

# PHILADELPHIA ELECTRIC COMPANY

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VICE PRESIDENT  
ELECTRIC PRODUCTION

December 20, 1985

Docket No. 50-278

Mr. Daniel R. Muller, Director  
BWR Project Directorate #2  
Division of Boiling Water Reactor Licensing  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

SUBJECT: Peach Bottom Atomic Power Station Unit 3  
Justification for Continued Operation Following  
In-Service Inspection and Repairs of Non-Conforming  
Austenitic Stainless Steel Piping Welds

REFERENCE: (1) Letter, S. L. Daltroff, PECO, to  
J. F. Stolz, USNRC, dated December 14, 1984  
(2) Letter, S. L. Daltroff, PECO, to  
J. F. Stolz, USNRC, dated October 11, 1985  
(3) Letter, S. L. Daltroff, PECO, to  
J. F. Stolz, USNRC, dated November 15, 1985  
(4) Letter, S. L. Daltroff, PECO, to  
J. F. Stolz, USNRC, dated November 27, 1985

ADD: BWR - L/BC's TECH SUPPORT  
EB (LIAW)  
PSB (L. HULMAN)  
EICSB (SRINIVASAN)  
RSB (ACTING)  
FOB (VASSALLO)  
AD - G. LAINAS (LTR ONLY)

Dear Mr. Muller:

This letter transmits an evaluation of the Peach Bottom Unit 3 Recirculation and Residual Heat Removal system crack indications. The evaluation justifies an additional eighteen months of continued operation. The evaluation is provided in the attached document titled, "Weld Overlay Design and Analysis for the Indications in the Peach Bottom Unit 3 Recirculation and Residual Heat Removal System" (Attachment 1).

Peach Bottom Unit 3 was removed from service on July 14, 1985 for a refueling and pipe weld inspection outage and is expected to return to service January 10, 1986. The weld inspections have been completed in response to Generic Letter 84-11, "Inspections of BWR Stainless Steel Piping", dated April 19, 1984. The scope of the welds examined is as described in Attachment 1 to the reference (1) letter.

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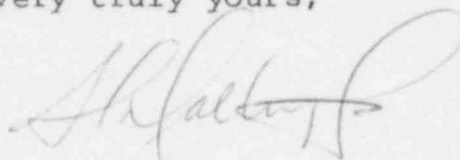
The inspection identified eighteen pipe welds on the Recirculation System with crack indications, of which thirteen have been subsequently repaired by weld overlay methods. Twelve pipe welds were found to exhibit crack indications on the Residual Heat Removal System. Five of those welds were repaired with weld overlays. Tables 1 and 2 of Attachment 1 summarize the disposition of these welds.

The evaluation provides the technical basis for (1) the acceptability of indications not requiring repairs, (2) designing weld overlays for indications that require repair, and (3) determining the effect of the weld overlay shrinkage on the system. The analyses are in compliance with the requirements of the ASME Code Section XI and Generic Letter 84-11. The results verify that all of the repaired and unrepaired welds are acceptable for at least an additional eighteen months of continued operation.

Further, an in-house safety evaluation has been prepared (Attachment 2) concerning the Unit 3 weld inspection program.

If you have any questions or require additional information, please do not hesitate to contact us.

Very truly yours,



Attachments

cc: Dr. T. E. Murley, Administrator, Region I, USNRC  
T. P. Johnson, Resident Site Inspector

ATTACHMENT 2

SUBJECT: Safety Evaluation for the Operation of Peach Bottom Atomic Power Station Unit No. 3 for at Least 18 Months.

INTRODUCTION

During the Peach Bottom Unit 3 outage which began on July 14, 1985, Philadelphia Electric Company, through contracts with General Electric Company (GE) and Southwest Research Institute (SwRI), performed ultrasonic examinations of welds in the recirculation and residual heat removal (RHR) systems. These examinations were performed as required by USNRC Generic Letter 84-11, NUREG 0313, and the ASME Boiler and Pressure Vessel Code Section XI ten-year inservice inspection program.

A total of one-hundred and thirty-two (132) welds in IGSCC susceptible material were examined with the result that IGSCC cracking was detected in forty (40) welds in which it had not been previously detected. Thirty (30) of these were butt welds in the recirculation and RHR systems and ten (10) were thermal sleeve attachment welds on the recirculation inlet safe ends.

Included in the one-hundred and thirty-two (132) welds examined were five (5) RHR system welds and two (2) jet pump instrumentation penetration welds which were weld overlay repaired in 1983 and 1984 respectively. These examinations determined that the overlays were sound and that the IGSCC cracks had not grown since their repairs. These seven (7) welds are not included in the current total of forty (40) welds with cracking.

Philadelphia Electric Company contracted GE to analyze the welds with indications and to make recommendations. Using acceptance criteria from Generic Letter 84-11 and the ASME Code Section XI, GE determined that twenty-two (22) welds could be operated without repair for a minimum of eighteen (18) months. These included twelve (12) butt welds - seven (7) RHR and five (5) Recirculation - and the ten (10) Recirculation inlet safe end thermal sleeve attachment welds.

The remaining eighteen (18) butt welds were recommended for overlay repair. These included five (5) RHR welds and thirteen (13) Recirculation welds. GE provided designs for full structural overlays which met the requirements of Generic letter 84-11 and provided the ASME code safety margins. The overlays were completed by welders qualified to procedures developed by GE

in concurrence with the on-site representative of the Hartford Steam Boiler Inspection and Insurance Company.

## DISCUSSION

### A. Examination

The ultrasonic examination procedures used in the detection of the crack-like indications had been demonstrated to be capable of finding IGSCC cracking at the EPRI NDE Center in Charlotte, North Carolina. The technicians participating in the examination were qualified as being able to detect service induced IGSCC by an actual demonstration using cracked specimens in accordance with NRC IE Bulletin 83-02 and Generic Letter 84-11.

All indications were verified by an independent examiner. GE verified the SwRI findings and vice versa. All sizing was performed by examiners qualified in sizing at the EPRI NDE Center.

### B. Analysis

Fracture Mechanics Analysis was performed by GE in accordance with Section XI, Appendix X of the ASME Code. For all welds to be operated without repair, the calculated growth was less than the limit for net section collapse with a safety factor of 3.0 and was also less than 2/3 of the limit for depth and length provided in the ASME Code Section XI, paragraph IWB-3640. In addition, calculated crack sizes in pipe butt welds were less than the allowable flaw size proposed in Section XI, Table IWB-3641-5.

The analysis was conservative in that the crack depth assumed was the peak depth measured by ultrasonic examination. In all cases the crack growth after 18 months of operation was calculated to be less than the above criteria.

All butt welds to be operated without repair except welds 2-AS-8 and 2-BD-12 also met the criteria for length and depth set forth in Generic Letter 84-11. PECO. has committed to performing a mid-cycle examination of these two (2) welds which do not meet the criteria. Additional information is available in PECO correspondence to the NRC dated November 15, 1985.

Crack growth calculations for the ten (10) recirculation inlet safe end thermal sleeve attachment welds also demonstrate that they can be operated without repair for at least eighteen (18) months. However, because many of these cracks exceed the limits for length and depth set forth in Generic Letter 84-11, PECO. has also committed to a mid-cycle inspection of the two (2) most severely cracked safe-ends.

Additional information is available in PECO correspondence to the NRC dated November 27, 1985.

C. Repairs

The overlay designs used to repair the eighteen (18) RHR and recirculation butt welds are conservative since they were designed to accommodate a hypothetical through-wall crack, 360 degrees in circumference. The overlay welds as applied are full structural overlays and meet all the requirements of NRC Generic Letter 84-11.

The welding procedures and welders used to perform the weld overlays were qualified to procedures which meet the requirements of the ASME Code Section III, 1983 Edition including the Summer 1983 Addenda. The welding procedures required adequate cooling water inside the pipe which produced compressive stresses on the inside diameter. Crack propagation into the weld metal is not likely to occur by IGSCC since the high ferrite weld material is not susceptible to IGSCC.

Additional conservatism was built into the overlay repairs in that no credit for thickness was taken until acceptable ferrite readings were achieved. This meant that at least one (1) layer of weld material (and in some cases two (2)) was applied before credit for thickness was taken. Inspection of the completed overlays included visual, liquid penetrant, and ultrasonic to verify the soundness of the overlay.

CONCLUSION

It is concluded, based on the considerations discussed above, that:

1. The Unit 3 ultrasonic examination was conducted by personnel trained in the detection and sizing of IGSCC cracking and qualified by ultrasonic technique demonstration at the EPRI NDE Center in Charlotte, North Carolina, in accordance with I.E. Bulletin 83-02 and NRC Generic Letter 84-11. The procedures and instrumentation used in this examination have been proven capable of detecting and characterizing intergranular stress corrosion cracking with a high level of certainty.
2. The Fracture Mechanics Analysis performed on the crack indications and the applied overlay temporary repairs possess an inherent safety factor of three (3) and provide full structural margins in accordance with NRC Generic Letter 84-11.

3. The overwhelming laboratory and industry experience to date has shown that if piping affected by IGSCC should fail, such failure would result in leak before break.

It can be concluded that Peach Bottom Atomic Power Station Unit 3 can operate at full power for at least eighteen (18) months with reasonable assurance that the health and safety of the public will not be endangered.