



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

ALTERNATIVE TO THE AUGMENTED EXAMINATION OF THE

REACTOR PRESSURE VESSEL LONGITUDINAL WELDS

PEACH BOTTOM ATOMIC POWER STATION, UNIT 2

PECO ENERGY COMPANY

DOCKET NO. 50-277

1.0 INTRODUCTION

Pursuant to 10 CFR 50.55a(g)(6)(ii)(A)(2), the licensees are required to perform augmented examinations of reactor pressure vessels. The licensees are required to implement an augmented examination of "essentially 100%" of the reactor pressure vessel (RPV) shell welds. The shell welds are specified in the 1989 Edition of the American Society of Mechanical Engineers (ASME) Code, Section XI, Table IWB-2500-1, Examination Category B-A, "Pressure Retaining Welds in Reactor Vessel," Item B1.10. This ASME category includes Item B1.12, longitudinal shell welds. The 10 CFR 50.55a(g)(6)(ii)(A)(2) defines "essentially 100%" examination as "more than 90% of the examination volume of each weld." Under 10 CFR 50.55a(g)(6)(ii)(A)(5), the licensees unable to completely satisfy the requirements of the augmented reactor vessel examination may propose an alternative that provides an acceptable level of quality and safety. A licensee may use its proposed alternative when authorized by the Director of the Office of Nuclear Reactor Regulation.

In a letter dated April 2, 1998, the PECO Energy Company (the licensee) submitted a request to use an alternative to perform certain augmented examinations of the RPV longitudinal shell welds at Peach Bottom Atomic Power Station (PBAPS), Unit 2. In a letter dated August 12, 1998, the licensee provided additional and clarifying information to support the original request. The licensee examined the RPV internal surface to the extent practical, even though 90% coverage was not attained.

2.0 REQUEST FOR ALTERNATIVE EXAMINATION

The licensee requests an alternative examination to performing additional examinations to achieve the full 90% coverage.

3.0 REQUIREMENT

Under 10 CFR 50.55a(g)(6)(ii)(A)(2) requirements, all licensees shall augment their reactor vessel examination by implementing once, as part of the inservice inspection interval in effect on September 8, 1992, the examination requirements for reactor vessel shell welds specified in Item B1.10 of Examination Category B-A, "Pressure Retaining Welds in Reactor Vessel," in Table IWB-2500-1 of subsection IWB of the 1989 Edition of section XI, Division 1, of the ASME Boiler and Pressure Vessel Code, subject to the conditions specified in 10 CFR 50.55a(g)(6)(ii)(A)(3) and (4).

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ENCLOSURE

4.0 BASIS FOR ALTERNATIVE EXAMINATION

Pursuant to 10 CFR 50.55a(g)(6)(ii)(A)(5), the licensees that are unable to completely satisfy the augmented RPV shell weld examination requirement may submit information to the Commission to support such determination and propose alternatives to the examination requirements that would provide an acceptable level of quality and safety.

5.0 PROPOSED ALTERNATIVE EXAMINATION

The licensee is unable to meet the 90% volume coverage requirement for each longitudinal weld of the PBAPS, Unit 2, reactor pressure vessel as required by 10 CFR 50.55a(g)(6)(ii)(A)(2). Therefore, it is proposing an alternative to 90% volume coverage requirement for each longitudinal weld, in accordance with 10 CFR 50.55a(a)(3)(i), pursuant to 10 CFR 50.55a(g)(6)(ii)(A)(5).

The licensee stated that it intends to inspect the PBAPS, Unit 2, RPV during the upcoming PBAPS, Unit 2 refueling outage (2R12), scheduled to begin in early October 1998. The proposed alternative is to perform an examination of the RPV longitudinal shell welds to the maximum extent practical from the Inner Diameter (ID), within the constraints of vessel internal restrictions. This examination would be performed for longitudinal shell welds specified in Item B1.10 of Examination Category B-A, "Pressure Retaining Welds in Reactor Vessel," in Table IWB-2500-1 of Subsection IWB of the 1989 Edition of Section XI, Division 1, of the ASME Boiler and Pressure Vessel Code. Further examination from the ID is not practical without disassembly of the vessel internal components. Table 1 provides the longitudinal welds, the estimated volumetric examination coverage from the ID, and the ID restrictions that will potentially obstruct scanning. The volumetric examination coverage and restrictions from the ID are based on a detailed weld coverage scan plan completed in February 1998. As shown in Table 1, eight of 15 welds achieve greater than 90% volumetric coverage, crediting ID inspections only. There are no vessel internals which pose a restriction to the ID examination which are easily removable. The only removable components (i.e., not welded to the vessel) which limit scan coverage are the feedwater spargers. However, it is impractical to remove the feedwater spargers due to the potential for damage to the sparger seals and nozzles. Therefore, there are no components which can be reasonably removed to increase coverage from the ID.

For those longitudinal welds where greater than 90% volumetric examination may not be achieved from the ID, the estimated supplemental coverage and physical constraints on the vessel Outer Diameter (OD) are identified in Table 1. As noted in Table 1, further review has determined that two (2) welds (RPV-V1A and RPV-V5A) would exceed 90% volume coverage with a supplemental OD examination. In some locations, the additional weld volume that can be accessed from the OD is a subset of the ID examinations.

The restrictions which prohibit unrestrained access to 100% of the longitudinal weld volume from the OD are the vessel insulation and the vessel nozzles.

The percentage of longitudinal weld volume coverage estimated from the ID examination reflects a significant portion of the total reactor pressure vessel weld length but represents greater than 90% of the longitudinal welds within the beltline region. The beltline is the region in the RPV that is adjacent to the core, receives significant amounts of neutron radiation, and is susceptible to

embrittlement. The beltline welds are RPV-VIA, VIB, VIC, V2A, V2B and V2C. Attempting to perform supplemental OD examinations would result in a minimal increase to longitudinal weld volume coverage and would only increase the amount of inspection of beltline weld RPV-VIA by a small amount (10%). Examination from the OD would only permit two additional welds to exceed 90% volumetric coverage requirement. Additional disassembly and reassembly of portions of the reactor vessel biological shield and insulation would result in further increases in personnel radiation exposure as well as an increase in the general area dose rates in the drywell for the entire population of workers. Additional doses to the entire population to perform the supplemental (OD) examinations contained in Table 1 are estimated to be 24 man-Rem. Therefore, based on the incremental cost and radiation dose, in conjunction with the limited additional volumetric coverage, the licensee has concluded that performing OD examinations to increase coverage beyond that achieved from the ID would result in undue hardship without a compensating increase in safety.

5.0 EVALUATION

The staff has evaluated the alternatives proposed by the licensee for the volumetric examination of the above mentioned reactor vessel shell welds in regard to the following factors:

- Physical constraints at each weld that limit the required examination coverage
- Maximum extent of volumetric coverage obtained with the existing constraints
- Supplementing inner diameter examination with examination from the outside
- Results of previous vessel examinations
- Detection of the presence of degradation mechanisms, if any, from the examination

Based on its evaluation, the NRC staff agrees that supplementing the ID examination with an OD examination would result in only two additional welds to achieve an increased volumetric coverage to meet the Code requirement. However, it constitutes a hardship in that a significant amount of disassembly and reassembly of the reactor vessel biological shield and insulation is required without a compensating increase in the level of quality and safety, and the licensee is unable to completely comply with the requirements.

During the fabrication process of the PBAPS, Unit 2 RPV, all of the shell welds were thoroughly examined using several examination methods as required by the original construction code. Additionally, all of the shell welds received volumetric examinations prior to initial plant operations, as prescribed by ASME Section XI preservice inspection requirements. Selected shell welds have received volumetric examinations during the first inservice inspection interval in accordance with ASME Section XI inservice inspection requirements. No rejectable indications were identified during any of these examinations. The preservice inspection and inservice inspection identified planar and/or linear indications are listed in Table 1. All indications in Table 1 are Code acceptable.

The General Electric (GE) GERIS-2000 System will be used to perform the remote controlled, automated UT examinations of the RPV. This tool has been used previously at PBAPS, Unit 3 and other Boiling Water Reactors for the purpose of RPV examinations. GE demonstrated this

system at the Performance Demonstration Initiative (PDI), qualification Session No. 61-02, in accordance with the 1992 Edition, 1993 Addenda of ASME Boiler and Pressure Vessel Code, Section XI, Appendix VIII requirements. Appendix VIII was developed to ensure the effectiveness of UT examinations within the nuclear industry by means of a rigorous, item-specific, performance demonstration. The performance demonstration was conducted on an RPV mock-up containing flaws of various sizes and locations. The demonstration established the capability of equipment, procedures, and personnel, which are similar or the same as those that will be used at PBAPS, Unit 2, to find flaws that could be detrimental to the integrity of the RPV.

Greater than 90% of the portion of each longitudinal weld within the beltline region will be scanned. Hence the welds that are most susceptible to radiation embrittlement will receive greater than 90% examination.

The staff concludes from the results of previous volumetric examinations and the extent of the examination proposed by the licensee that there is reasonable assurance that any degradation mechanism that could exist in the welds would be detected during the proposed volumetric examination. Hence, the licensee's proposed alternative provides reasonable assurance of structural integrity, and provides an acceptable level of quality and safety.

6.0 CONCLUSION

Pursuant to 10 CFR 50.55a(g)(6)(ii)(A)(5), the staff evaluated the licensee's proposed alternative of examining reactor vessel shell welds specified in Item B1.12 of Examination Category B-A "Pressure Retaining Welds in Reactor Vessel," in Table IWB-2500-1 of Subsection IWB of the 1989 Edition of the ASME Code, Section XI and the augmented examination requirements in 10 CFR 50.55a(g)(6)(ii)(A)(2). The staff has determined that the licensee is unable to completely comply with the requirements, and that the proposed alternative provides an acceptable level of quality and safety. The licensee's proposed alternative is authorized pursuant to 10 CFR 50.55a(g)(6)(ii)(A)(5).

Attachment: Table

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