

Nebraska Public Power District

Nebraska's Energy Leader

NLS980163

October 2, 1998

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

Gentlemen:

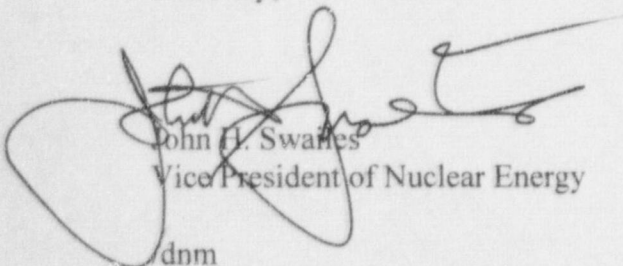
Subject: Inspection of Reactor Vessel Shell Welds - Supplemental Information
Cooper Nuclear Station, NRC Docket 50-298, DPR-46

Reference: 1. Letter (No. NLS980133) to USNRC Document Control Desk from Alan R. Shiever for John H. Swailes (NPPD) dated August 31, 1998, "Inspection of Reactor Vessel Shell Welds"

In the above reference, the Nebraska Public Power District (District) submitted to the Nuclear Regulatory Commission (NRC) an inservice Inspection (ISI) relief request (Relief Request No. RI-04) concerning the inspection of reactor vessel shell welds at Cooper Nuclear Station (CNS). In a telephone conversation, on September 23, 1998, between the District and the NRC Office of Nuclear Reactor Regulation, Division of Reactor Projects, Project Manager for CNS, the District was requested to provide supplemental information supporting ISI Relief Request, RI-04. In this telephone conversation, the District was requested to provide a direct comparison between the GERIS 2000 methodology and the applicable ASME requirements. Please find attached the supplemental supporting information.

Should you have any questions concerning this matter, please contact me.

Sincerely,



John H. Swailes
Vice President of Nuclear Energy

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Attachment

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cc: Regional Administrator
USNRC - Region IV

Senior Project Manager
USNRC - NRR Project Directorate IV-1

Senior Resident Inspector
USNRC

NPG Distribution

Comparison of GERIS 2000 Procedures and ASME Requirements

This document compares the General Electric Performance Demonstration Initiative (PDI) qualified reactor pressure vessel (RPV) examination procedures to ASME Section XI, 1989 Edition and the related requirements of Section V, Article 4. The GERIS 2000 In-vessel system was successfully demonstrated in accordance with the PDI-RPV Protocol which implements the requirements of ASME XI, Appendix VIII, 1992 Edition with the 1993 Addenda.

ASME Section XI, Division 1

IWB-2500 Examination and Pressure Test Requirements

(a) Components shall be examined and tested as specified in Table 2500-1. The method of examination for the components and parts of the pressure retaining boundaries shall comply with those tabulated in Table IWB-2500-1 except where alternate examination methods are used that meet the requirements of IWA-2240.

General Electric's procedure complies with IWB-2500.

IWA-2230 Volumetric Examination

A volumetric examination indicates the presence of discontinuities throughout the volume of material and may be conducted from either the inside or outside surface of a component.

General Electric's procedure complies with IWA-2230 by use of an inside surface ultrasonic examination.

IWA-2232 Ultrasonic Examination

Ultrasonic examinations shall be conducted in accordance with Appendix I.

General Electric's procedure does not comply with IWA-2232 or Appendix I. The procedure complies with Appendix VIII, ASME Section XI, 1992 Edition, 1993 Addenda and the PDI-RPV Protocol.

The following is a comparison of the qualified procedures (GE-UT-700 and GE-UT-701) and the requirements of Appendix I of ASME Section XI, 1989 Edition, No Addenda.

Supplement 1

The calibration blocks are furnished by the Owner. For Owner furnished blocks, both the material and thickness are assumed to meet the requirements of this Supplement.

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Note: Ultrasonic calibrations are performed on the GERIS 2000 Invessel system only for the purpose of providing a reference for the comparison of detected flaws with previous and future data. The GERIS 2000 does not rely on any characteristic of the basic calibration block for either flaw detection or sizing.

Supplement 2

The calibration blocks are furnished by the Owner. For Owner furnished blocks the clad surfaces are assumed to meet the requirements of this Supplement.

Supplement 3

The calibration blocks are furnished by the Owner. For Owner furnished blocks the curvature is assumed to meet the requirements of this Supplement.

Supplement 4

The calibration blocks are furnished by the Owner. No alternative calibration block designs are used for GERIS 2000 Invessel System calibrations.

Supplement 5

No electronic calibration simulators are used.

Supplement 6

Pulse repetition rate is defined as an essential variable by Appendix VIII. The GERIS 2000 Invessel System was qualified with a Pulse On Position (POP) repetition rate. Each search unit is pulsed once for each step position within its assigned examination area.

Supplement 7

Due to the design characteristics of the GERIS 2000 the linearity checks of Section V, Article 4, T-431 do not verify any portion of the ultrasonic system's electronics or displays. No linearity checks are performed as part of the GERIS 2000 ultrasonic calibrations.

Supplement 8

Scan overlap is defined as an essential variable by Appendix VIII as implemented by the PDI protocol. The GERIS 2000 Invessel System was qualified with a maximum step size of 0.25 inch.

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Supplement 9

The minimum scan requirements for effective coverage, as demonstrated, are:

Effective examination of the clad/base material interface region for the detection of flaws oriented perpendicular to the weld axis requires, as a minimum, examination by at least one 70 degree refracted longitudinal (RL) search unit directed parallel to the weld axis.

Effective examination of the clad/base material interface region for the detection of flaws oriented parallel to the weld axis requires, as a minimum, examination by at least one 70 degree RL search unit directed perpendicular to the weld axis.

Effective examination of the exam volume (not including the interface region) for the detection of flaws oriented perpendicular to the weld axis requires, as a minimum, examination by at least one 45 degree shear wave search unit directed parallel to the weld axis.

Effective examination of the exam volume (not including the interface region) for the detection of flaws oriented parallel to the weld axis requires, as a minimum, examination by at least one 45 degree shear wave search unit directed perpendicular to the weld axis.

For calibration of the 70 degree RL search unit an alternate set of calibration reflectors is also provided in addition to those specified by Supplement 9. The alternate reflectors are 1/16 in. diameter, maximum, side drilled holes installed at 1/10 in. increments to a depth of 1 in. to establish metal path calibration.

Supplement 10

Method of data recording is defined as an essential variable by Appendix VIII.

The GERIS 2000 Invesel System examination procedure requires the recording of relevant reflectors at the 20% DAC level. This recording requirement provides a means for the comparison of current examination results to previous and future examinations.

All reflectors having echo-dynamic characteristics typical of planar indications are reviewed to determine their origin regardless of amplitude. Planar indications accompanied by tip diffracted signals are recorded regardless of amplitude. This recording requirement is the basis for the qualified detection method.

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Supplement 11

Method and criteria for the discrimination of indications including geometric indications is defined as an essential variable by Appendix VIII.

Supplement 12

Method and criteria for the discrimination of indications including length and depth sizing of flaws is defined as an essential variable by Appendix VIII.

ASME Section V, Article 4

Instrument Calibration

T-431.2 requires screen height and amplitude control linearity checks.

Due to the design characteristics of the GERIS 2000 the linearity checks specified by T-431.2 do not verify any portion of the ultrasonic system's electronics or displays.

The screen height linearity checks specified by T-431.2.1 are applicable to ultrasonic instruments using integral CRT displays for the recording of ultrasonic data. Display deficiencies in these instruments may result in errors in the recorded data. Alternatively, the GERIS 2000 records data prior to CRT display and is not subject to this effect.

The amplitude control linearity checks specified by T-431.2.2 are applicable to linear ultrasonic instruments which rely on varying display gain to provide sufficient display resolution for data recording. Amplitude control deficiencies in these instruments may result in errors in recorded amplitude with changes in the display gain. The GERIS 2000 is a logarithmic ultrasonic instrument and no changes in gain are made during calibration or examination and is not subject to this effect.

Beam Spread Measurements

T-432.3.1 and T-434, include a requirement to measure beam spread, vertical plane (T-432.3.1(e)). These data are intended for use in comparing successive sets of system calibration data. A further intent is to have these data available as more sophisticated methods of flaw sizing are developed.

Beam profile measurements are not obtained as part of the qualified procedure. Angle beam profile data is required for amplitude based sizing techniques using beam spread correction. Amplitude based sizing is not used by the GERIS 2000 Invesel system. The flaw sizing

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techniques used by the GERIS 2000 are tip diffracted sizing techniques and are the anticipated more sophisticated methods.

System Calibration Requirements

General Electric's procedure complies with the General Requirements of T-432.

Calibration Confirmation

T-432.1.2 requires a calibration check at the finish of each examination and every 12 hours during the examination.

General Electric's procedures do not rely on any characteristic of the basic calibration block for flaw detection or sizing and, as such, no intermediate calibration verifications are performed.

Scanning Requirements

T-441.3.2 requires scanning of the weld and adjacent base material with straight and angle beam techniques. The angle beam scans are generally 45°, 60°, and 70° angle beams. Other angles are permitted. The examination volume is required to be scanned with the angle beams directed at both right angles to the weld and along the weld axis. Wherever feasible, the examination is to be performed in both directions.

General Electric's procedure (GE-UT-700) complies with the scanning requirements. The minimum requirements for effective examination coverage as qualified by the performance demonstration are:

Para 7.2.3.a) Effective examination of the clad/base material interface region for the detection of flaws oriented perpendicular to the weld axis requires, as a minimum, examination by at least one 70° refracted longitudinal search unit directed parallel to the weld axis.

Para 7.2.3.b) Effective examination of the clad/base material interface region for the detection of flaws oriented parallel to the weld axis requires, as a minimum, examination by at least one 70° refracted longitudinal search unit directed perpendicular to the weld axis.

Para 7.2.3.c) Effective examination of the examination volume (not including the interface region) for the detection of flaws oriented perpendicular to the weld axis requires, as a minimum, examination by at least one 45° shear wave search unit directed parallel to the weld axis.

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Para 7.2.3.d) Effective examination of the examination volume (not including the interface region) for the detection of flaws oriented parallel to the weld axis requires, as a minimum, examination by at least one 45° shear wave search unit directed perpendicular to the weld axis.

The minimum requirements for effective examination coverage as qualified do not include any contribution from the straight beam or 60° shear wave examination. Since General Electric is not using the technique described in Article 4, the term "Code" coverage is not applicable. All coverage reported is effective coverage as defined by the qualified procedure.

Recording Examination Data

T-441.3.2.8 requires recording all reflectors equal to or greater than 20% of distance amplitude correction (DAC) and all surface reflectors that produce a response equal or exceeding the response from the opposite surface notch.

General Electric's procedure (GE-UT-700) requires the investigation of all relevant reflectors, regardless of amplitude, that possess the echo-dynamic characteristics of planar reflectors. All reflectors that are accompanied by tip diffracted signals are recorded. Relevant reflectors exceeding 20% of DAC are also recorded.

Evaluation of Reflectors

T-452 requires the dimensioning of flaws using amplitude based techniques. Reflectors exceeding 100% of DAC are dimensioned at the 50% maximum amplitude points. Angle beam planar reflectors exceeding 20% DAC are dimensioned at the 20% DAC end points. Straight beam planar reflectors exceeding 50% of DAC are dimensioned at the 50% DAC end points.

General Electric's procedure requires the dimensioning of flaws using tip diffraction techniques. Reflector lengths are determined at the 50% maximum amplitude end points, half maximum amplitude end points, or loss of signal end points depending on the search unit angle and the flaw characteristics.

Summary

An examination performed in accordance with General Electric's procedure will result in the examination volume being interrogated by the same straight and angle beam search units as an Article 4 procedure. Any areas of limited access would be common to the Article 4 procedure.

The recording criteria of General Electric's procedure will result in the recording of any flaw required to be recorded by an Article 4 procedure. Flaws considerably below the 20% DAC

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and ASME Requirements**

threshold, i.e., less than 5% of DAC, are routinely recorded and evaluated with the GERIS 2000 In vessel system.

General Electric's flaw dimensioning techniques have been demonstrated to be within the tolerances of Appendix VIII as implemented by PDI. Article 4's flaw dimensioning techniques have not been successfully demonstrated within the tolerances in Appendix VIII.

Correspondence No: NLS980163

The following table identifies those actions committed to by the District in this document. Any other actions discussed in the submittal represent intended or planned actions by the District. They are described to the NRC for the NRC's information and are not regulatory commitments. Please notify the NL&S Manager at Cooper Nuclear Station of any questions regarding this document or any associated regulatory commitments.

COMMITMENT	COMMITTED DATE OR OUTAGE
None	N/A