DEFICIENCY 91-201-02

Deficiency Title:

Installation Inadequacies

Response:

Recognizing the potential safety significance of this issue, we conducted a detailed walkdown of all tubing, safety related and non-safety related, in the intake structure to determine the present status of tubing installation and supports. This walkdown of approximately 900 feet of instrument tubing indicated that approximately 40 feet of tubing was not ruggedly supported.

Tubing support deficiencies were identified at the following locations.

- Tubing for SSW "A" Loop discharge piping to pressure switches 29-PS-3828A and 29-PS-3829B.
- Tubing for SSW "B" Loop discharge piping to pressure switches 29-PS-3829A and 29-PS-3829B.
- Tubing for SSW Pump "A" to its Pressure Indicator (PI) #29-PI-3802.
- Tubing for SSW Pump "D" to its PI #29-PI-3817. and,
- Tubing for SSW Pump "E" to its PI #29-PI-3822.

Additionally, support straps were missing from tubing near pressure switch 29-PS-3829A although the tubing was very ruggedly supported by three rigid steel conduits.

Further reviews indicated these tubing runs were designed to have supports but the supports had been removed and were not reinstalled. All supports have been reinstalled and tubing slopes have been corrected. Other walkdowns within the process buildings conducted during the inspection confirmed proper slope and support of the instrument tubing. In addition, we included a review of the separation between the instrument lines and instruments during the walkdown. The separation was determined to be acceptable.

Lack of proper supports for instrument tubing to PT3828 and PS3828 A&B is of concern in that during a seismic event the integrity of the tubing could not have been assured. Loss or rupture of tubing to PT3828 would have result in loss of Control Room indication for SSW header pressure. As determined in our response to Deficiency 91-201-03, there are no significant adverse safety consequences associated with this failure.

Loss or rupture of the tubing to PS3828 A&B could have resulted in a start signal that would have caused all the SSW pumps on the loop to start. The effects of this have been analyzed in BECo's response to Deficiency 91-201-01. The analysis indicated the diesel generator would not have been overloaded and the system would have performed its intended function. Based upon this determination, loss of the instrument tubing would not have impacted plant safety.

A formal root cause analysis is being conducted. The analysis will include a review of selected plant modification and maintenance records. It is targeted to be completed within 60-90 days of this response. We will inform you of the results of the analysis and any further actions to be taken.

Corrective Action Taken

Boston Edison performed a calculation to establish tubing support spacing criteria. Additional supports were installed to conform to the above spacing criteria. Construction associated with installation of the new supports was completed on November 17, 1991. Addition of the new supports ensures the tubing structure is rugged enough to withstand a seismic event. A corrective action document (Potential Condition Adverse to Quality) was issued to address the root cause of the deficiency.

The slope in the area of the discharge piping was corrected by the installation of new tube supports.

Installation detail M263, Sheet 155, has been voided and Drawing M8328, Rev. E1, has been modified to show current "As-Built" configuration (i.e., two lines through a common penetration, pressure transmitters tee into appropriate pressure switch lines).

DEFICIENCY 91-201-03

Deficiency Title:

Lack of Calibration Procedure for Instrument PT3828.

Response

Pressure transmitter PT3828 is mounted at the SSW pump discharge header to provide indication (PI3828) in the Control Room. PT3828 was calibrated during the course of the NRC inspection and a revision to Procedure 8.E.29.1. "Salt Service Water (SSW) Instrumentation Calibration and Functional Test", is in process. It will include calibrating PT3828 at a frequency of once/18 months.

PT3828 has no active safety function. Operators routinely monitor header pressure for degrading conditions using PI3828. Additional diverse instrumentation is available to provide sufficient indication of degrading conditions if PT3828 fails and the low header pressure alarm alerts operators in the Control Room of rapid decreases in header pressure.

PI3828 is used for normal operation. Its loss does not require operator action. Although the pressure indicator helps operators assess SSW system performance, the lack of a calibration procedure for PT3828 was not considered a significant safety concern since loss of the instrument would not affect the operability of any safety-related equipment.

DEFICIENCY 91-201-04

Deficiency Title:

Drawing and Procedure Discrepancies

Response

Although the examples stated in the inspection report did not result in any significant safety concerns, we believe the adequacy and accuracy of drawings and procedures is vital. Discrepancies in controlled documents are taken seriously. We record and track to completion via various corrective action processes any discrepancy identified in a controlled document. The discrepancies identified during the inspection were recorded on Potential Condition Adverse to Quality (PCAQ) documents. The PCAQ process ensures the discrepancy is resolved. The discrepancies noted in this deficiency were corrected before the inspection ended.

We consider potential drawing and procedure discrepancies a significant issue given their potential safety impact. We are in the process of updating our design drawings. This is a multi-year project which is scheduled for completion in 1992 and it will will enhance design and configuration control programs at Pilgrim.

DEFICIENCY 91-201-05

Deficiency Title:

Inadequate Torus Level Instrumentation

Response

Transmitters LT5038 and LT5049 sense Torus Water Level and provide a signal to Control Room Recorders LR5038, LR5049, and EPIC points correlating to ±16 inches of water. Technical Specification 3.7.A.1.M requires indicated Torus Water Level to be maintained within -6 inches to -3 inches to ensure proper downcomer submergence of 3 to 3.25 feet. The torus water level operating limits were established by procedure equivalent to the Technical Specification limits. Therefore, no margin was available to account for torus water level loop inaccuracy when at the operational limits.

To address this concern, BECo performed a preliminary loop uncertainty calculation prior to startup. The transmitters were assumed to be installed at plant elevation -2'6" (i.e., the centerlines of LT5038 and LT5049 were assumed to be at their required elevation ± 0.15 inches). The actual elevation of the level transmitters was confirmed within two weeks of startup. Based on the calculation results, the operational range for the torus water level was narrowed to within -5.25 to -3.75 inches. Torus level is being maintained in this range administratively. The existing recorder loop inaccuracy is approximately ± 0.6 inches which is less than the three quarter inch margin between the Technical Specification limits and the administratively controlled Operating Range.

A leveling survey was performed on December 2, 1991 in the Torus Compartment to establish a benchmark with a known tolerance (± 1/32") for use in calibrating all instruments associated with the Torus. The benchmark datum is the torus invert. The tolerance of the benchmark (1/32") is consistent with the loop accuracy calculation assumptions. The method of calibrating these transmitters was changed from a dry methodology utilizing weights to a wet method utilizing tygon tubing and a known benchmark elevation in the vicinity of the transmitters. Other torus level instruments were checked against this benchmark to verify the accuracy of the setpoints. No setpoint adjustments were required since they were found within acceptable limits.

A Plant Design Change (PDC) is being prepared to replace the existing transmitters with more accurate transmitters. These transmitters will be calibrated to a smaller span to improve the existing loop uncertainty. The PDC will improve the loop uncertainty to approximately ± 0.3 inches.

An evaluation of the Mark I containment structural analyses identified an additional ± 1 inch at both ends of the level range. This margin reflects consideration of the structural design analysis. Similarly, General Electric Company, the NSSS supplier for PNPS, has researched the torus level analytical limit and has indicaetd 3 to 4 inches of margin is available at the lower end of the current 3 inch Technical Specification band.

The GE analyses represents non-structural considerations (e.g., NPSH, condensation, etc.). The evaluation of the analytical limit for torus water level demonstrates that operating at the limits of the old 3 inch operating band did not represent a safety concern because sufficient analytical margin exists to compensate for loop inaccuracy.

It should be noted the licensing basis for operating at the Technical Specification limit was provided to the NRC during the Mark 1 containment program. The NRC concluded in 1978 based on industry input and existing setpoint methodology, the errors in the torus water level instrument are sufficiently small relative to the magnitude of the measurement that they may be neglected (See reference below).

BECo is pursuing an additional expansion of the operating band through further evaluation of structural analyses. Subsequently, a Technical Specification change will be evaluated that would increase the allowable operating range for torus water level and relieve operators of the requirement to maintain torus water level inside a restrictive band.

Reference 1 - NRC letter Thomas A. Ippolito, to G. Cari Andognini dated June 21, 1978, Enclosure 2 - Safety Evaluation supporting Amendment No. 31 to License No. DPR-35, page 3

DEFICIENCY 91-201-06

Deficiency Title:

Inadequate Torus Temperature Instrumentation

Response:

As stated in the inspection report, we were not able to retrieve the basis for the analytical limits or margins used to establish the Technical Specification values during the inspection. An 80°F bulk temperature Limit is established in the Technical Specifications. Administrative procedures required torus water temperature to be reduced when the temperature reaches 78°F. This provided a 2°F margin to account for instrument loop uncertainties. Using the criteria in Regulatory Guide 1.105, our initial evaluations of the Torus Water Temperature Monitoring loops resulted in total loop uncertainty of:

Recorders $\pm$ 5.2°F
Indicators $\pm$ 5.2°F

Consequently, the allowable indicated operating temperature was administratively lowered to accommodate these uncertainties.

Two future modifications are planned to replace the recorders and the indicators. Both are planned for completion by the end of 1992. The upgrade of these indicators and recorders with more accurate instruments will result in an improved instrument loop accuracy, thereby increasing the allowable indicated operating temperature.

Also, the BWR Owner's Group is in the process of resolving this issue on a generic basis. NEDO 31695, "BWR Suppression Pool Temperature Technical Specification Limits", supports suppression pool temperature Limiting Condition of Operation of 100°F. The Owner's Group analysis is applicable to Pilgrim and it demonstrates a minimum margin of 20°F exists between the analytical limit and most BWR Technical Specification limits. We believe the bulk temperature limit at PNPS is conservative. Given the margin between the analytical limit (100°F) and the existing Technical Specification limit (80°F), we do not consider this issue a significant safety concern. We will continue to control Torus Water Temperature utilizing lowered administrative limits pending installation of new temperature instrumentation or resolution of the BWR Owners Group position.

DEFICIENCY 91-201-07

Deficiency Title:

Inadequate Design Basis for Reactor Water Level Setpoints

Response:

Based on a preliminary HPCI setpoint calculation, this issue is not a significant safety concern because the existing setpoint provides enough margin to account for total loop uncertainties, including those associated with the reference leg heatup effect due to pipe break outside of the contaiment. The analytical low-low reactor water level value is based on a review of applicable accident and transient analyses. This provides 10.9 inches of margin between the actual setpoint (-46 inches) and the analytical limit (-56.9 inches). Although this margin is administratively controlled, a Technical Specification revision will be evaluated for the long term resolution of this issue.

The Safety Evaluations associated with moving the reactor water level reference legs outside containment and replacing the level switches with an analog trip system did not address the effects of pipe break outside containment on the reference legs. When these safety evaluations were written, it was recognized that, by implementing the modifications, more margin would be provided between the existing setpoint and the analytical limit than was provided by the original design. The reference legs were moved outside the containment to avoid flashing. Since the original setpoint was not in question and moving the reference legs outside containment solved the flashing problem, it was not deemed necessary to quantify the amount of additional margin by performing a setpoint calculation. In addition, industry concensus on performing setpoint calculations was not well established when these safety evaluations were written (1984/85). It was not until 1988 that an effort was begun by the Instrument Society of America (ISA) to provide definitive guidance on performing setpoint calculations.

Recognizing that improvements could be made, we issued an engineering instruction in 1988 that followed the guidelines of Regulatory Guide 1.105 setpoint methodology. Safety-related setpoint calculations performed after that date account for loop uncertainties like reference leg heat up.

The conclusion reached by the safety evaluation was correct for the reasons stated above. Sufficient controls exist today to ensure loop uncertainties are fully considered when performing setpoint calculations. Conclusions reached in previous safety evaluations will be confirmed by the setpoint program as discussed in Attachment B.

It should also be noted that plant design changes and associated safety evaluations are reviewed by a Design Review Board (DRB) prior to the Onsite Review Committee review. The process is subject to continuous review and improvement to enhance the design process. The DRB has been evaluated many times by the NRC and INPO an found to be a strength. In addition, our Quality Assurance department conducts random audits to assess completeness of design and installation. These reviews provide reasonable assurance the design change process is thorough.

ATTACHMENT B

PNPS TECHNICAL SPECIFICATIONS SETPOINT REVIEW

We plan to review approximately 135 safety-related instruments. This will involve preparation of approximately 40 setpoint calculations. The review will include the following elements. The first element will be to calculate the loop uncertainty associated with the setpoint. The second element will be to verify that margin exists between the Technical Specification value and the analytical limit to accommodate the setpoint uncertainty. The third element will include a review of the applicable calibration procedures to ensure consistency with the setpoint calculation assumptions (e.g., M&TE Accuracy). We plan to complete this effort by the end of 1993. We will evaluate expanding the review based on the results of the program described above.