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PSEG Nuclear LLC

United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Gentlemen:

INSERVICE INSPECTION PROGRAM
RELIEF REQUEST S2-RR-B04
RESUBMITTAL WITH SUPPLEMENTAL INFORMATION
SALEM UNIT 2 GENERATING STATION
FACILITY OPERATING LICENSES DPR-75
DOCKET NOS. 50-311

Reference: Letter (No. LRN-01-0366) to USNRC Document Control Desk from G. Salamon, dated November 7, 2001, "Inservice Inspection Program Relief Request S2-RR-B04"

In the above reference, PSEG Nuclear submitted to the Nuclear Regulatory Commission (NRC) an Inservice Inspection (ISI) relief request S2-RR-B04 concerning the inspection of Reactor Pressure Vessel (RPV) flange-to-shell weld at Salem Generating Station, Unit 2. In a telephone conversation on January 8, 2002, the NRC Project Manager for Salem requested supplemental information supporting relief request S2-RR-B04. Specifically, PSEG Nuclear was requested to provide coverage information on the weld inspection proposed in the relief request.

Subsequent to the NRC Project Managers request for additional information, a change in ISI vendors occurred. Therefore, relief request S2-RR-B04 is being resubmitted in entirety, with vendor and weld coverage information.

Should you have any questions regarding this request, please contact Mr. Howard Berrick at 856-339-1862.

Sincerely,

G. Salamon
Manager – Nuclear Safety and Licensing

Attachments

1. ISI Relief Request S2-RR-B04
2. Comparison of Reactor Pressure Vessel Shell Weld Examination Techniques

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COMPONENT DESCRIPTION:

Salem Unit 2 Class 1, Category B-A Pressure Retaining Welds In Reactor Vessel Item No. B1.30 Shell-to-Flange Weld.

ASME CODE CLASS:

ASME Section XI Class 1

ASME EXAMINATION REQUIREMENTS:

ASME Code, Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, 1986 Edition, IWA-2232 requires Ultrasonic examination of the RPV to flange weld be in accordance with ASME Section V Article 4.

In addition the NRC has issued Regulatory Guide 1.150 Rev 1 "Ultrasonic Testing of Reactor Vessel Welds During Preservice and Inservice Examinations" as regulatory guidance for the UT examination of RPV welds.

RELIEF REQUESTED:

An acceptable partial examination of the RPV vessel-to-flange weld was performed from the flange surface during the first period of the second interval, satisfying the requirements of ASME Section V Article 4 and the Regulatory Guide 1.150 Rev 1.

Pursuant to 10CFR50.55a(a)(3)(i), PSEG Nuclear requests relief to use ASME Section XI, Div. 1,1995 Edition, 1996 Addenda, Appendix VIII Supplement 4 and 6 as amended by the Federal Register Notice 64FR 51370 through 51400, dated September 22, 1999 to complete the UT examination of the RPV-to-flange weld from the vessel shell side. This is in lieu of performing the examination per ASME Section V Article 4 and the subsequent guideline requirements of Reg. Guide 1.150 Rev 1.

This relief request is for the Salem Unit Two 10 year second interval vessel examination scheduled for the spring of 2002.

BASIS FOR RELIEF:

PSEG Nuclear Salem Unit 2 is required to perform in-service examination of the RPV flange weld in accordance with the requirements of ASME Section V Article 4 and the subsequent guideline requirements of Regulatory Guide 1.150 Rev 1.

Federal Register Notice 64FR 51370 through 51400, dated September 22, 1999, revised the 1999 Edition of 10 CFR 50.55(a) Codes and Standards. This revision requires that ASME Section XI, Appendix VIII, Supplements 4, *Qualification Requirements For The Clad/Base Metal Interface of Reactor Vessel*, and Supplement 6, *Qualification Requirements For Reactor Vessel Welds Other Than Clad/Base Metal Interface,* be implemented for most of the RPV welds by Nov 22, 2000. The RPV vessel-to-flange weld is the only RPV circumferential weld not included in Appendix VIII.

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This relief is requested to allow the use of a PDI qualified procedure to complete the UT examination of the RPV vessel-to-flange weld from the vessel side of the weld in accordance with ASME Section XI, Div. 1,1995 Edition, 1996 Addenda, Appendix VIII Supplement 4 and 6 as amended by the Federal Register Notice 64FR 51370 through 51400, dated September 22, 1999 in lieu of ASME Section V Article 4.

During the upcoming ten (10) year RPV weld examinations, we will be employing personnel, procedures and equipment, demonstrated and qualified by a Performance Demonstration Initiative (PDI) and in accordance with ASME Section XI, Div.1, 1995 Edition, 1996 Addenda, Appendix VIII Supplements 4 and 6 as amended by the Federal Register Notice 64FR 51370 through 51400, dated September 22, 1999 for the adjacent welds.

The remote examinations will be performed using the WesDyne International Supreem Robot and WesDyne Paragon data acquisition system in accordance with PDI qualified procedure PDI-ISI-254 "*Remote Inservice Examination of Reactor Vessel Shell Welds". The procedure was successfully demonstrated in accordance with ASME Section XI, Appendix VIII, Supplements 4 and 6* in 2001 (PDQS 404). The procedure complies with ASME Section XI, Appendix VIII, 1995 edition, 1996 Addenda as modified in final rule. [See Attachment 2, Comparison of Reactor Pressure Vessel Shell Weld Examination Techniques]

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 a RPV mockup containing flaws of various sizes and locations. The demonstration established the capability of equipment, procedures and personnel to find flaws that could be detrimental to the integrity of the RPV.

Although Appendix VIII is not a requirement for this weld, the qualification process to Appendix VIII criteria demonstrates that the examination and evaluation techniques are equal or surpass the requirements of paragraph IWA-2232, "Ultrasonic Examination" of Section XI of the ASME Code and the guidance in RG 1.150.

A comparison between the ASME Section V Article 4 based UT methods and the procedures developed to satisfy the PDI/Appendix VIII can be best described as a comparison between a compliance-based procedure (ASME Section V Article 4) and a results-based procedure (PDI/Appendix VIII). ASME Section V procedures use an amplitude-based technique and a known reflector. The proposed alternate UT method was established independently from the acceptance standards for flaw size found in ASME Section XI.

The PDI qualified sizing method is considered more accurate than the method used in ASME Section V Article 4 The proposed alternate UT examination technique provides an acceptable level of quality and examination repeatability as compared to the Article 4 requirements

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The PDI Program's PDQS No. 404 attests that WesDyne procedure PDI-ISI-254 complies with the detection and sizing requirements of Appendix VIII. The PDI qualification method involves a blind test on realistic flawed samples using testing parameters strictly defined in the procedure. The sensitivity of the examination procedure is greater than specified by ASME Code Section V, Article 4 because interpretation and investigation of defects is carried out down to the baseline response level and is not subject to an amplitude threshold as is the case in the Code methodology

The examination and sizing procedure use echo-dynamic motion and tip diffraction characteristics of the flaw instead of the amplitude characteristics required by ASME Section V Article 4. The search units interrogate the same examination volume as depicted by ASME Section XI, Figure IWB 2500-4, *Shell-to-Flange Weld Joint.*

The use of procedures for satisfying the requirements of ASME Section V Article 4 for the UT examination of the RPV to flange weld from the vessel shell has not received the same qualifications as PDI qualified procedure.

The use of Appendix VIII Supplements 4 and 6 for the completion of the RPV vessel-to-flange weld from the shell side (with PDI qualified procedures) is expected to reduce examination time, which translates to reduce personnel radiation exposure.

Additionally, this relief would allow a smooth transition to the welds adjacent to the RPV circumferential and longitudinal welds (welds B1.11 and B1.12) which do require an examination in accordance with Appendix VIII Supplement 4 and 6. This would eliminate the need to switch to the different calibration, procedure and techniques required by ASME Section V Article 4 and the Regulatory Guide 1.150 Rev 1. This would result in a reduction in transition time to the different calibration, procedure and techniques required which translates to reduce personnel radiation exposure and is more cost effective.

The coverage for the RPV-to-flange weld from the shell side is 96% of the required volume as depicted in figure IWB-2500-4 and would be the same for both examinations (either the ASME Section V Article 4 or the proposed ASME Section XI Appendix VIII Supplement 4 and 6 as modified by the Final Rule).

The coverage for the RPV-to-flange weld from the shell during the first interval was 60%. The improvement in coverage to 96% is due to the fact the transducers are no longer mounted together in one sled but rather they are spring loaded and individually suspended, allowing for more flexibility in the shell transition area.

The examination performed from the Reactor Pressure Vessel (RPV) flange surface earlier during this second interval provided 100% of the required volume from the flange surface.

It is concluded that the examination coverage of RPV-to-flange weld meets the requirements of Code Case N-460, *Alternative Examination Coverage for Class 1 and Class 2 Welds*, which requires the examination coverage of Class 1 welds be greater than 90%.

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ALTERNATIVE EXAMINATIONS:

The remaining automated shell-to-flange weld examinations shall be performed using a qualified procedure in accordance with ASME Code, Section XI, Div. 1, 1995 Edition, 1996 Addenda, Appendix VIII Supplement 4 and 6 as amended by the Federal Register Notice 64FR 51370 through 51400, dated September 22, 1999.

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Comparison of Reactor Pressure Vessel Shell Weld Examination Techniques

Description (Code Reference)	ASME Section V Article 4, 1986 Edition ASME Section XI, 1986 Edition NRC Regulatory Guide 1.150 Revision 1, February 1983	WesDyne Examination Procedure PDI-ISI-254 Requirements
Examination Angle	Section V, Article 4, T-441 requires the volume of weld and adjacent base material be scanned by straight and angle beam techniques. Two angle beams, having nominal angles of 45 and 60 degrees with respect to a perpendicular to the examination surface shall generally be used. Other pairs of angle beams are permitted provided the measured difference between the angles is at least 10 degrees.	Examinations are conducted with angles of 45 degree Longitudinal wave; dual element, 45 degree Longitudinal wave single element and a 45 degree shear wave single element transducer. These 3 transducer types were qualified to examine the 11" thick Supplement 4 and Supplement 6 test specimens.
Instrument Calibrations	Section V, Article 4, T-431 requires that instrument screen height and amplitude linearity be evaluated at least every three months. Section XI, IWA-2232 requires that these screen height and linearity checks be performed at the beginning and end of the weld examination performed on a vessel during one outage.	Instrument screen height and amplitude linearity are checked prior to and following completion of the examinations of the PSEG Nuclear Salem Unit 2 reactor vessel.
System Calibrations	Section V, Article 4, T-432 requires that the original system calibration be performed on the Code basic calibration block. T-432 allows the use of different types of reference blocks and electronic simulators to perform system calibration verifications.	System calibrations are conducted on a generic calibration block designed to be a conservative representation of vessel shell materials. The basic reflectors are side-drilled holes of smaller diameter than those specified by Code. Interim and final checks are performed by comparative histogram analysis of vessel material noise levels.
Scanning Sensitivity	Section V, Article 4, T-424 permits scanning to be performed at the reference level when electronic distance-amplitude correction (DAC) is used with automated recording.	Compared to ASME levels, scanning is performed at less than the 10% of DAC level.

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Description (Code Reference)	ASME Section V Article 4, 1986 Edition ASME Section XI, 1986 Edition NRC Regulatory Guide 1.150 Revision 1, February 1983	WesDyne Examination Procedure PDI-ISI-254 Requirements
Recording Level	Section V, Article 4, T-441 requires recording and evaluation of reflectors that produce a response equal to or greater than 50% DAC. Regulatory Guide 1.150 requires recording and evaluation at 20% DAC for the inner 25% of material thickness.	For all inspection zones, all indications interpreted as flaws are subject to measurement and assessment, regardless of amplitude.
Scan Index and Pulse Repetition Rate	Section V, Article 4, T-424 requires each pass of the search unit overlap a minimum of 10% of the transducer piezoelectric element dimension perpendicular to the direction of the scan. Section XI, IWA-2232 requires each pass of the search unit overlap at least 50% of the transducer piezoelectric element dimension perpendicular to the direction of the scan. NRC Regulatory Guide 1.150 requires a 25% maximum overlap for detection and 0.25-inch maximum increments for sizing.	A scan index of 0.5" is used for detection and indication measurement. This scan index meets the requirements of T-424, IWA-2232 and Regulatory Guide 1.150.
Flaw Sizing and Evaluation	Section V, article 4, T-441 requires amplitude based sizing at 50% DAC. Section V, Article 4, T-453 permits evaluation to alternative standards.	All indications are characterized as valid or non-valid. Diffraction signals and responses from indication features are used for determining the bounding size of the flaw. Length sizing is accomplished by determining the number of scanning sweeps where features are present.