



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

ENCLOSURE

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REVIEW OF TECHNICAL SAFETY ASSESSMENT OF FEEDWATER

LOCATION X-175 INSIDE CONTAINMENT

MATERIALS AND CHEMICAL ENGINEERING BRANCH

TAC NO. M83987

PENNSYLVANIA POWER AND LIGHT COMPANY

SUSQUEHANNA STEAM ELECTRIC STATION, UNIT 1

DOCKET NO. 50-387

1.0 BACKGROUND

On April 7th, 1992, Pennsylvania Power and Light (PP&L) stated in an event notification that, as a result of inspection data taken during Refueling and Inspection Outage (RIO) #6 of the Susquehanna Steam Electric Station, Unit 1, a 12" feedwater riser to the reactor pressure vessel had experienced an amount of wear in its pipe wall in excess of that normally expected for the component. This riser (Component X-175) is just downstream of a weld to a 20" x 12" reducing tee, and is part of feedwater line DLA-102-1. The amount of wear reported corresponded to ~83% of the difference between the nominal and minimum wall thicknesses. The licensee's initial conclusion was that the component (X-175) would not remain above the minimum wall thickness until reaching the next refueling outage. The NRC issued Information Notice 92-35 to inform the industry of the event.

On May 4-7, 1992, members of a joint Region I/NRR inspection team performed an inspection of PP&L's program for monitoring erosion/corrosion related wear in single- and two-phase, high energy, carbon steel piping systems. Part of the inspection involved a review of the program as it related to the erosion/corrosion of component X-175. The inspection team concluded in their exit meeting with the licensee that the erosion/corrosion program had done a reasonable job of predicting the wear in component X-175, and that the program for monitoring erosion/corrosion in carbon steel piping was implemented in accordance with the guidelines of Generic Letter 89-08.

Subsequent to the inspection, the licensee had performed an overlay repair of component X-175 prior to startup of the plant. From the viewpoint of the licensee, the repair was performed in accordance with the 1977 edition of the ASME Code, Section III, and Addenda through to 1979. The licensee's argument was based on the following premises:

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- the thinned area is not a flaw as defined by ASME Section XI and, therefore, the base metal reinforcement provisions of ASME Section III are applicable.
- the thinned area was not below the code minimum allowable thickness at the time of the repair.
- the repair was performed in accordance with ASME Section III.

The NRC position was that the thinned area of the feedwater pipe is a flaw, and that the repair of the pipe did not meet the requirements of ASME Section XI. According to this position, the repair would have to be performed in either of the following manners in order to meet code requirements:

- replace the eroded pipe with a spool of acceptable replacement material (ASME Section XI, Article IWA-7000), or
- repair the eroded portion on the I.D. of the pipe (a flawed area of the pipe) in accordance with the requirements of ASME Section XI, Article IWA 4000 (repair: i.e., remove the flaw and re-weld).

Repair of high energy carbon steel piping systems was not originally included in the scope of the NRC's inspection of the licensee's erosion/corrosion program. However, upon learning of the type of repair the licensee had made, an addendum was incorporated into the final inspection report describing the repair of the feedwater pipe. The adequacy of this repair was identified as an open item. As a result, the NRC requested that the licensee submit a safety evaluation to show that the flawed condition of the component X-175 would not constitute an adverse safety hazard from loss of structural integrity of the feedwater pipe. The evaluation was to be performed without taking credit for the overlay.

2.0 EVALUATION

On July 17, 1992, PP&L submitted a Technical Safety Assessment of component X-175. The Technical Safety Assessment was submitted to justify continued operation of Unit 1 to the next refueling outage. The licensee's Technical Safety Assessment takes no credit for the weld buildup created by the overlay. The licensee based its analysis on evaluations using three conservative wear rates of 0.050, 0.100, and 0.150 inches per cycle. The analysis based on the 0.150 inch/cycle wear rate bounds the worst case wear rate of 0.137 inch/cycle as calculated from actual ultrasonic testing (UT) measurements. The staff finds that this is a conservative approach for predicting the wear in X-175 since the licensee's wear rate calculations are based on nominal wall thicknesses, and since the evaluation does not take into account that the worn area is in a counter-bored portion of the pipe spool.



Using a thinning rate of 0.150 inches per cycle and the thinnest measured wall thickness of 0.482 inches, the licensee predicted that the thinnest wall thickness (t_p) at the next outage (RIO #7) would be 0.332 inches. This is thinner than the code allowable minimum wall thickness (t_{min}) of 0.438 inches. As a result, the licensee performed a structural evaluation of component X-175 to show that X-175 would maintain its structural integrity even under the worst postulated conditions of wall thinning. The licensee's structural evaluation is based on the ASME Section XI, Code Case N-480, "Examination Requirements for Pipe Wall Thinning Due to Single Phase Erosion and Corrosion."

Code Case N-480 contains a hierarchy of methods and acceptance criteria, which evaluate the localized structural integrity by calculating a minimum allowable wall thickness, t_{aloc} , and comparing it to the current measured or predicted wall thickness, t_p . Piping which fails to meet the acceptance criteria of the hierarchical method needs to be repaired or replaced. Code Case N-480 has not been endorsed by the NRC staff. However, the licensee's analysis has been accepted based on a preliminary staff assessment of the method used for calculating the results, which has determined that it is comparable to other methods used in current engineering practice to evaluate wall thinning in piping components. Other methods and prescribed procedures in the code case have not, as yet, been evaluated.

Using Code Case N-480 acceptance criteria, the licensee calculated a t_{aloc} of 0.333 inches. This is slightly greater than the thickness of 0.332 inches predicted at the next outage. However, this is based on a very conservative rate of thinning and the licensee maintains that the predicted and calculated thicknesses are comparable within the computational accuracy of the calculations. Therefore, the predicted thickness is acceptable within the acceptance criteria of the code case. Independent calculations performed by the NRC using the code case acceptance criteria confirmed the licensee's analysis.

The licensee has also performed a conservative stress analysis of component X-175 based on the acceptance criteria of ASME Code Section III, Article NB-3000, Paragraph NB-3600. The results of the analysis predict that an overstress condition could exist for cases when the wall thickness is less than the code minimum required thickness. However, the licensee's calculation was based upon a conservative assumption that the eroded area of the pipe extended 360 degrees around the girth of the pipe.

3.0 CONCLUSION

PP&L's Technical Safety Assessment indicates that acceptance criteria based on ASME Section XI, Code Case N-480 are satisfied. The staff has assessed these criteria and has found them to be in conformance with current engineering practice. Based on our review of the evaluations, the staff finds the component acceptable for service during the current operating cycle.

According to PP&L's June 17, 1992 letter, the licensee has committed to repair component X-175 if the results of the RIO #7 inspections or predictions indicate that the component is outside the minimum allowable wall thickness. If the results of the RIO #7 inspections indicate that a repair of component X-175 is not warranted, the licensee has committed to submit the results of the evaluations to the NRC for review and approval, prior to restart of Unit 1.

Principal Contributors: J. Medoff
J. Raleigh

Date: October 15, 1992

Letter of June 17, 1992, the licensee has committed to repair component X-175 if the results of the RIO #7 inspections or predictions indicate that the component is outside the minimum allowable wall thickness. If the results of the RIO #7 inspections indicate that a repair of component X-175 is not warranted, the licensee has committed to submit the results of the evaluations to the NRC for review and approval, prior to restart of Unit 1. The staff recommends that the disposition of component X-175 be made a restart item prior to resuming operation from RIO #7. The staff's evaluation is enclosed.

Sincerely,

Original signed by:

James J. Raleigh, Project Manager
Project Directorate I-2
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Enclosure:
Safety Evaluation

cc w/enclosure:
See next page

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