TENNESSEE VALLEY AUTHORITY

1101 Market Street, Chattanooga, Tennessee 37402

CNL-22-002

May 24, 2022

10 CFR 50.55a(g)(5)(iii)
10 CFR 50.55a(g)(6)

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

Browns Ferry Nuclear Plant, Unit 2
Renewed Facility Operating License No. DPR-52
NRC Docket No. 50-260

Subject: **Browns Ferry Nuclear Plant, Unit 2 – Request for Relief from American Society of Mechanical Engineers Boiler and Pressure Vessel Code Section XI, in Accordance with 10 CFR 50.55a(g)(5)(iii) and 50.55a(g)(6) (BFN-2-ISI-003)**

In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a, "Codes and Standards," paragraph (g)(5)(iii) and (g)(6), Tennessee Valley Authority (TVA) is submitting for Nuclear Regulatory Commission (NRC) approval, Relief Request BFN-2-ISI-003 for the Browns Ferry Nuclear Plant (BFN), Unit 2 from the requirements of American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (BPVC), Section XI, examination requirements for Table IWB-2500-1, Category B-D, and Code Case N-577, Category R-A, as identified in the enclosure to this letter.

Specifically, TVA requests relief for the welds listed in this request from Code requirements of achieving essentially 100 percent examination coverage. ASME BPVC, Section XI, Code Case N-460 states "that when the entire examination volume or area cannot be examined due to interference by another component or part geometry, a reduction in examination coverage on any Class 1 or Class 2 weld may be accepted provided the reduction in coverage for that weld is less than 10%. The applicable examination records shall identify both the cause and percentage of reduced examination coverage." The component examinations in the scope of the relief request are those for which greater than 90 percent of the required examination volume or surface area could not be achieved. The enclosed relief request provides information to support the determination that achieving essentially 100 percent coverage of the listed welds is impractical.

This relief is requested for the BFN Unit 2 fourth 10-year inservice inspection interval (ISI) that began May 25, 2011, and ended May 24, 2021. During the fourth 10-year ISI interval, the applicable ASME BPVC of Record for BFN Unit 2 was ASME Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," 2004 Edition, subject to the limitations and modifications of 10 CFR 50.55a(b)(2).

TVA requests approval of this request for relief within one year of the date of this letter.

There are no new regulatory commitments associated with this submittal. Please address any questions regarding this request to Stuart L. Rymer, Senior Manager, Fleet Licensing, at slrymer@tva.gov.

Respectfully,

Digitally signed by Carla Edmondson
Date: 2022.05.24 10:57:44 -04'00'

James T. Polickoski
Director, Nuclear Regulatory Affairs

Enclosure:

Browns Ferry Nuclear Plant, Unit 2, American Society of Mechanical Engineers, Boiler & Pressure Vessel Code, Section XI, Request for Relief Number BFN-2-ISI-003

cc (Enclosure):

NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Browns Ferry Nuclear Plant
NRC Project Manager - Browns Ferry Nuclear Plant

Enclosure

Browns Ferry Nuclear Plant, Unit 2

American Society of Mechanical Engineers, Boiler & Pressure Vessel Code, Section XI

Request for Relief Number BFN-2-ISI-003

Introduction

In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 55.55a(g)(5)(iii) and (g)(6), Tennessee Valley Authority (TVA) is requesting relief from weld examination coverage requirements specified in the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (BPVC) Section XI examinations performed during the Browns Ferry Nuclear Plant (BFN) Unit 2 fourth interval, for which limited examination coverage was obtained. For BFN Unit 2, the fourth 10-year inservice inspection (ISI) interval began on May 25, 2011, and ended May 24, 2021. The limited examinations contained in this request are required to be submitted to the Nuclear Regulatory Commission (NRC) on or before 12 months after this date.

This enclosure contains the figures and tables that depict the limitations and calculations used for obtained coverage, materials and product forms, ultrasonic examination angles and wave modes used, and the examination results for the welds associated with this request for relief, including any applicable previous examination history used. Table 1 identifies the welds within the scope of this request and summarizes the extent of examination coverage achieved for each weld.

Frequently, ultrasonic testing (UT) scan numbers were used in the original nondestructive examination (NDE) data sheets to determine and describe the examinations performed and coverage percentages obtained. In the examination data that follows, UT scan number identifiers have been omitted for clarity and replaced with specific descriptions of weld configurations and scan directions. The scan numbers, if used, have been applied as described in Figure I-1 for piping and Figure I-2 for vessels.

I. ASME Code Components Affected

The BFN Unit 2, Class 1 welds with limited examinations requiring relief during the fourth 10-year ISI interval are listed in Table 1 to this enclosure. The content of this request includes the insights gained from guidance provided in NRC presentation “Coverage Relief Requests” (Reference 1). The following Code Classes, Examination Categories, and Item Numbers apply.

Code Classes	1
Examination Categories	B-D and R-A
Item Numbers	B3.100, B3.90, and R1.16

II. Applicable Code Edition and Addenda

During the fourth ten-year ISI interval, the applicable ASME BPVC of Record (Code) for BFN Unit 2 was ASME Section XI, “Rules for Inservice Inspection of Nuclear Power Plant Components,” 2004 Edition, subject to the limitations and modifications of 10 CFR 50.55a(b)(2).

III. Applicable Code Requirements

ASME BPVC, Section XI, Code Case N-460 (Reference 2), as endorsed in Regulatory Guide 1.147, Revision 16, states: "when the entire examination volume or area cannot be examined due to interference by another component or part geometry, a reduction in coverage on any Class 1 or Class 2 weld may be accepted provided the reduction in coverage for that weld is less than 10%." Therefore, TVA is requesting relief only for those welds, in accordance with Code Case N-460, that were inspected and received Code coverage of 90 percent (%) or less. All NDE of the required examination surface or volume were conducted to the maximum extent possible.

Relief is being requested for the following examination category and item numbers:

Exam Cat.	Item No.	Class 1 Weld Examination Coverage Requirements
B-D	B3.100	Full penetration welded reactor vessel nozzle inside radius section. Volumetric examination of essentially 100% of the weld and adjacent base material and inside radius as depicted in Figure IWB-2500-7(a) through (d). Code Case N-648-1 (Reference 3) allows examination category B-D, Item No. B3.100 to receive a visual (VT-1) examination of the surface M-N shown in Figures IWB-2500-7(a) through (d) in the 1998 Edition in lieu of the volumetric examination. This alternative excludes boiling water reactor (BWR) feedwater nozzles and operational control rod drive return line nozzles. A four inch (4") jet pump instrumentation nozzle inside radius encountered a limitation while being visually examined in accordance with Code Case N-648-1.

Exam Cat.	Item No.	Class 1 Weld Examination Coverage Requirements
B-D	B3.90	Full penetration welded reactor vessel nozzle-to-vessel. Volumetric examination of essentially 100% of the weld and adjacent base material and inside radius as depicted in Figure IWB-2500-7(a) through (d). Code Case N-613-1 (Reference 4) allows ultrasonic examination of category B-D, Item Number B3.90 nozzle-to-vessel welds, previously ultrasonically examined using the examination volumes of Figures IWB-2500-7(a)-(c), be examined using the reduced examination volume (A-B-C-D-E-F-G-H) of N-613-1 Figures 1, 2, and 3. Reactor water recirculation outlet (N1), reactor water feedwater (N4), and jet pump instrumentation (N8) nozzles encountered limitations on various nozzle to vessel welds while being volumetrically examined.

Exam Cat.	Item No.	Class 1 Piping Welds / Risk-Informed Inservice Inspection Program Coverage Requirements; Code Case N-577 (Reference 5)
R-A	R1.16	Volumetric examination of 100% of the weld and adjacent base material as depicted in Figures IWB-2500-8(c) and IWB-2500-9, 10, and 11 of the 1989 Edition. The extent of examination of piping welds for the fourth inspection interval was determined in accordance with the Risk-Informed Inservice Inspection Program (RI-ISI). The RI-ISI Program was prepared in accordance with the methodology contained in Code Case N-577. Residual heat removal (1), reactor water cleanup (3), reactor water recirculation (2) and core spray (2) piping welds encountered limitations while being volumetrically examined.

IV. Reason for Request

Pursuant to 10 CFR 50.55a(g)(5)(iii) and (g)(6), TVA has determined that compliance with the Code requirements of achieving essentially 100% coverage of the welds listed in this request is impractical for BFN Unit 2. This request is based on actual demonstrated limitations experienced when attempting to comply with the Code requirements in the performance of the examinations listed in this request.

V. Impracticality of Compliance

When examined, the welds listed in this request did not receive the required code volume coverage due to their component design configurations or interference by other items. These conditions resulted in scanning access limitations that prohibited obtaining essentially 100% examination coverage of the required examination volumes. When this situation occurred, 100% of the accessible volumes of each weld were covered to the maximum extent practicable. Details of examination restrictions and reductions in required examination coverage are explained in Table 1.

In those cases where UT examinations could potentially have interrogated additional area, such as the inside surface of cast stainless valves by looking through a stainless steel weld, these were considered a best effort examination. These are shown on the figures below by the represented angles. However, no additional coverage is credited.

The design configuration of the nozzle-to-vessel welds and piping system welds in Table 1 precludes UT examination of essentially 100% of the required examination volume. In order to examine the welds in accordance with the ASME Code requirements, extensive design modifications would be required. The physical arrangement of the nozzle-to-vessel welds precludes UT examination from the nozzle side. The limitations are inherent to the nozzle-to-vessel weld design. Scanning from the nozzle surface is ineffective due to the weld location and the asymmetrical inside surface where the nozzle and vessel converge.

For each weld in the scope of this request, it is not possible to obtain UT interrogation of greater than 90% of the required code examination volume or surface areas without extensive weld or component design modifications. Using radiography as an alternative would result in numerous work-related stoppages and increased radiation exposure due to the shutdown and startup of other work in the areas. The water may need to be drained from some systems or components where radiography is performed, which increases the radiation dose rates over a much broader area than the weld being examined. There is significant impracticality associated with the performance of weld or area modifications or the use of radiography in order to increase the examination coverage.

VI. Proposed Alternative and Basis for Use

Proposed Alternative

1) Periodic system pressure tests and VT-2 visual examinations will continue to be performed on Class 1 pressure retaining welds and items during each refueling outage in accordance with Examination Category B-P of Table IWB-2500-1.

2) UT examinations are conducted to the maximum extent possible using demonstrated techniques as required by ASME Section XI or the RI-ISI Programs.

3) Continual monitoring instrumentation is in place to detect any reactor coolant system (RCS) pressure boundary leakage.

Basis for Use

Title 10 of the *Code of Federal Regulations* 50.55a(g)(4) recognizes that throughout the service life of a nuclear power facility, components which are classified as ASME Code Class 1, Class 2, and Class 3 must meet the requirements, except design and access provisions and preservice examination requirements, set forth in the ASME Code to the extent practical within the limitations of design, geometry, and materials of construction. This request for relief has been written to address areas where these types of conditions exist and where the required amount of coverage was reduced below the minimum acceptable. TVA has performed the weld examinations listed in this request to the maximum extent possible for each of the welds identified with limitations in the attachment to this enclosure.

During each refueling outage, the system pressure test involves the Class 1 equivalent portions of systems. These examinations are completed with qualified VT-2 / Alt VT-2 personnel under plant conditions required by ASME Section XI. This examination provides assurance that any relevant conditions, including through-wall leaks, are identified and addressed per ASME Section XI before the unit operates for a full cycle.

The piping welds and the reactor pressure vessel (RPV) nozzle-to-vessel welds and inner radius section were examined with the latest techniques, procedures, equipment, and personnel qualified to the requirements of the Electric Power Research Institutes (EPRI) Performance Demonstration Initiative (PDI) program. These examinations provide an acceptable level of quality and safety because the information and data obtained provides sufficient information to judge the overall integrity of the piping welds. Additionally, these welds are part of a larger population of welds examined for which the required examination coverage is attained. When considered in aggregate with the entire sample population, an adequate level of inspection was

performed to provide reasonable assurance that a pattern of intergranular stress corrosion cracking (IGSCC) degradation that, if present, could affect the overall integrity of the components would be detected. The piping welds were selected and examined to satisfy the requirements of Generic Letter 88-01, "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping" and EPRI Report BWRVIP-75-A, "BWR Vessel and Internals Project Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules."

The welds in the scope of this request are located inside the reactor building. All but two welds are located in the drywell. There is continuous monitoring instrumentation in place to assure that early detection of any RCS pressure boundary leakage is identified. This is accomplished by monitoring of the following parameters: (a) pressure and temperature in the primary containment, (b) flow in the equipment drain sump and floor drain sump, (c) cooling water temperature to and from the drywell coolers, and (d) drywell atmosphere for airborne activity. The unidentified leakage rate limit for BFN is based, with an adequate margin for contingencies, on the crack size large enough to propagate rapidly. The established limit is sufficiently low so that, even if the entire unidentified leakage rate were coming from a single crack in the nuclear system process barrier, corrective action could be taken before the integrity of the barrier is threatened with significant compromise. RCS leakage detection instrumentation is required to be operable by BFN Unit 2 Technical Specification (TS) 3.4.5. BFN TS 3.4.5 requires that the following RCS leakage detection instrumentation shall be operable:

- Drywell floor drain sump monitoring system; and
- One channel of either primary containment atmospheric particulate or atmospheric gaseous monitoring system.

The above instruments are used to quantify any unidentified leakage from the RCS and to meet BFN Unit 2 TS 3.4.4, which states that RCS operational leakage shall be limited to:

a) No pressure boundary leakage;

b) Less than or equal to five gallons per minute (gpm) unidentified leakage;

c) Less than or equal to 30 gpm identified leakage over the previous 24-hour period; and

d) Less than or equal to two gpm increase in unidentified leakage within the previous 24-hour period in Mode 1.

Conclusions made in the ASME NDE subcommittee report, "Technical Basis for Elimination of Reactor Vessel Nozzle Inner Radius Inspections," (Reference 6) in conjunction with fracture toughness tests performed at Oak Ridge National Laboratories, indicate there is a large flaw tolerance for BWR nozzle inner radius regions. Even if flaw propagation was assumed, test results indicate a leak before break scenario would occur, which would not result in a significant increase in core damage frequency.

Based upon the extent of the required UT examination volume achieved for each of the welds within this request for relief, and coupled with applicable leakage monitoring and required system pressure tests with VT-2 visual examinations, no further action can be taken by TVA at this time to improve these examinations without applying impractical options. The proposed alternative in this request for relief will provide assurance of an acceptable level of quality and safety by providing reasonable assurance of structural integrity.

VII. Duration of the Proposed Alternative

This relief is requested for the BFN Unit 2 fourth ten-year inspection interval that began May 25, 2011, and ended May 24, 2021.

VIII. Precedents

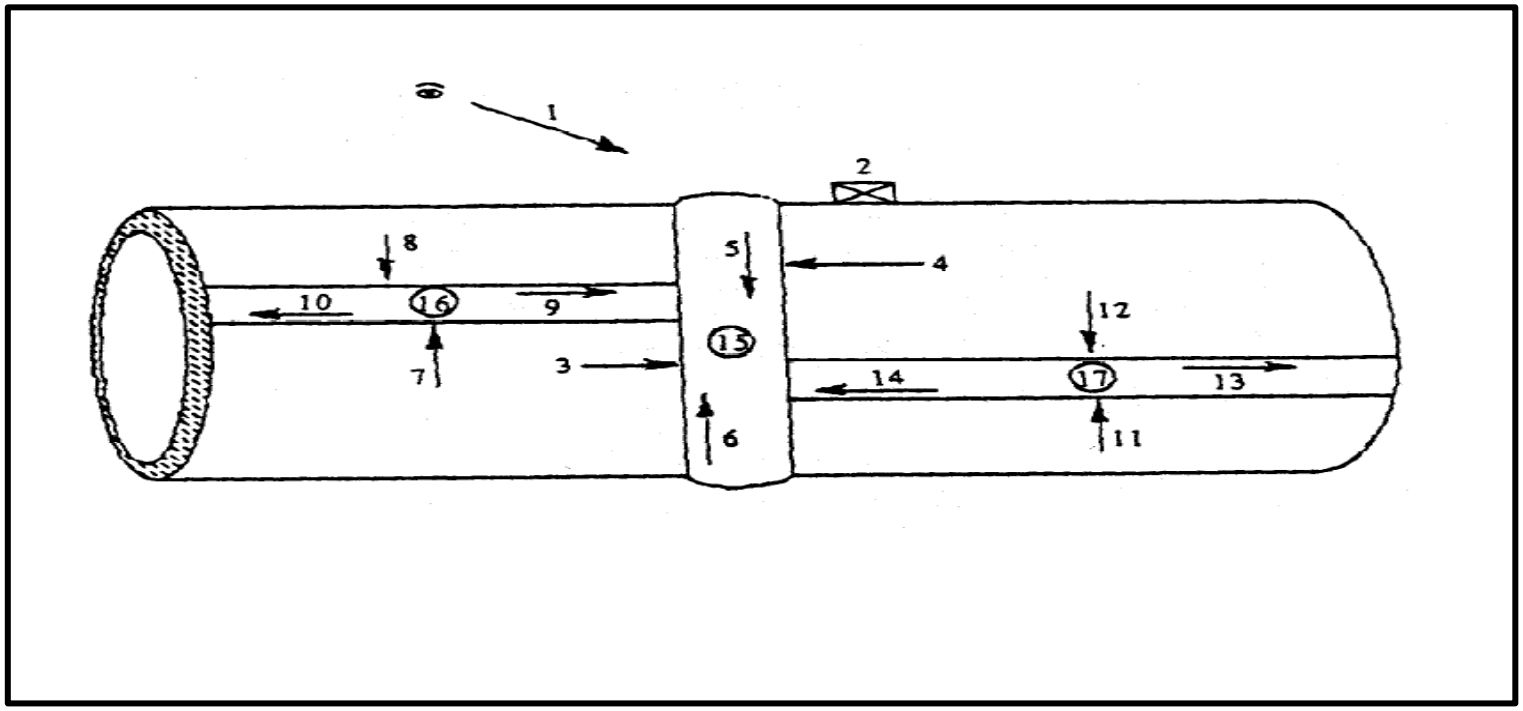
This request for relief is similar to the following TVA relief requests for BFN that were approved by the NRC.

- 3-ISI-25, NRC approved by letter dated January 20, 2012 (ML12003A081)
- 3-ISI-29, NRC approved by letter dated August 18, 2017 (ML17135A146)
- 1-ISI-29, NRC approved by letter dated December 31, 2018 (ML18323A172)

IX. References

1. NRC Presentation, “Coverage Relief Requests,” Industry/NRC NDE Technical Information Exchange Public Meeting, January 13-15, 2015 (ML15013A266)
2. ASME Code Case N-460, “Alternative Examination Coverage for Class 1 and Class 2 Welds, Section XI, Division 1”
3. ASME Code Case N-648-1, “Alternative Requirements for Inner Radius Examinations of Class 1 Reactor Vessel Nozzles, Section XI, Division 1”
4. ASME Code Case N-613-1, “Ultrasonic Examination of Full Penetration Nozzles in Vessels, Examination Category B-D, Item No’s. B3.10 and B3.90, Reactor Nozzle-To-Vessel Welds, Figs. IWB-2500-7(a), (b), and (c), Section XI, Division 1”
5. ASME Code Case N-577, “Risk-Informed Requirements for Class 1, 2, or 3 Piping, Method A, Section XI, Division 1”
6. ASME NDE Subcommittee Report, “Technical Basis for Elimination of Reactor Vessel Nozzle Inner Radius Inspections,” Proceedings of ASME 2001 Pressure Vessels and Piping Conference, Atlanta, GA

FIGURE I-1 – SCANNING NOMENCLATURE IDENTIFICATION FOR PIPING



1 = Visual
2 = Base Material When Required
3-14 = Angle Beam
15-17 = 0° Weld and HAZ

Reference Arrow Flow

FIGURE I-2 – SCANNING NOMENCLATURE IDENTIFICATION FOR VESSELS

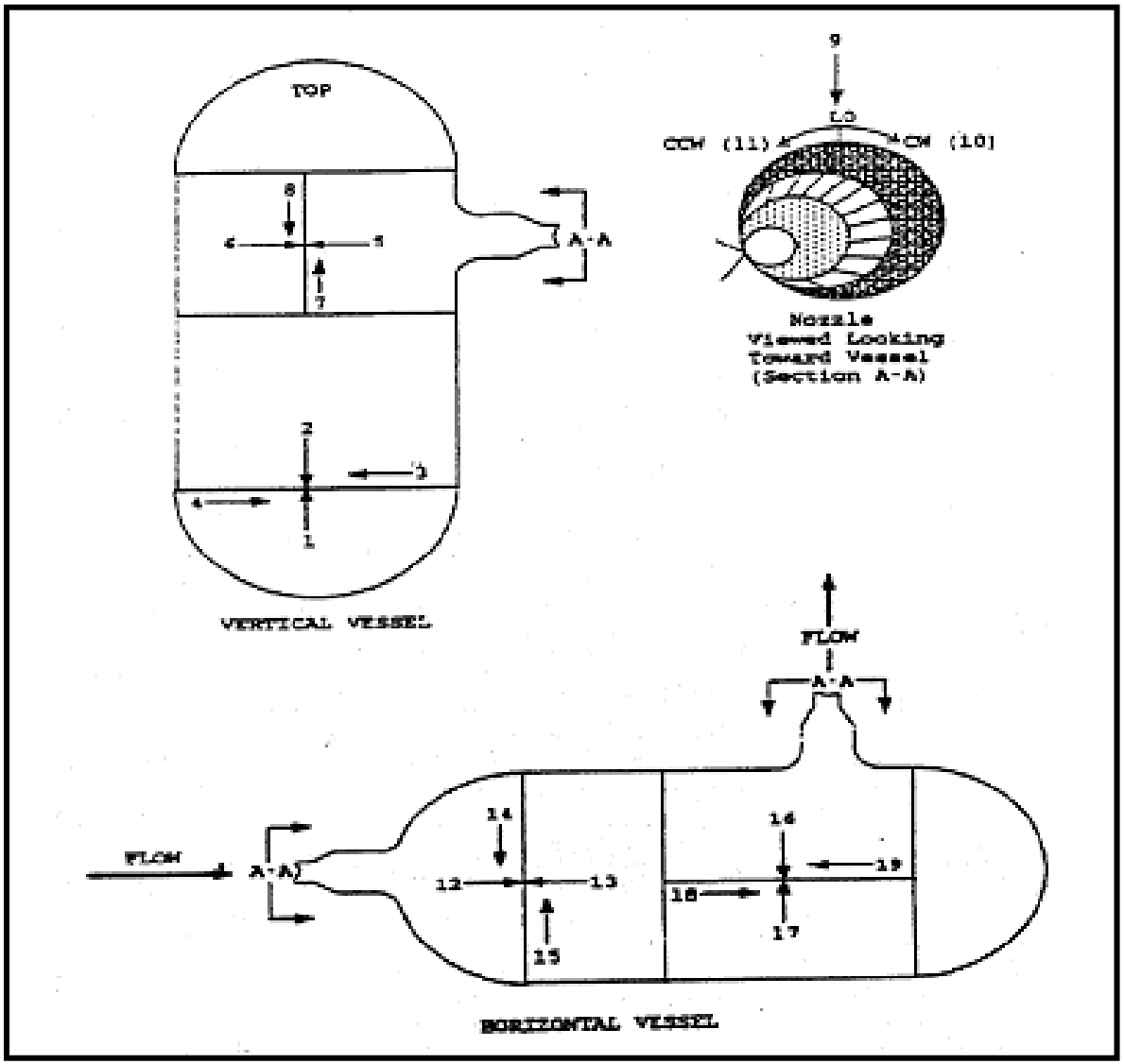


TABLE 1 – BFN UNIT 2 WELDS WITH LIMITED EXAMINATIONS								
Seq. Number Weld Identification Cycle	**Class Category Item No.**	**Weld Description**	**Material 1 Product Form**	**Material 2 Weld**	**Material 3 Product Form**	**Code Coverage Obtained %**	**Examination Limitations and Results**	**Applicable Tables and Figures**
1.1 N8A-IR U2R17	1 B-D B3.100	4” Jet Pump Instrumentation Nozzle Inside Radius	Nozzle: A508-2-1332-2	Weld: SMAW with E309 First Layer and E308L Subsequent Layers	Shell: Mn-Mo Steel Plate with Austenitic Stainless Steel Cladding	50	Examined the N8A Nozzle Inner Radii as far in the nozzle as possible inclusive of 12 inches around on the Vessel wall. Limited access due to Jet Pumps #5 and #4, and the sensing lines. No Recordable Indications	Figure 1.1-1
1.2 N8A-NV U2R17	1 B-D B3.90	4” Jet Pump Instrumentation Nozzle to Shell Weld Shell T^{NOM} = 6.125” Cladding = 0.125 (min)	Nozzle: A508-2-1332-2	Weld: SMAW with E9016-G	Shell: Mn-Mo Steel Plate with Austenitic Stainless Steel Cladding	84.2	Examination of the N8A Nozzle to Vessel Weld was limited due to nozzle configuration 360°. Geometric Nozzle. No Recordable Indications	Figures 1.2-1 through 1.2-3 Table 1.2-1
1.3 N1A-NV U2R17	1 B-D B3.90	28” Reactor Water Recirculation Outlet Nozzle to Shell Weld Shell T^{NOM} = 6.125” Cladding = 0.125 (min)	Nozzle: A508-2-1332-2	Weld: SMAW with E9016-G	Shell: Mn-Mo Steel Plate with Austenitic Stainless Steel Cladding	24.5	Examination of the N1A Nozzle to Vessel Weld was limited due to nozzle configuration 360°. Geometric Nozzle. No Recordable Indications	Figures 1.3-1 through 1.3-3 Table 1.3-1
1.4 N4A-NV U2R17	1 B-D B3.90	12” Reactor Feedwater Nozzle to Shell Weld	Nozzle: A508-2-1332-2	Weld: SMAW with E9016-G	Shell: Mn-Mo Steel Plate with Austenitic Stainless Steel Cladding	29.9	Examination of the N4A Nozzle to Vessel Weld was limited due to nozzle configuration 360° and lift off from circumferential weld C-3-4. No Recordable Indications	Figures 1.4-1 through 1.4-4 Table 1.4-1

TABLE 1 – BFN UNIT 2 WELDS WITH LIMITED EXAMINATIONS								
Seq. Number Weld Identification Cycle	**Class Category Item No.**	**Weld Description**	**Material 1 Product Form**	**Material 2 Weld**	**Material 3 Product Form**	**Code Coverage Obtained %**	**Examination Limitations and Results**	**Applicable Tables and Figures**
1.5 N4B-NV U2R17	1 B-D B3.90	12” Reactor Feedwater Nozzle to Shell Weld	Nozzle: A508-2-1332-2	Weld: SMAW with E9016-G	Shell: Mn-Mo Steel Plate with Austenitic Stainless Steel Cladding	29.9	Examination of the N4B Nozzle to Vessel Weld was limited due to nozzle configuration 360° and lift off from circumferential weld C-3-4. No Recordable Indications	Figures 1.5-1 through 1.5-4 Table 1.5-1
1.6 N4C-NV U2R17	1 B-D B3.90	12” Reactor Feedwater Nozzle to Shell Weld	Nozzle: A508-2-1332-2	Weld: SMAW with E9016-G	Shell: Mn-Mo Steel Plate with Austenitic Stainless Steel Cladding	29.9	Examination of the N4C Nozzle to Vessel Weld was limited due to nozzle configuration 360° and lift off from circumferential weld C-3-4. No Recordable Indications	Figures 1.6-1 through 1.6-4 Table 1.6-1
1.7 N4D-NV U2R17	1 B-D B3.90	12” Reactor Feedwater Nozzle to Shell Weld	Nozzle: A508-2-1332-2	Weld: SMAW with E9016-G	Shell: Mn-Mo Steel Plate with Austenitic Stainless Steel Cladding	29.9	Examination of the N4D Nozzle to Vessel Weld was limited due to nozzle configuration 360° and lift off from circumferential weld C-3-4. No Recordable Indications	Figures 1.7-1 through 1.7-4 Table 1.7-1
1.8 N4E-NV U2R17	1 B-D B3.90	12” Reactor Feedwater Nozzle to Shell Weld	Nozzle: A508-2-1332-2	Weld: SMAW with E9016-G	Shell: Mn-Mo Steel Plate with Austenitic Stainless Steel Cladding	29.9	Examination of the N4E Nozzle to Vessel Weld was limited due to nozzle configuration 360° and lift off from circumferential weld C-3-4. No Recordable Indications	Figures 1.8-1 through 1.8-4 Table 1.8-1

TABLE 1 – BFN UNIT 2 WELDS WITH LIMITED EXAMINATIONS								
Seq. Number Weld Identification Cycle	**Class Category Item No.**	**Weld Description**	**Material 1 Product Form**	**Material 2 Weld**	**Material 3 Product Form**	**Code Coverage Obtained %**	**Examination Limitations and Results**	**Applicable Tables and Figures**
1.9 N4F-NV U2R17	1 B-D B3.90	12” Reactor Feedwater Nozzle to Shell Weld	Nozzle: A508-2-1332-2	Weld: SMAW with E9016-G	Shell: Mn-Mo Steel Plate with Austenitic Stainless Steel Cladding	29.9	Examination of the N4F Nozzle to Vessel Weld was limited due to nozzle configuration 360° and lift off from circumferential weld C-3-4. No Recordable Indications	Figures 1.9-1 through 1.9-4 Table 1.9-1
1.10 DRHR-2-03 U2R17	1 R-A R1.16	24” Valve to Flued Head IGSCC Cat. D Residual Heat Removal	Flued Head: A182 F304	Weld: Stainless Steel	Valve: A351 CF8M	51.4	Single Sided Exam due to weld configuration. No Recordable Indications	Figures 1.10-1 through 1.10-2 Table 1.10-1
1.11 RWCU-2-003-G003 U2R17	1 R-A R1.16	6” Penetration to Pipe IGSCC Cat. A Reactor Water Cleanup	Penetration: Stainless Steel	Weld: Stainless Steel	Pipe: SA376, A312	75	Penetration to Pipe weld configuration presented single side access. No Recordable Indications	Figures 1.11-1 through 1.11-2 Table 1.11-1
1.12 RWC-2-001-G002 U2R18	1 R-A R1.16	4” Elbow to Valve IGSCC Cat. A Reactor Water Cleanup	Elbow: A420-WPL-1	Weld: ER309L	Valve: A351 CF8M SS	43.9	Single Sided Exam due to configuration. Stainless Steel Valve to a Carbon Steel Elbow Weld. No Recordable Indications	Figures 1.12-1 through 1.12-3 Table 1.12-1
1.13 RWCU-2-003-070 U2R17	1 R-A R1.16	6” Pipe to Weld-o-let Butt Weld IGSCC Cat. D Reactor Water Cleanup	Pipe: SA376 TP316 NG	Weld: ER316/ 316L	Pipe: A403 WP304	73.7	Single Sided Exam due to configuration. No Recordable Indications	Figures 1.13-1 through 1.13-4 Table 1.13-1

TABLE 1 – BFN UNIT 2 WELDS WITH LIMITED EXAMINATIONS								
Seq. Number Weld Identification Cycle	**Class Category Item No.**	**Weld Description**	**Material 1 Product Form**	**Material 2 Weld**	**Material 3 Product Form**	**Code Coverage Obtained %**	**Examination Limitations and Results**	**Applicable Tables and Figures**
1.14 KR-2-25 U2R17	1 R-A R1.16	28” Pipe to Tee IGSCC Cat. C Reactor Water Recirculation	Pipe: A358 TP304	Weld: Stainless Steel	Tee: A358 TP304	50	Single Sided Exam due to configuration of a wrought piping Tee Fitting. No Recordable Indications	Figures 1.14-1 through 1.14-2 Table 1.14-1
1.15 KR-2-03 U2R18	1 R-A R1.16	28” Pipe to Tee IGSCC Cat. C Reactor Water Recirculation	Pipe: A358 TP304	Weld: Stainless Steel	Tee: A358 TP304	83.86	Single Sided Exam due to configuration. No Recordable Indications	Figures 1.15-1 through 1.15-3 Table 1.15-1
1.16 DCS-2-05 U2R18	1 R-A R1.16	12” Pipe to Valve IGSCC Cat. C Core Spray	Pipe: A358 GR304	Weld: Stainless Steel	Valve: A351 CF8M SS	50	Single side access due to cast stainless steel valve.	Figures 1.16-1 through 1.16-2 Table 1.16-1
1.17 DCS-2-14 U2R18	1 R-A R1.16	12” Pipe to Valve IGSCC Cat. C Core Spray	Pipe: A358 GR304	Weld: Stainless Steel	Valve: A351 CF8M SS	50	Single side access due to cast stainless steel valve.	Figures 1.17-1 through 1.17-2 Table 1.17-1

1.1 Weld **N8A-IR** Jet Pump Instrumentation Nozzle Inside Radius

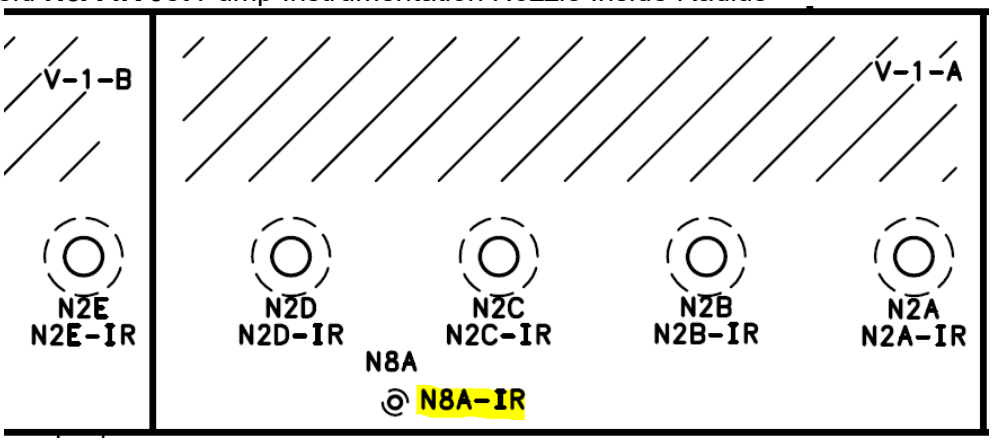


Figure 1.1-1 Weld **N8A-IR** (Extracted from Reference Drawing 2-CHM-2046-C-01)

This weld was visually examined in the fourth 10-Year ISI Interval, first period, during the U2R17 refueling outage in 2013. The NDE data may be found on Report No. VT-13-067. The required examination volume was based on Code Case N-648-1, surfaces M-N which implements VT-1 examination of the surface in lieu of the volumetric examination required by ASME, Section XI, Table IWB-2500-1. The nozzle inner radii were examined as far in the nozzle as possible as well as 12 inches around on the vessel wall. The enhanced visual (MVT-1) examination was limited based on Jet Pumps #5 and #4 as well as the sensing lines resulting in approximately 50% of the total coverage. There are no examination coverage figures or summary table associated with this weld because this was a visual examination.

Performing the nozzle inner radius section volumetric examinations from the outside surfaces of the reactor vessel are time consuming due to the asymmetrical configuration of both the nozzle outside surface (where the transducers are manipulated) and the inner radius section of the nozzle being interrogated. Performance of the volumetric examination requires the examiner(s) to enter and remain inside the biological shield penetration area around the nozzle for the duration of the ultrasonic examination. Performance of a visual examination using remote cameras essentially eliminates any personnel exposure.

Visual examination of the accessible nozzle inner radius surface (zone M-N) provides reasonable assurance that deep flaws are not present. Additionally, when flaws are initiated by the fatigue mechanism, they typically are encountered over a significant portion of the circumference, as was the case for cracking of feedwater nozzles addressed in NUREG-0619. Fatigue cracking is the only relevant degradation mechanism for the RPV nozzle inner radius region and for all nozzles other than feedwater, there is no significant thermal cycling during operation.

Therefore, performance of VT-1 examinations of RPV nozzle inner radii to the extent practical provides an acceptable examination without compromising the level of quality and safety.

A review of the plant's corrective action program did not note any failures at this weld. Previous examination data from the U2R12, R-169 report were reviewed for the visual examination. No recordable indications were noted.

1.2 Weld **N8A-NV** Jet Pump Instrumentation Nozzle to Shell Weld

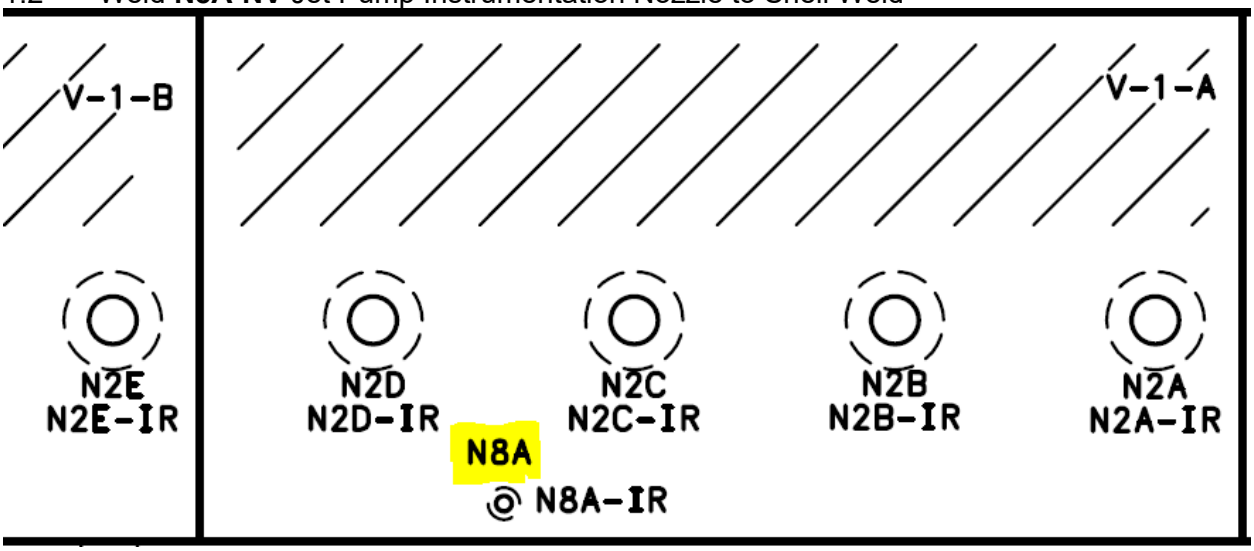


Figure 1.2-1 Weld **N8A-NV** (Extracted from Reference Drawing 2-CHM-2046-C-01)

This weld was UT examined in the fourth 10-Year ISI Interval, first period, during the U2R17 refueling outage in 2013. The NDE data can be found on UT Report No. UT-13-069. The required examination volume was based on Code Case N-613-1 Figure 1, exam volume A-B-C-D-E-F-G-H. The UT examination was limited based on the nozzle and weld configuration which resulted in a total UT coverage 84.2% as described in Table 1.2-1 and combined with Figure 1.2-2 thru 1.2-3.

The blend radius of the weld restricts the scanning movement and/or transducer contact. The areas receiving little, or no examination coverage are located toward the outside surface of the reactor vessel in the general area of the nozzle outside blend radius. Degradation if present at the inside surface or inner 15% would have been located.

UT examination of the subject areas to the maximum extent practical due to the design of the weld joints provides an acceptable level of quality and safety. Because the inner 15% thickness was fully examined for nozzle to vessel welds, any significant degradation, if present, would have been detected during these UT examinations. As a result, reasonable assurance of operational readiness of the subject welds has been provided.

A review of the plant's corrective action program did not note any failures at this weld. Previous examination data from the U2R12, UT R-165 report were reviewed for the UT examination. No recordable indications were noted.

Section XI, Mandatory Appendix I, I-2110 implements the Appendix VIII, Performance Demonstration Program, for this ultrasonic examination.

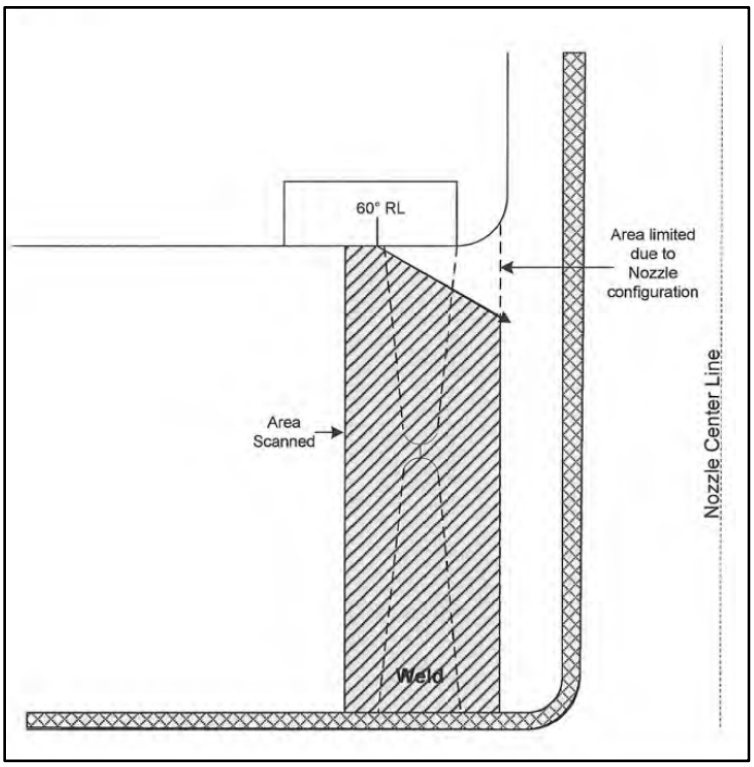


Figure 1.2-2 Weld **N8A-NV**, Radial Scan Examination Coverage

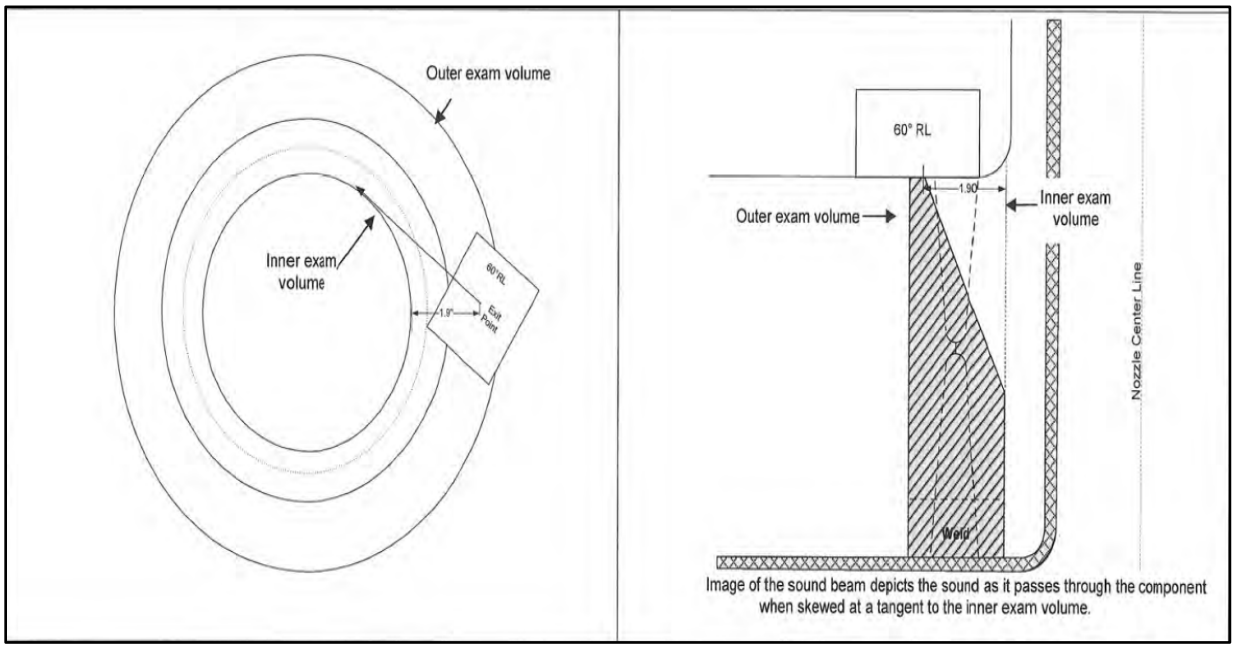


Figure 1.2-3 Weld **N8A-NV**, Tangential Scans Examination Coverage

Table 1.2-1 Weld **N8A-NV**, Scan Coverage and Scan Summary

	Radial Scans	**Tangential Scans**		
	100% Thickness	**Inner 15% (Note 1)**	**Outer 85%**	**Sub-Totals "Tangential"**
Required Exam Area (in^2) (Note 2)	14.0	2.1	11.9	14.0
Exam Area Achieved (in^2) (Note 2)	13.0	2.1	8.4	10.5
% Coverage Achieved	**(A) 92.9%**	100%	60.5%	**(B) 75.5%**
TOTAL Coverage Claimed	**(A + B)/2 = (92.9%+75.5%)/2=84.2%**			

Note:
1) The Jet Pump Instrumentation Nozzle-to-Shell weld, N8A-NV, was scanned using the requirements of EPRI Modeling Report IR-2003-19. The area scanned was expanded beyond the maximum R-value of the modeling report IR-2003-19.
2) Examination data reported required and scanned areas versus exam volume. Limitations observed in the circumferential directions were consistent 360° around the nozzle.

Wave Modes Used = 60° RL and 50° Shear

1.3 Weld **N1A-NV** Reactor Water Recirculation Outlet Nozzle to Shell Weld

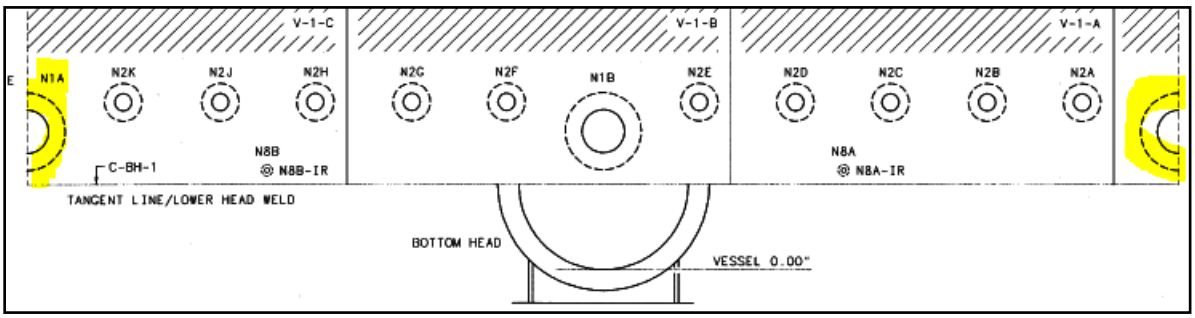


Figure 1.3-1 Weld **N1A-NV** (Extracted from Reference Drawing 2-CHM-2046-C-01)

This weld was UT examined in the fourth 10-Year ISI Interval, first period, during the U2R17 refueling outage in 2013. The NDE data may be found on UT Report No. UT-13-050. The required examination volume was based on Code Case N-613-1 Figure 1, exam volume A-B-C-D-E-F-G-H. The UT examination was limited based the nozzle and weld configuration which resulted in total UT coverage of 24.5% as described in Table 1.3-1 and combined with Figures 1.3-2 thru 1.3-3.

The blend radius of the weld restricts the scanning movement and/or transducer contact. The areas receiving little, or no examination coverage are located toward the outside surface of the reactor vessel in the general area of the nozzle outside blend radius. Degradation if present at the inside surface or inner 15% would have been located.

UT examination of the subject areas to the maximum extent practical due to the design of the weld joints provides an acceptable level of quality and safety. Because the inner 15% thickness was fully examined for nozzle to vessel welds, any significant degradation, if present, would have been detected during these UT examinations. As a result, reasonable assurance of operational readiness of the subject welds has been provided.

A review of the plant's corrective action program did not note any failures at this weld. Previous examination data from the U2R12, R-160 report were reviewed for the UT examination. No recordable indications were noted.

Section XI, Mandatory Appendix I, I-2110 implements the Appendix VIII, Performance Demonstration Program, for this ultrasonic examination.

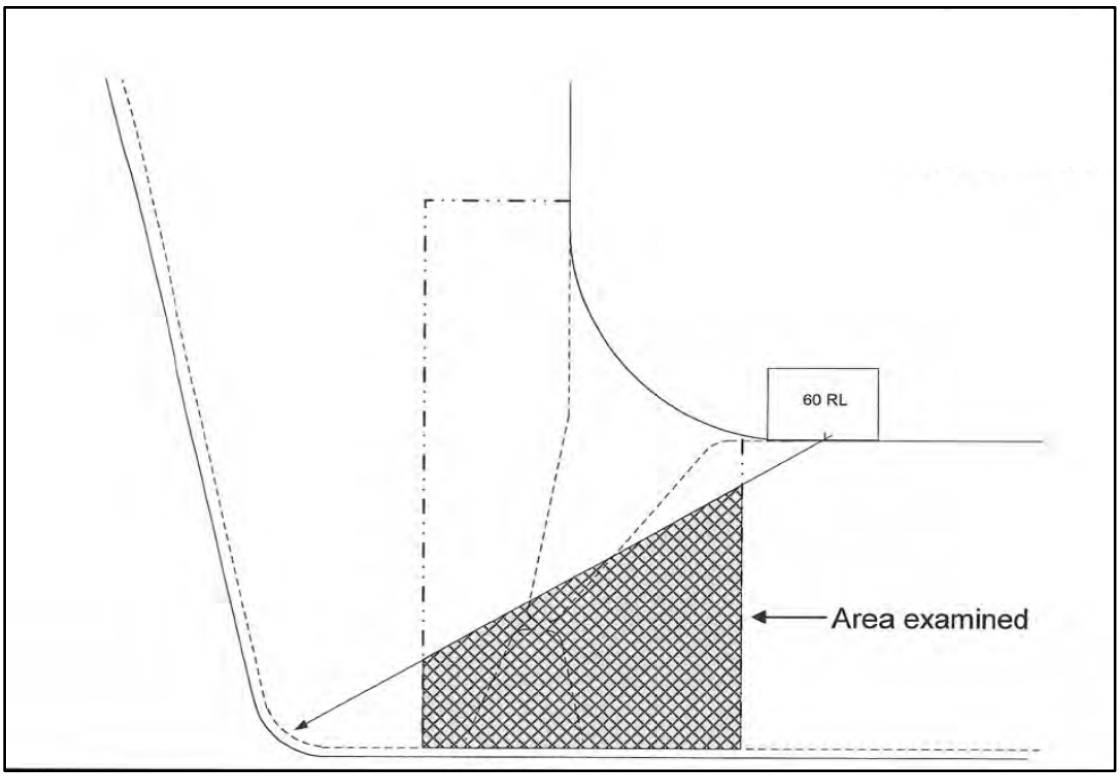


Figure 1.3-2 Weld **N1A-NV**, Radial Scan Examination Coverage

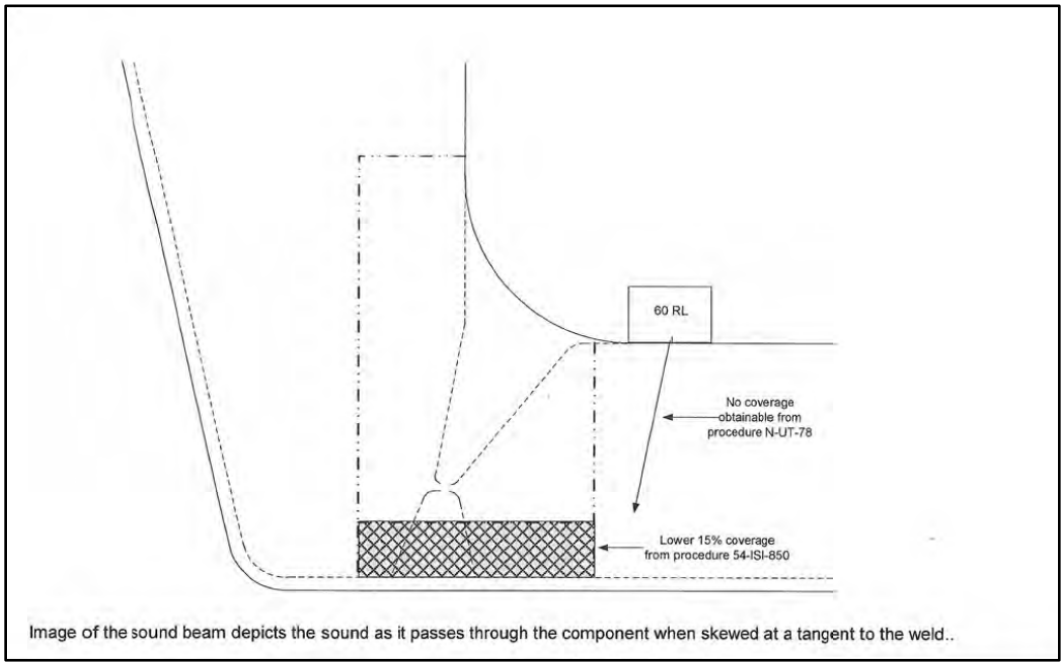


Figure 1.3-3 Weld **N1A-NV**, Tangential Scan Examination Coverage

Table 1.3-1 Weld **N1A-NV**, Scan Coverage and Scan Summary

	Radial Scans	**Tangential Scans**		
	100% Thickness	**Inner 15% (Note 1)**	**Outer 85%**	**Sub-Totals "Tangential"**
Required Exam Volume (in^2) (Note 2)	60.7	6.2	54.5	60.7
Exam Volume Achieved (in^2) (Note 2)	23.6	6.2	0	6.2
% Coverage Achieved	**(A) 38.9%**	100%	0%	**(B) 10.2%**
TOTAL Coverage Claimed	**(A + B)/2 = (38.9%+10.2%)/2 = 24.5%**			

Note:
1) The Jet Pump Instrumentation Nozzle-to-Shell weld, N1A-NV, was scanned using the requirements of EPRI Modeling Report IR-2007-266.
2) Examination data reported required and scanned areas versus exam volume. Limitations observed in the circumferential directions were consistent 360° around the nozzle.

Wave Modes used: 60° RL and 43° Shear

1.4 Weld **N4A-NV** Reactor Feedwater Nozzle to Shell Weld

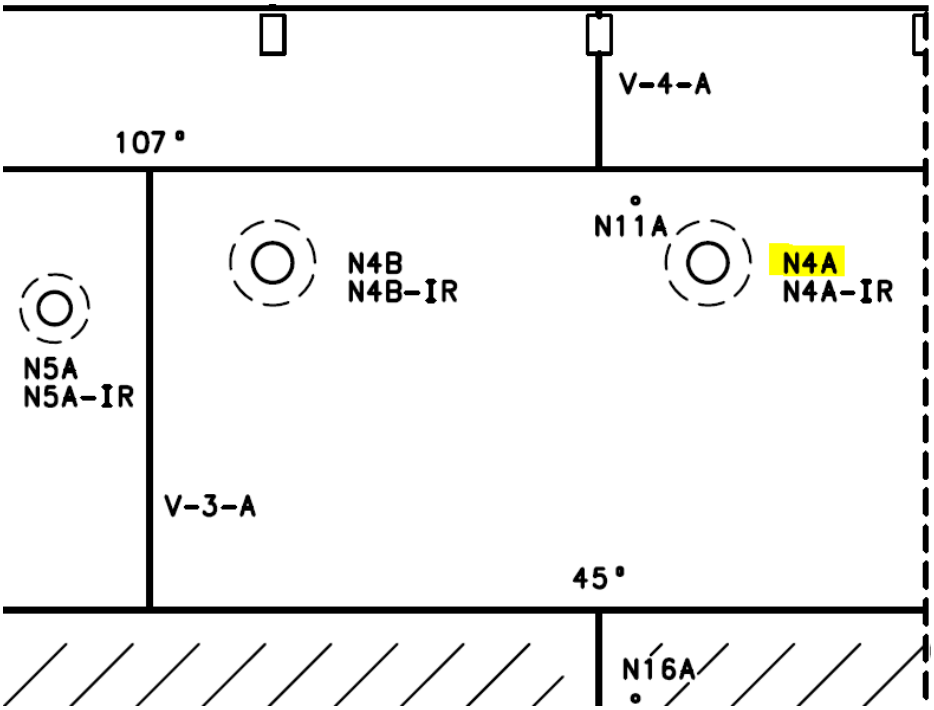


Figure 1.4-1 Weld **N4A-NV** (Extracted from Reference Drawing 2-CHM-2046-C-01)

This weld was UT examined in the fourth 10-Year ISI Interval, first period, during the U2R17 refueling outage in 2013. The NDE data can be found on UT Report No. UT-13-051. The required examination volume was based on Code Case N-613-1 Figure 1, exam volume A-B-C-D-E-F-G-H. The UT examination was limited based on the nozzle to weld configuration and from the intersecting circumferential weld C-3-4 which resulted in a total UT coverage of 29.9% as described in Table 1.4-1 and combined with Figures 1.4-2 thru 1.4-4.

The blend radius of the weld restricts the scanning movement and/or transducer contact. The areas receiving little, or no examination coverage are located toward the outside surface of the reactor vessel in the general area of the nozzle outside blend radius. Degradation if present at the inside surface or inner 15% would have been located.

UT examination of the subject areas to the maximum extent practical due to the design of the weld joints provides an acceptable level of quality and safety. Because the inner 15% thickness was fully examined for nozzle to vessel welds, any significant degradation, if present, would have been detected during these UT examinations. As a result, reasonable assurance of operational readiness of the subject welds has been provided.

Tightly adhering paint was present on the examination surface and did not interfere with examination. Tangential Scans were performed utilizing skews to maximize coverage.

A review of the plant's corrective action program did not note any failures at this weld. Previous examination data from the U2R12, UT R-141 report were reviewed for the UT examination. No recordable indications were noted.

Section XI, Mandatory Appendix I, I-2110 implements the Appendix VIII, Performance Demonstration Program, for this ultrasonic examination.

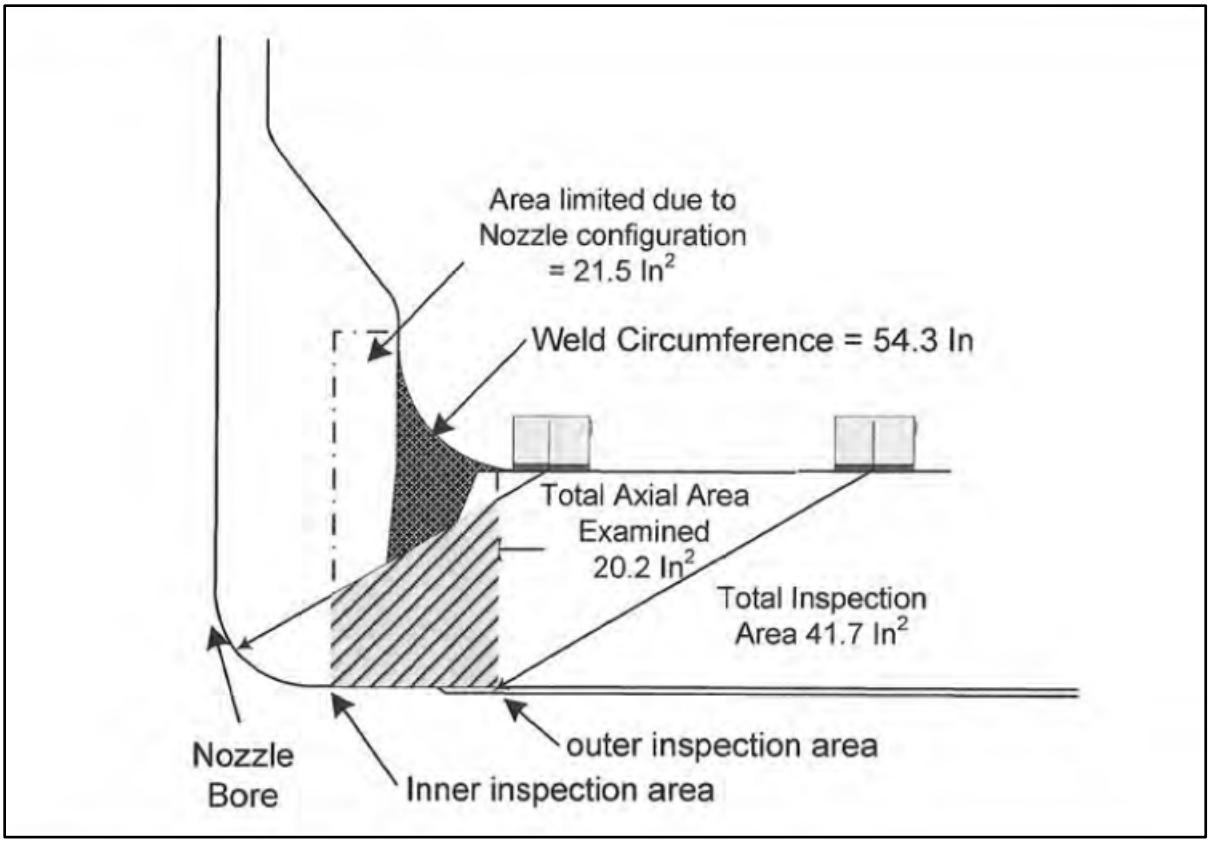


Figure 1.4-2 Weld **N4A-NV**, Radial Scan Examination Coverage

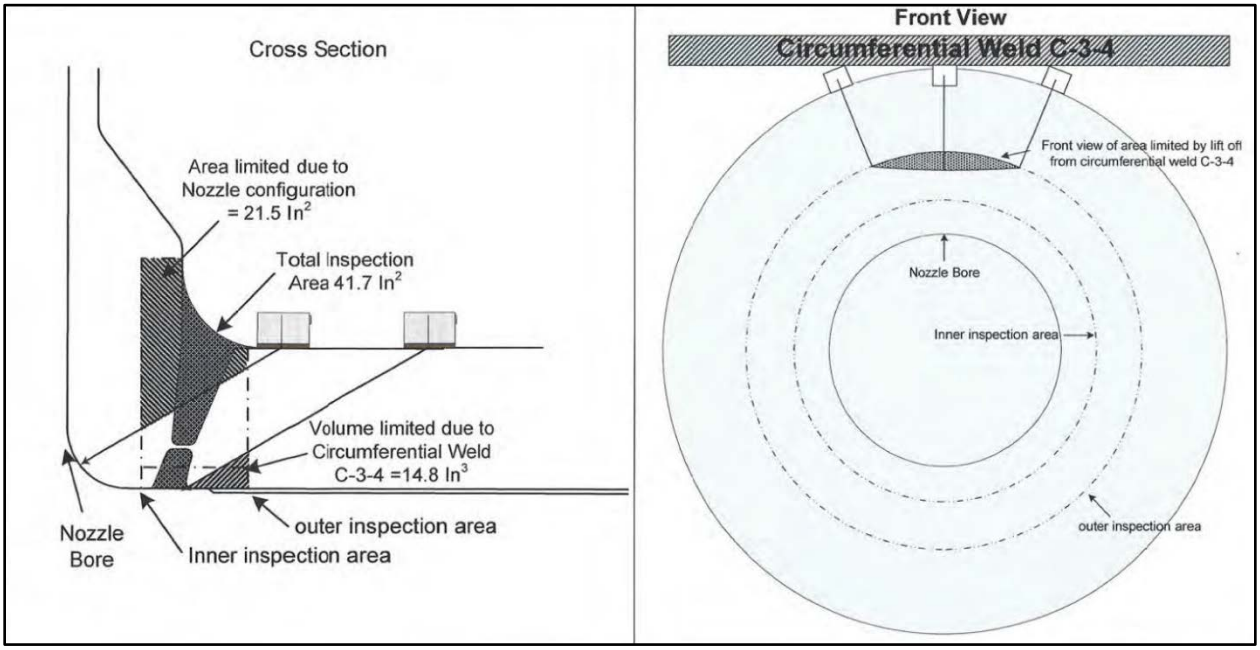


Figure 1.4-3 Weld **N4A-NV**, Radial Scan Examination Limitation from Circumferential Weld C-3-4

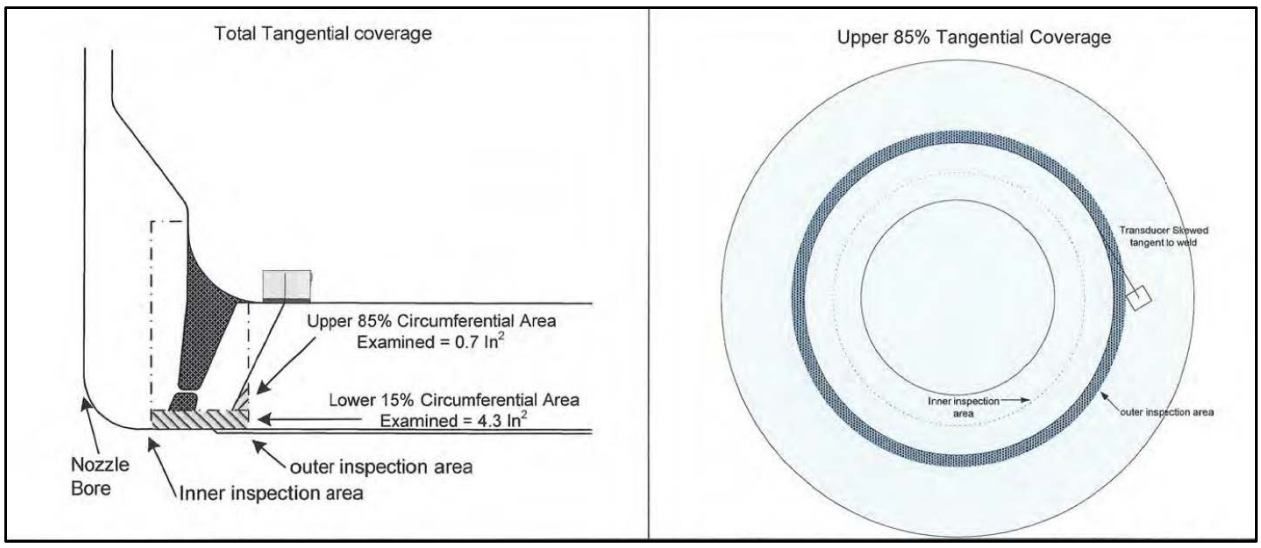


Figure 1.4-4 Weld **N4A-NV**, Tangential Scan Examination Coverage

Table 1.4-1 Weld **N4A-NV**, Scan Coverage and Scan Summary

	Radial Scans	**Tangential Scans**		
	100% Thickness	**Inner 15% (Note 1)**	**Outer 85%**	**Sub-Totals "Tangential"**
Required Exam Volume (Note 2) (Note 3)	2264.3 in^3	4.3 in^2	37.4 in^2	41.7 in^2
Exam Volume Achieved	1082.0 in^3	4.3 in^2	0.7 in^2	5.0 in^2
% Coverage Achieved	**(A) 47.8%**	100%	1.9%	**(B) 12.0%**
TOTAL Coverage Claimed	***(A + B)/2 = (47.8% +12.0%)/2 = 29.9%***			

Note:
1) Feedwater Nozzle-to-Shell weld, N4A-NV, was scanned using the requirements of EPRI Modeling Report IR-2003-19.
2) Examination data reported in square area for required and scanned areas versus exam volume for Tangential scans. Limitations observed in the circumferential directions were consistent 360° around the nozzle.
3) Examination data reported in cubic inches for required and scanned volumes for Radial Scans. Limitations in the circumferential directions from Weld C-3-4.

Wave Modes used: 60°RL and 40° & 60° Shear

1.5 Weld **N4B-NV** Reactor Feedwater Nozzle to Shell Weld

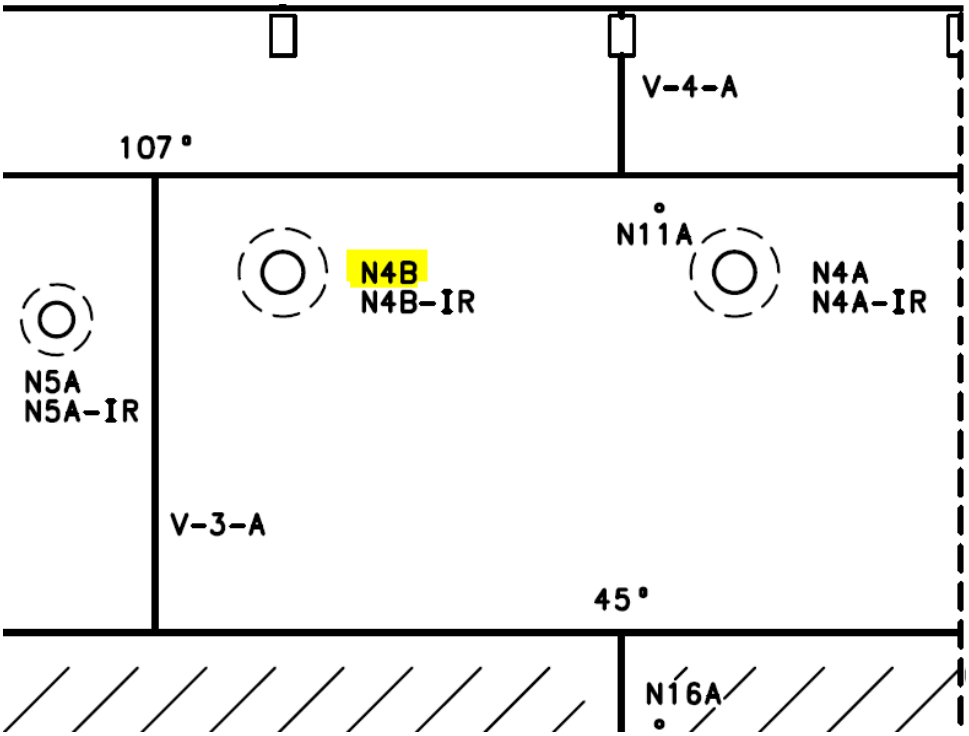


Figure 1.5-1 Weld **N4B-NV** (Extracted from Reference Drawing 2-CHM-2046-C-01)

This weld was UT examined in the fourth 10-Year ISI Interval, first period, during the U2R17 refueling outage in 2013. The NDE data can be found on UT Report No. UT-13-054. The required examination volume was based on Code Case N-613-1 Figure 1, exam volume A-B-C-D-E-F-G-H. The UT examination was limited based on the configuration resulting in total UT coverage 29.9% as described in Table 1.5-1 and combined with Figures 1.5-2 thru 1.5-4.

The blend radius of the weld restricts the scanning movement and/or transducer contact. The areas receiving little, or no examination coverage are located toward the outside surface of the reactor vessel in the general area of the nozzle outside blend radius. Degradation if present at the inside surface or inner 15% would have been located.

UT examination of the subject areas to the maximum extent practical due to the design of the weld joints provides an acceptable level of quality and safety. Because the inner 15% thickness was fully examined for nozzle to vessel welds, any significant degradation, if present, would have been detected during these UT examinations. As a result, reasonable assurance of operational readiness of the subject welds has been provided.

Tightly adhering paint was present on the examination surface and did not interfere with examination. Tangential Scans were performed utilizing skews to maximize coverage.

A review of the plant's corrective action program did not note any failures at this weld. Previous examination data from the U2R12, UT R-142 report were reviewed for the UT examination. No recordable indications were noted.

Section XI, Mandatory Appendix I, I-2110 implements the Appendix VIII, Performance Demonstration Program, for this ultrasonic examination.

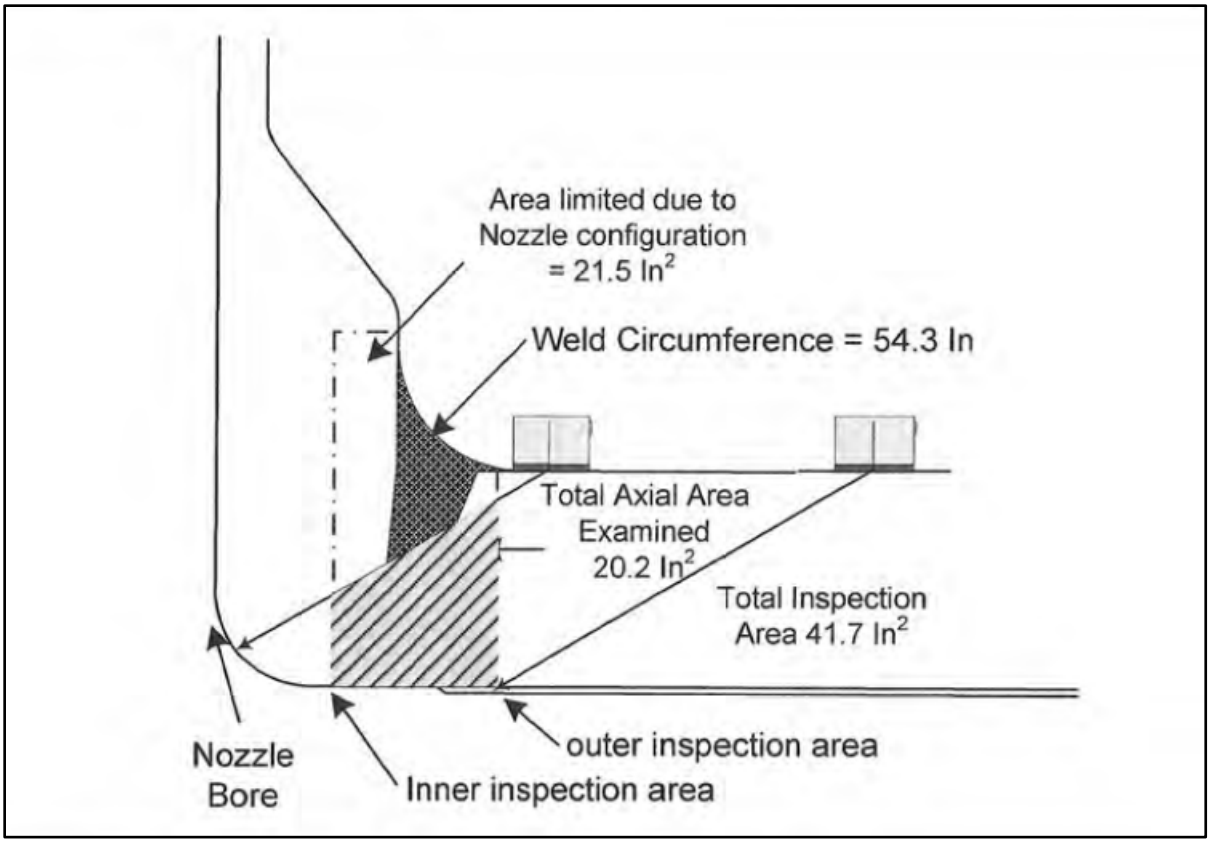


Figure 1.5-2 Weld **N4B-NV**, Radial Scan Examination Coverage

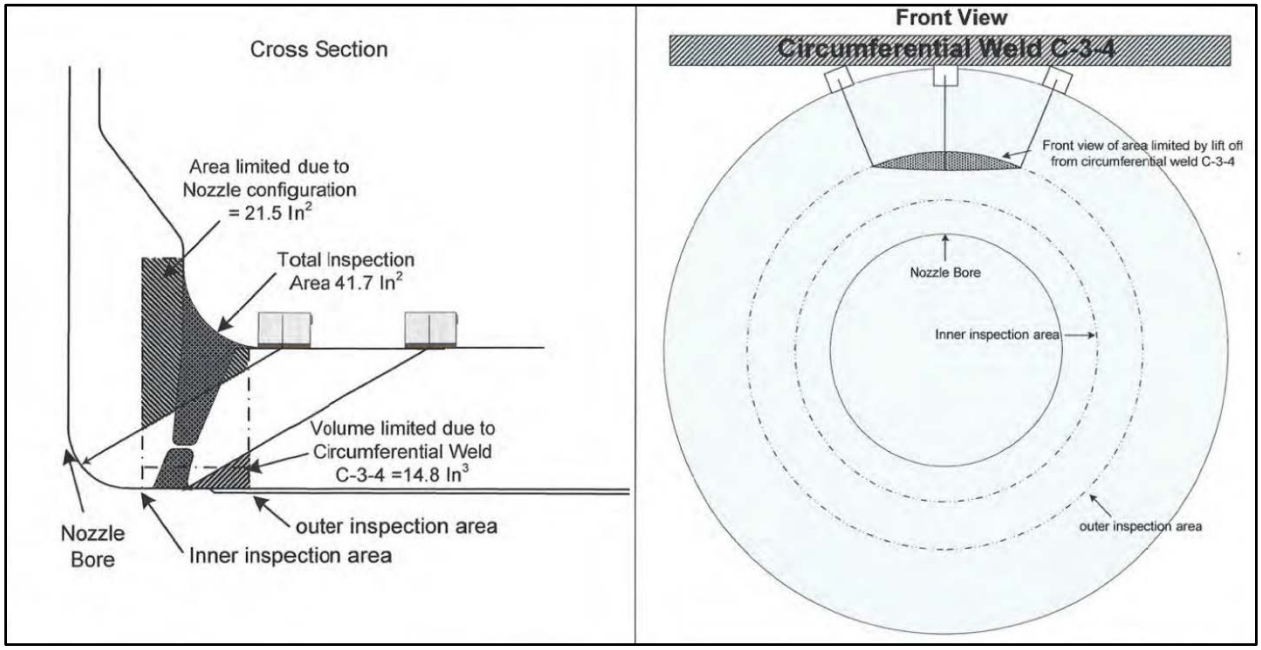


Figure 1.5-3 Weld **N4B-NV**, Radial Scan Examination Limitation from Circumferential Weld C-3-4

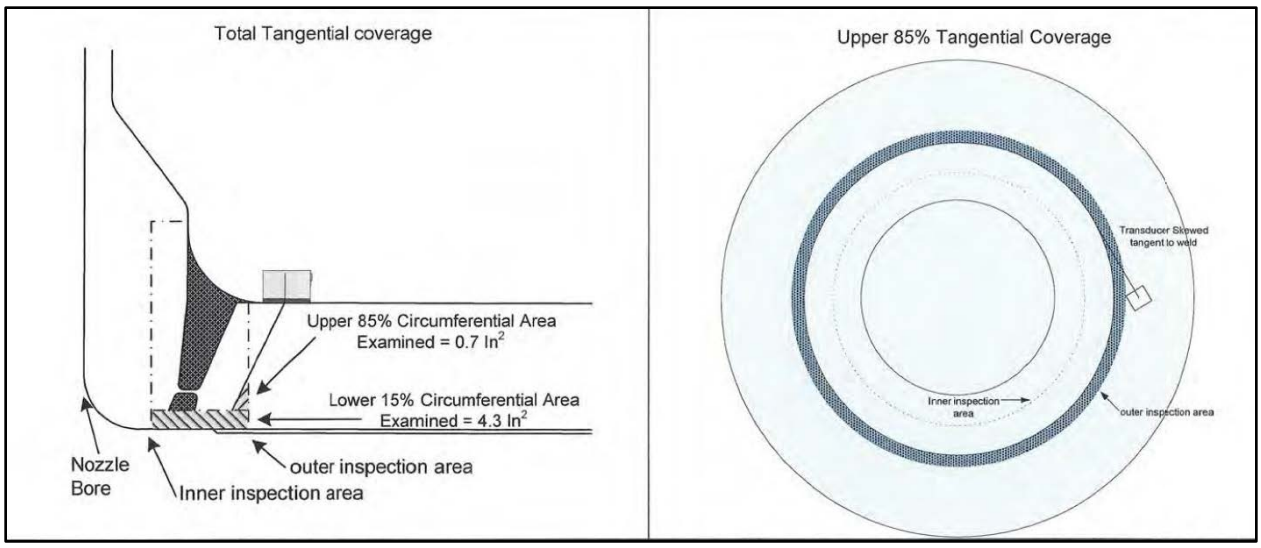


Figure 1.5-4 Weld **N4B-NV**, Tangential Scan Examination Coverage

Table 1.5-1 Weld **N4B-NV**, Scan Coverage and Scan Summary

	Radial Scans	**Tangential Scans**		
	100% Thickness	**Inner 15% (Note 1)**	**Outer 85%**	**Sub-Totals "Tangential"**
Required Exam Volume (Note 2) (Note 3)	2264.3 in^3	4.3 in^2	37.4 in^2	41.7 in^2
Exam Volume Achieved	1082.0 in^3	4.3 in^2	0.7 in^2	5.0 in^2
% Coverage Achieved	**(A) 47.8%**	100%	1.9%	**(B) 12.0%**
TOTAL Coverage Claimed	***(A + B)/2 = (47.8% +12.0%)/2 = 29.9%***			

Note:
1) Feedwater Nozzle-to-Shell weld, N4B-NV, was scanned using the requirements of EPRI Modeling Report IR-2003-19.
2) Examination data reported in square area for required and scanned areas versus exam volume for Tangential scans. Limitations observed in the circumferential directions were consistent 360° around the nozzle.
3) Examination data reported in cubic inches for required and scanned volumes for Radial Scans. Limitations in the circumferential directions from Weld C-3-4.

Wave Modes used: 60°RL and 40° & 60° Shear

1.6 Weld **N4C-NV** Reactor Feedwater Nozzle to Shell Weld

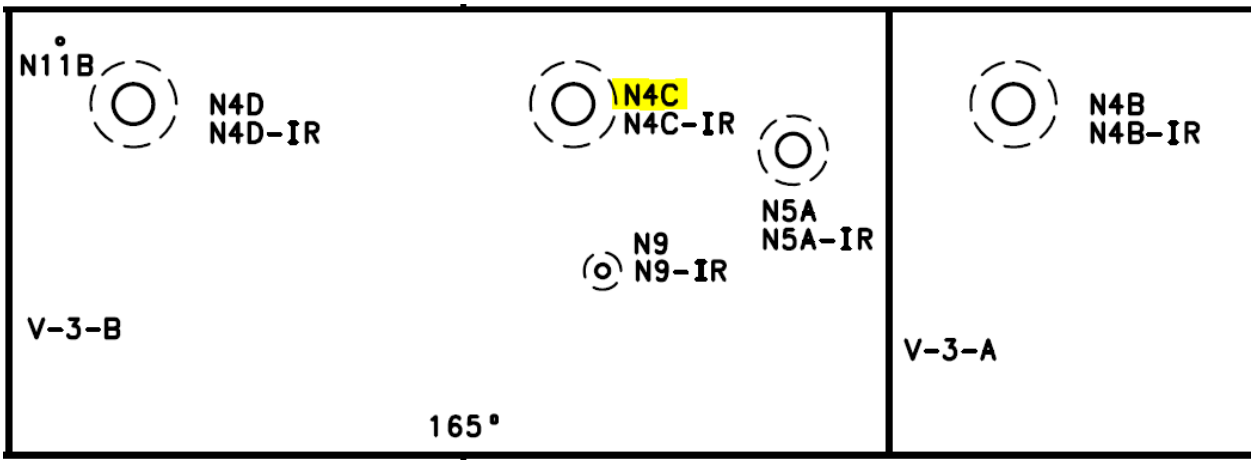


Figure 1.6-1 Weld **N4C-NV** (Extracted from Reference Drawing 2-CHM-2046-C-01)

This weld was UT examined in the fourth 10-Year ISI Interval, first period, during the U2R17 refueling outage in 2013. The NDE data can be found on UT Report No. UT-13-057. The required examination volume was based on Code Case N-613-1 Figure 1, exam volume A-B-C-D-E-F-G-H. The UT examination was limited based on the configuration resulting in total UT coverage 29.9% as described in Table 1.6-1 and combined with Figures 1.6-2 thru 1.6-4.

The blend radius of the weld restricts the scanning movement and/or transducer contact. The areas receiving little, or no examination coverage are located toward the outside surface of the reactor vessel in the general area of the nozzle outside blend radius. Degradation if present at the inside surface or inner 15% would have been located.

UT examination of the subject areas to the maximum extent practical due to the design of the weld joints provides an acceptable level of quality and safety. Because the inner 15% thickness was fully examined for nozzle to vessel welds, any significant degradation, if present, would have been detected during these UT examinations. As a result, reasonable assurance of operational readiness of the subject welds has been provided.

Tightly adhering paint was present on the examination surface and did not interfere with examination. Tangential Scans were performed utilizing skews to maximize coverage.

A review of the plant's corrective action program did not note any failures at this weld. Previous examination data from the U2R12, UT R-143 report were reviewed for the UT examination. No recordable indications were noted.

Section XI, Mandatory Appendix I, I-2110 implements the Appendix VIII, Performance Demonstration Program, for this ultrasonic examination.

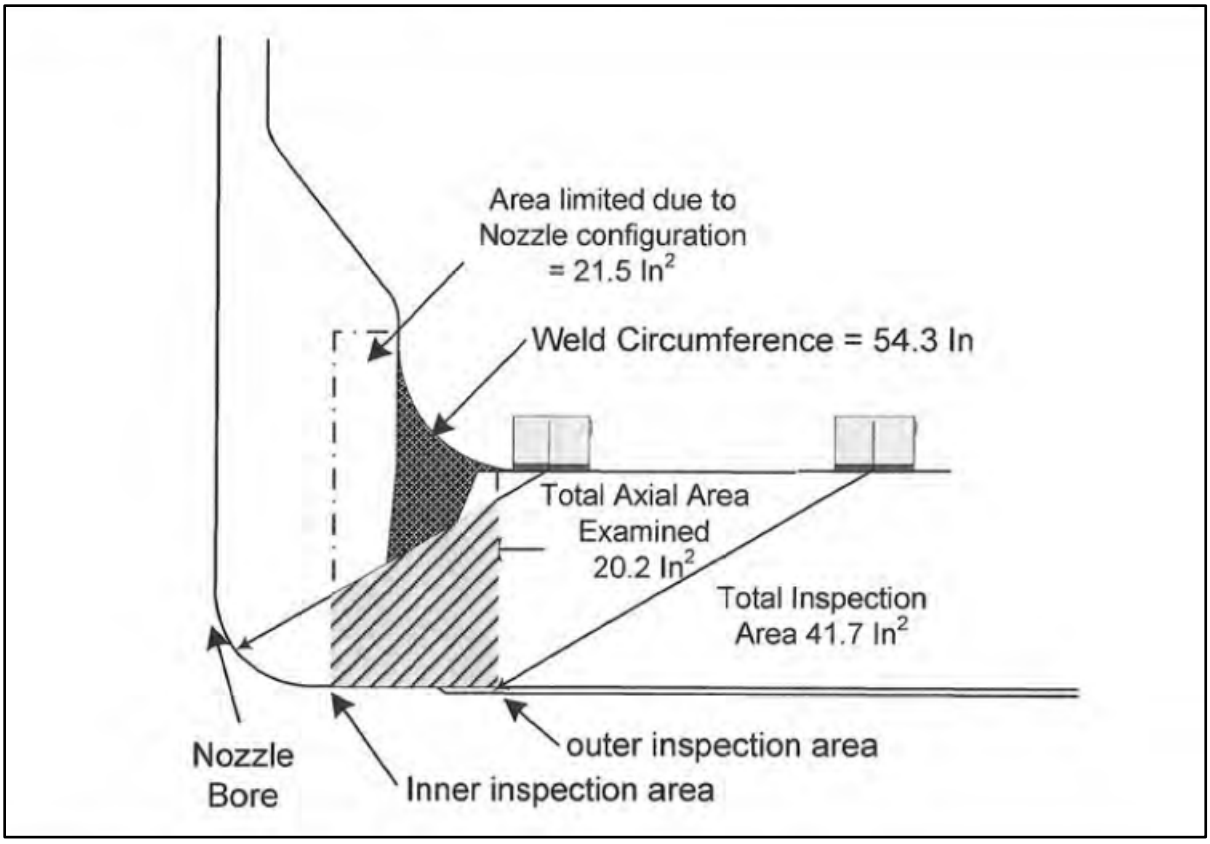


Figure 1.6-2 Weld **N4C-NV**, Radial Scan Examination Coverage

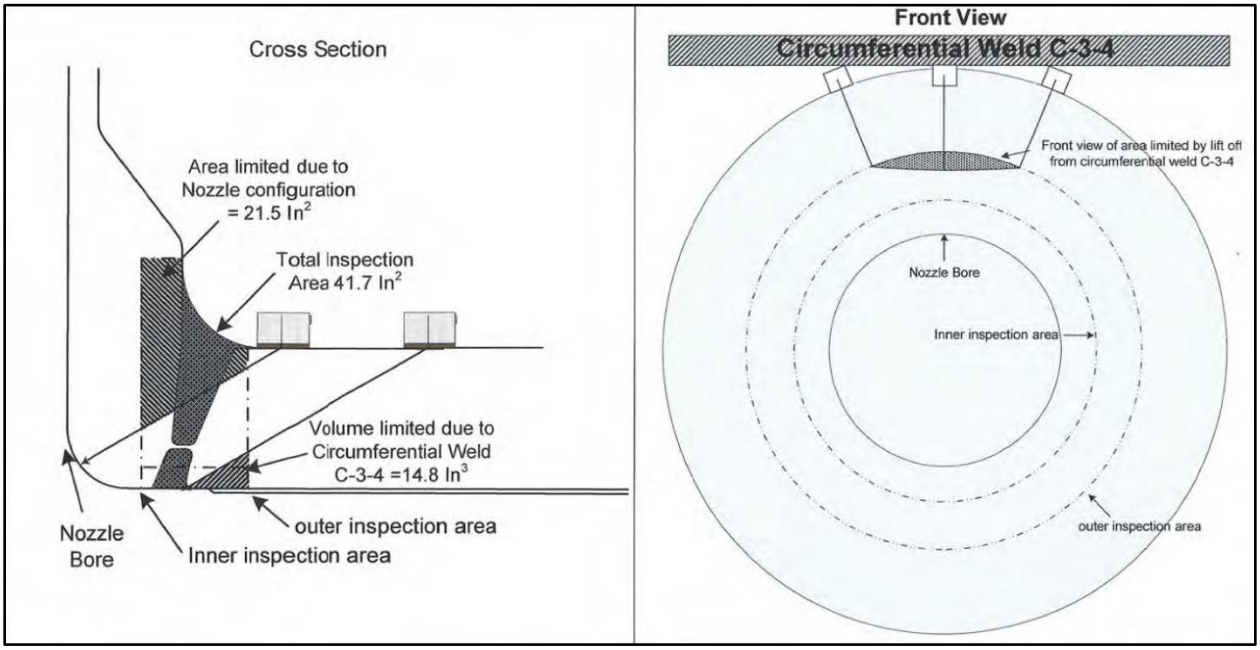


Figure 1.6-3 Weld **N4C-NV**, Radial Scan Examination Limitation from Circumferential Weld C-3-4

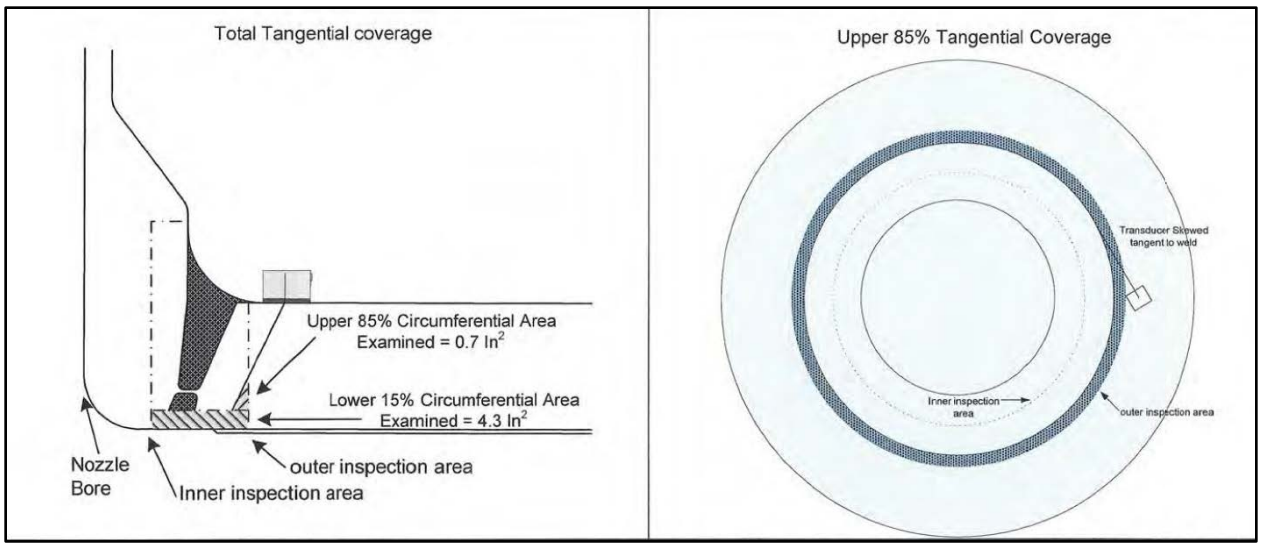


Figure 1.6-4 Weld **N4C-NV**, Tangential Scan Examination Coverage

Table 1.6-1 Weld **N4C-NV**, Scan Coverage and Scan Summary

	Radial Scans	**Tangential Scans**		
	100% Thickness	**Inner 15% (Note 1)**	**Outer 85%**	**Sub-Totals "Tangential"**
Required Exam Volume (Note 2) (Note 3)	2264.3 in^3	4.3 in^2	37.4 in^2	41.7 in^2
Exam Volume Achieved	1082.0 in^3	4.3 in^2	0.7 in^2	5.0 in^2
% Coverage Achieved	**(A) 47.8%**	100%	1.9%	**(B) 12.0%**
TOTAL Coverage Claimed	**(A + B)/2 = (47.8% +12.0%)/2 = 29.9%**			

Note:
1) Feedwater Nozzle-to-Shell weld, N4C-NV, was scanned using the requirements of EPRI Modeling Report IR-2003-19.
2) Examination data reported in square area for required and scanned areas versus exam volume for Tangential scans. Limitations observed in the circumferential directions were consistent 360° around the nozzle.
3) Examination data reported in cubic inches for required and scanned volumes for Radial Scans. Limitations in the circumferential directions from Weld C-3-4.

Wave Modes used: 60°RL and 40° & 60° Shear

1.7 Weld **N4D-NV** Reactor Feedwater Nozzle to Shell Weld

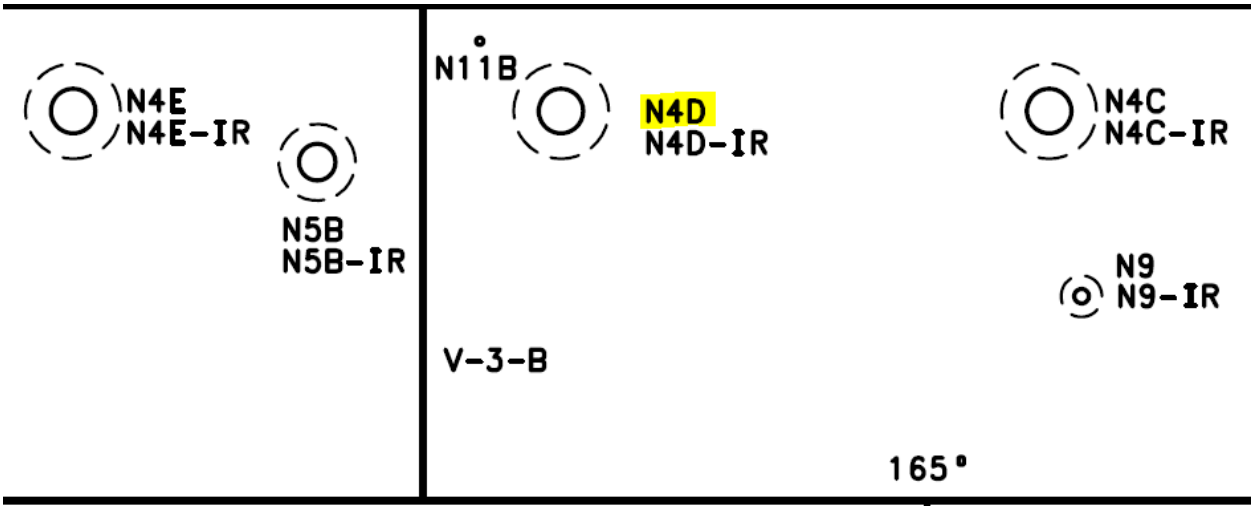


Figure 1.7-1 Weld **N4D-NV** (Extracted from Reference Drawing 2-CHM-2046-C-01)

This weld was UT examined in the fourth 10-Year ISI Interval, first period, during the U2R17 refueling outage in 2013. The NDE data can be found on UT Report No. UT-13-060. The required examination volume was based on Code Case N-613-1 Figure 1, exam volume A-B-C-D-E-F-G-H. The UT examination was limited based on the configuration resulting in total UT coverage 29.9% as described in Table 1.7-1 and combined with Figures 1.7-2 thru 1.7-4.

The blend radius of the weld restricts the scanning movement and/or transducer contact. The areas receiving little, or no examination coverage are located toward the outside surface of the reactor vessel in the general area of the nozzle outside blend radius. Degradation if present at the inside surface or inner 15% would have been located.

UT examination of the subject areas to the maximum extent practical due to the design of the weld joints provides an acceptable level of quality and safety. Because the inner 15% thickness was fully examined for nozzle to vessel welds, any significant degradation, if present, would have been detected during these UT examinations. As a result, reasonable assurance of operational readiness of the subject welds has been provided.

Tightly adhering paint was present on the examination surface and did not interfere with examination. Tangential Scans were performed utilizing skews to maximize coverage.

A review of the plant's corrective action program did not note any failures at this weld. Previous examination data from the U2R12, UT R-144 report were reviewed for the UT examination. No recordable indications were noted.

Section XI, Mandatory Appendix I, I-2110 implements the Appendix VIII, Performance Demonstration Program, for this ultrasonic examination.

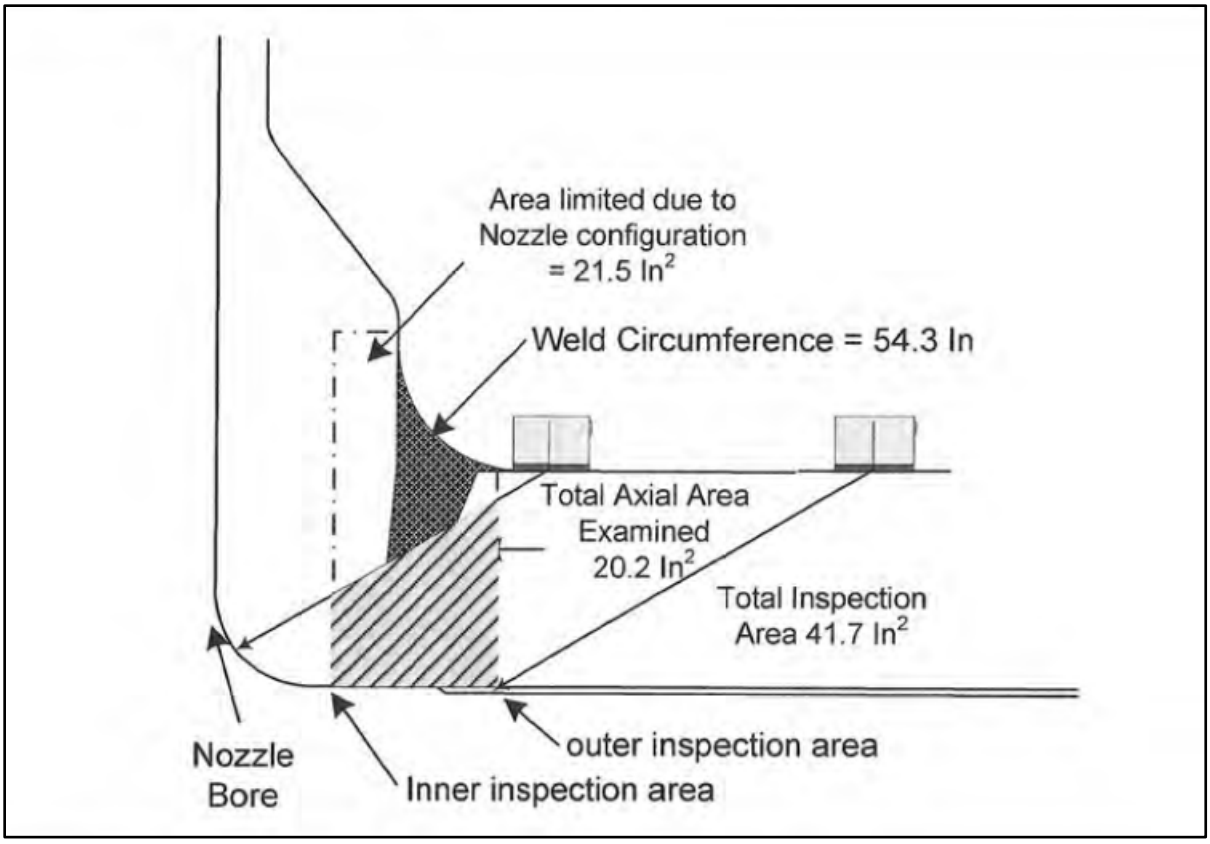


Figure 1.7-2 Weld **N4D-NV**, Radial Scan Examination Coverage

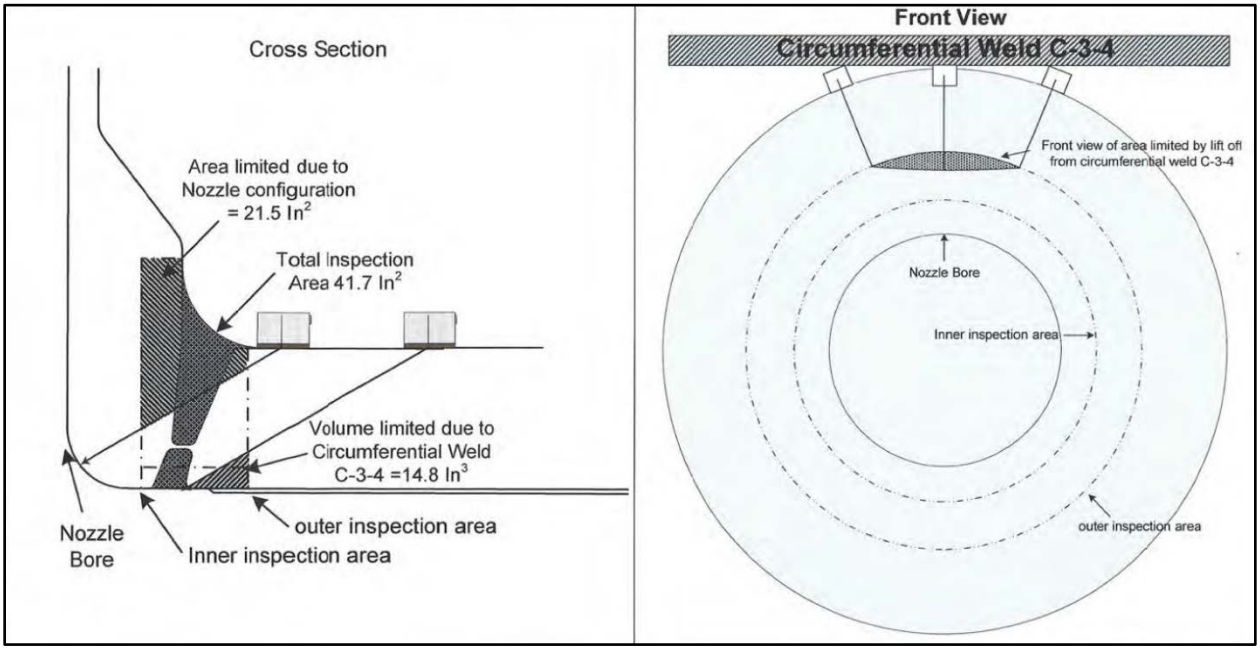


Figure 1.7-3 Weld **N4D-NV**, Radial Scan Examination Limitation from Circumferential Weld C-3-4

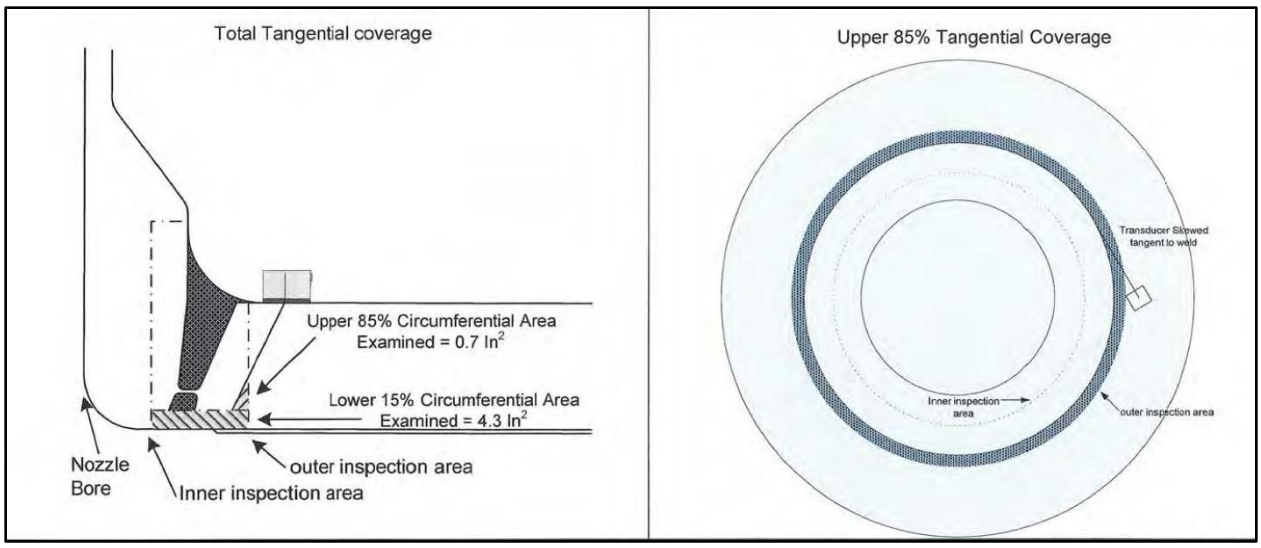


Figure 1.7-4 Weld **N4D-NV**, Tangential Scan Examination Coverage

Table 1.7-1 Weld **N4D-NV**, Scan Coverage and Scan Summary

	Radial Scans	**Tangential Scans**		
	100% Thickness	**Inner 15% (Note 1)**	**Outer 85%**	**Sub-Totals "Tangential"**
Required Exam Volume (Note 2) (Note 3)	2264.3 in^3	4.3 in^2	37.4 in^2	41.7 in^2
Exam Volume Achieved	1082.0 in^3	4.3 in^2	0.7 in^2	5.0 in^2
% Coverage Achieved	**(A) 47.8%**	100%	1.9%	**(B) 12.0%**
TOTAL Coverage Claimed	**(A + B)/2 = (47.8% +12.0%)/2 = 29.9%**			

Note:
1) Feedwater Nozzle-to-Shell weld, N4D-NV, was scanned using the requirements of EPRI Modeling Report IR-2003-19.
2) Examination data reported in square area for required and scanned areas versus exam volume for Tangential scans. Limitations observed in the circumferential directions were consistent 360° around the nozzle.
3) Examination data reported in cubic inches for required and scanned volumes for Radial Scans. Limitations in the circumferential directions from Weld C-3-4.

Wave Modes used: 60°RL and 40° & 60° Shear

1.8 Weld **N4E-NV** Reactor Feedwater Nozzle to Shell Weld

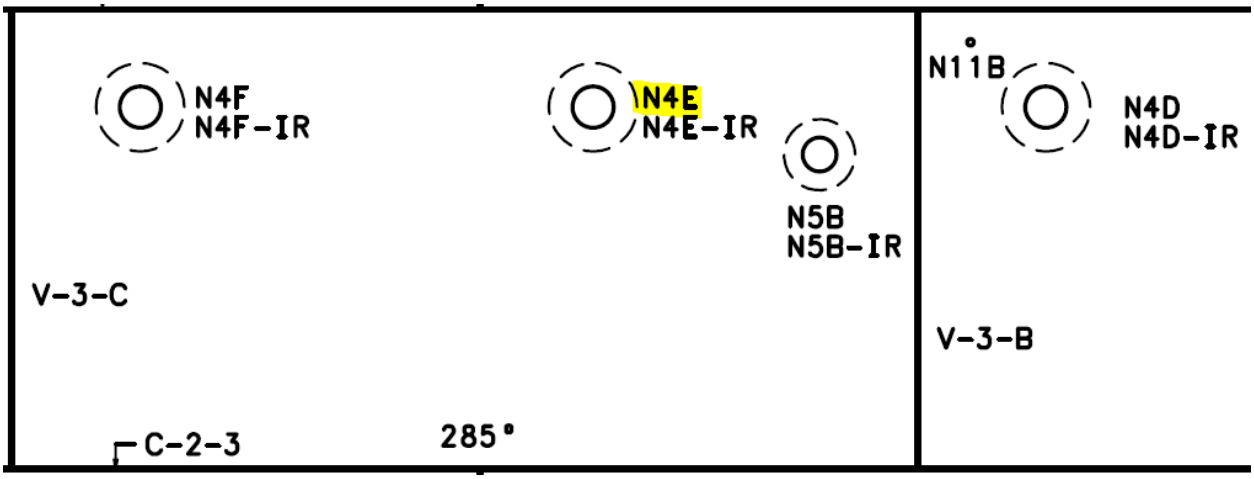


Figure 1.8-1 Weld **N4E-NV** (Extracted from Reference Drawing 2-CHM-2046-C-01)

This weld was UT examined in the fourth 10-Year ISI Interval, first period, during the U2R17 refueling outage in 2013. The NDE data can be found on UT Report No. UT-13-063. The required examination volume was based on Code Case N-613-1 Figure 1, exam volume A-B-C-D-E-F-G-H. The UT examination was limited based on the configuration resulting in total UT coverage 29.9% as described in Table 1.8-1 and combined with Figures 1.8-2 thru 1.8-4.

The blend radius of the weld restricts the scanning movement and/or transducer contact. The areas receiving little, or no examination coverage are located toward the outside surface of the reactor vessel in the general area of the nozzle outside blend radius. Degradation if present at the inside surface or inner 15% would have been located.

UT examination of the subject areas to the maximum extent practical due to the design of the weld joints provides an acceptable level of quality and safety. Because the inner 15% thickness was fully examined for nozzle to vessel welds, any significant degradation, if present, would have been detected during these UT examinations. As a result, reasonable assurance of operational readiness of the subject welds has been provided.

Tightly adhering paint was present on the examination surface and did not interfere with examination. Tangential Scans were performed utilizing skews to maximize coverage.

A review of the plant's corrective action program did not note any failures at this weld. Previous examination data from the U2R12, UT R-145 report were reviewed for the UT examination. No recordable indications were noted.

Section XI, Mandatory Appendix I, I-2110 implements the Appendix VIII, Performance Demonstration Program, for this ultrasonic examination.

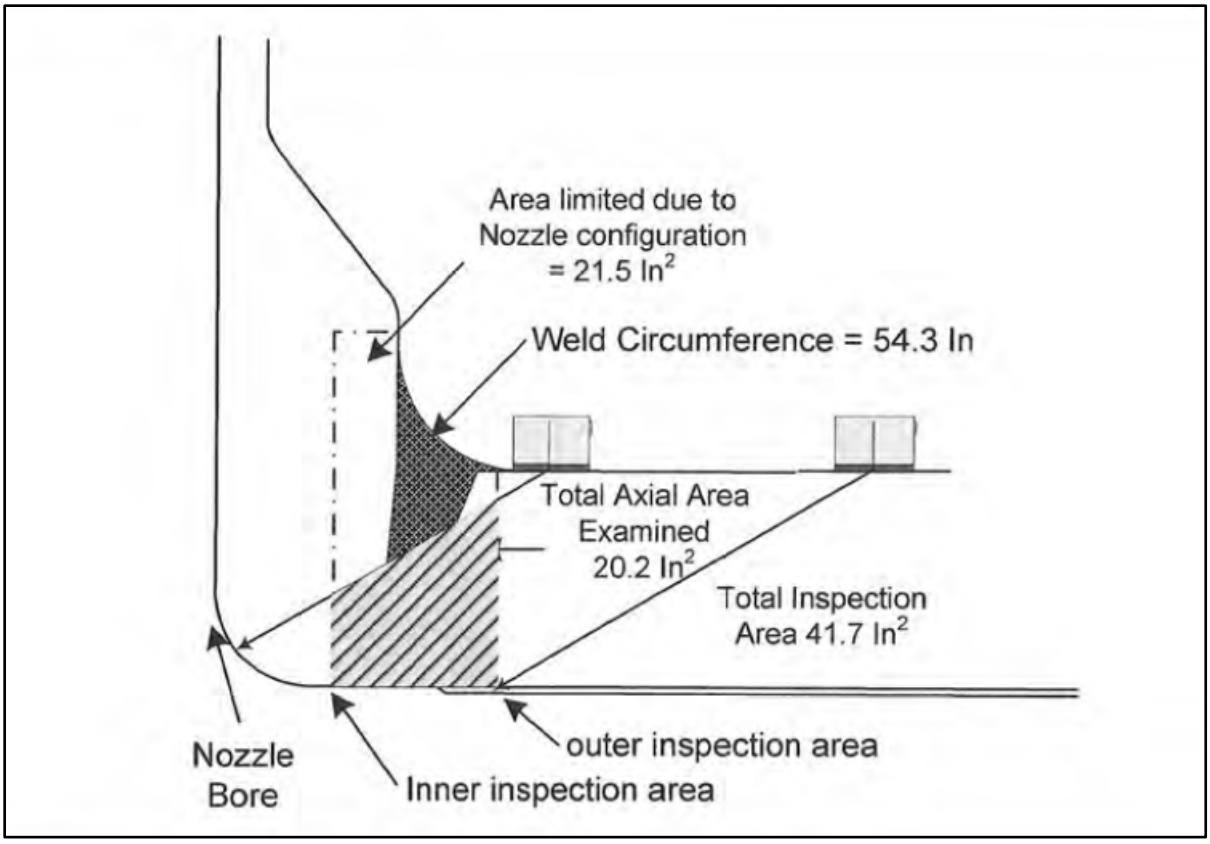


Figure 1.8-2 Weld **N4E-NV**, Radial Scan Examination Coverage

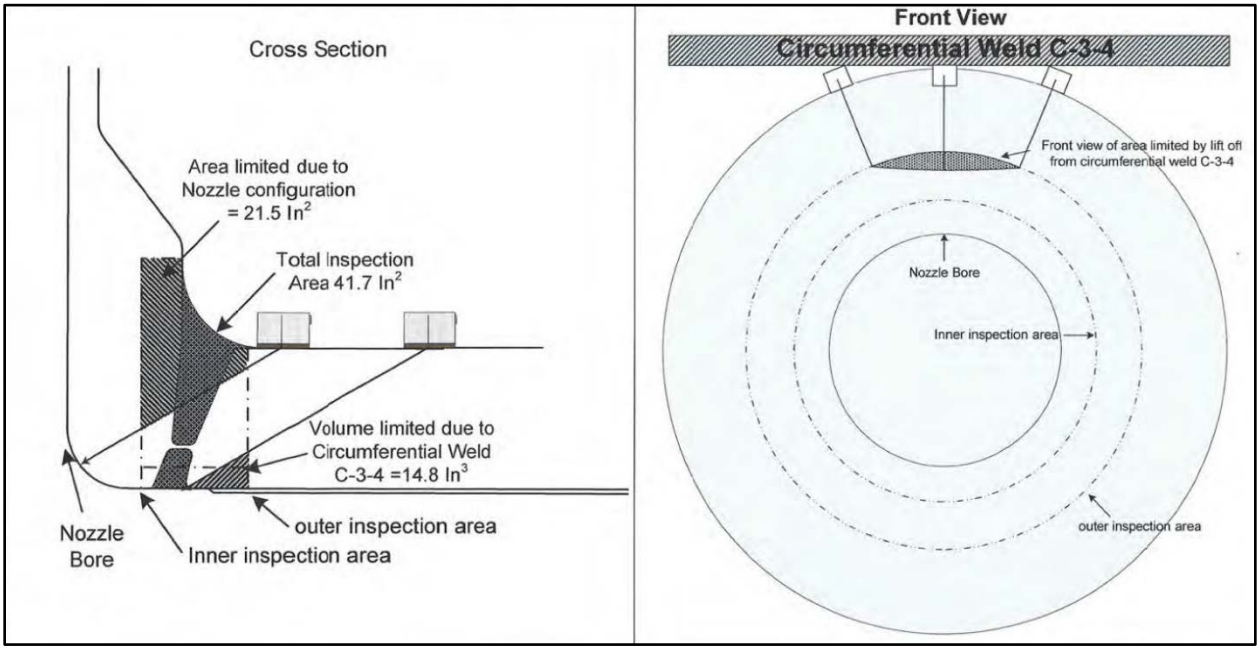


Figure 1.8-3 Weld **N4E-NV**, Radial Scan Examination Limitation from Circumferential Weld C-3-4

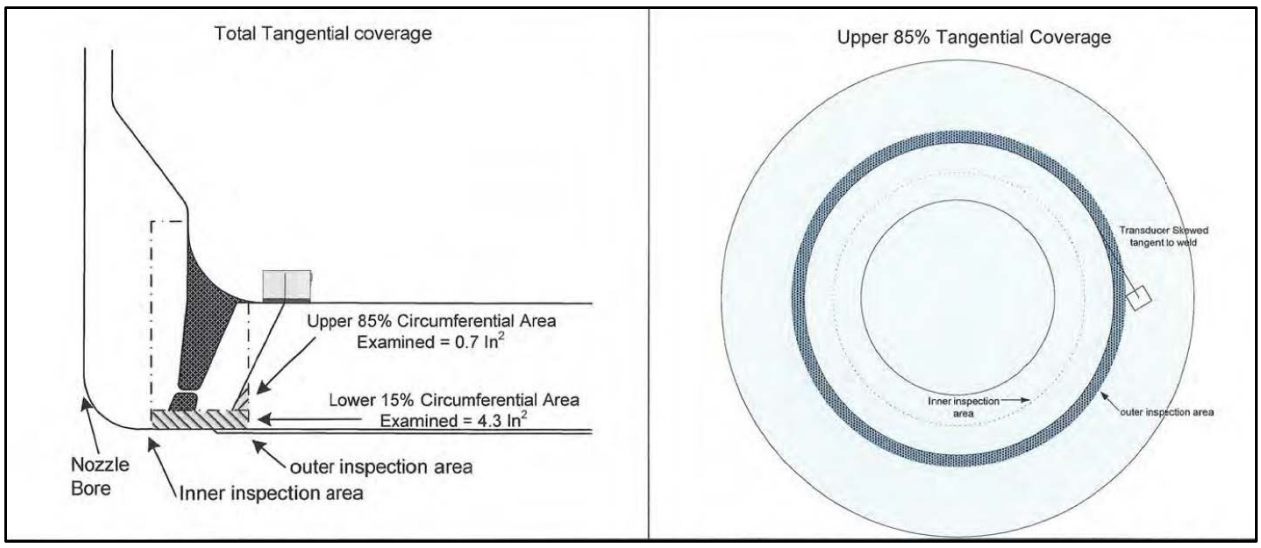


Figure 1.8-4 Weld **N4E-NV**, Tangential Scan Examination Coverage

Table 1.8-1 Weld **N4E-NV**, Scan Coverage and Scan Summary

	Radial Scans	**Tangential Scans**		
	100% Thickness	**Inner 15% (Note 1)**	**Outer 85%**	**Sub-Totals "Tangential"**
Required Exam Volume (Note 2) (Note 3)	2264.3 in^3	4.3 in^2	37.4 in^2	41.7 in^2
Exam Volume Achieved	1082.0 in^3	4.3 in^2	0.7 in^2	5.0 in^2
% Coverage Achieved	**(A) 47.8%**	100%	1.9%	**(B) 12.0%**
TOTAL Coverage Claimed	**(A + B)/2 = (47.8% +12.0%)/2 = 29.9%**			

Note:
1) Feedwater Nozzle-to-Shell weld, N4E-NV, was scanned using the requirements of EPRI Modeling Report IR-2003-19.
2) Examination data reported in square area for required and scanned areas versus exam volume for Tangential scans. Limitations observed in the circumferential directions were consistent 360° around the nozzle.
3) Examination data reported in cubic inches for required and scanned volumes for Radial Scans. Limitations in the circumferential directions from Weld C-3-4.

Wave Modes used: 60°RL and 40° & 60° Shear

1.9 Weld **N4F-NV** Reactor Feedwater Nozzle to Shell Weld

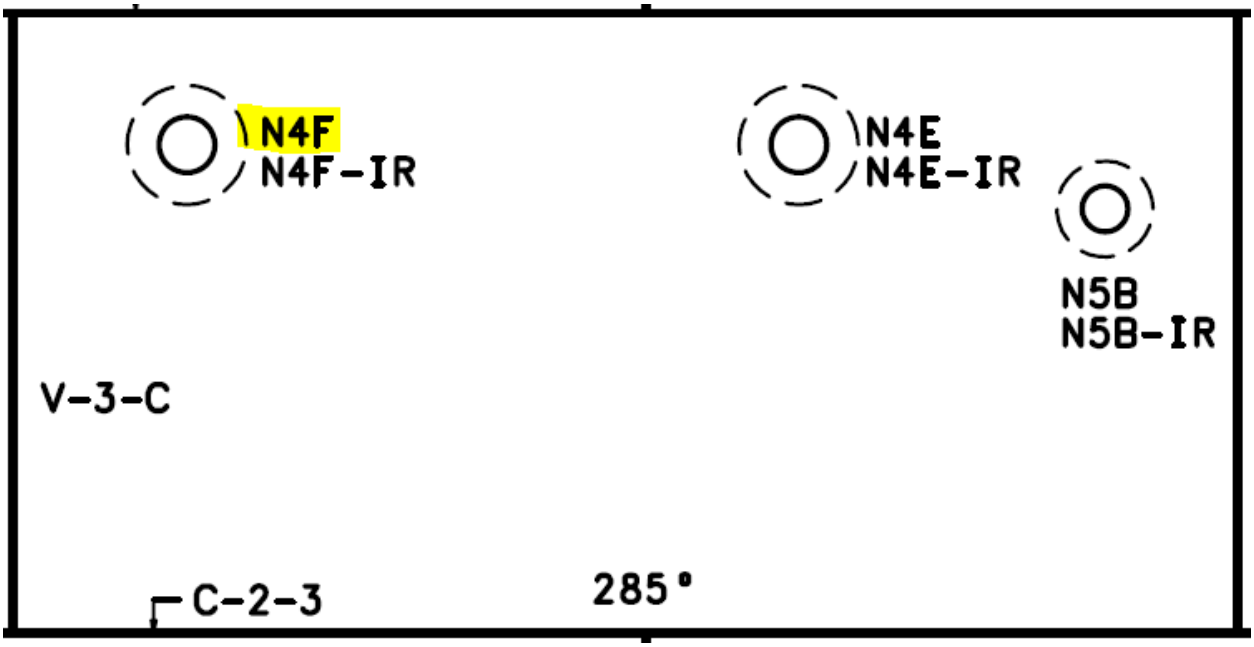


Figure 1.9-1 Weld **N4F-NV** (Extracted from Reference Drawing 2-CHM-2046-C-01)

This weld was UT examined in the fourth 10-Year ISI Interval, first period, during the U2R17 refueling outage in 2013. The NDE data can be found on UT Report No. UT-13-066. The required examination volume was based on Code Case N-613-1 Figure 1, exam volume A-B-C-D-E-F-G-H. The UT examination was limited based on the configuration resulting in total UT coverage 29.9% as described in Table 1.9-1 and combined with Figures 1.9-2 thru 1.9-4.

The blend radius of the weld restricts the scanning movement and/or transducer contact. The areas receiving little, or no examination coverage are located toward the outside surface of the reactor vessel in the general area of the nozzle outside blend radius. Degradation if present at the inside surface or inner 15% would have been located.

UT examination of the subject areas to the maximum extent practical due to the design of the weld joints provides an acceptable level of quality and safety. Because the inner 15% thickness was fully examined for nozzle to vessel welds, any significant degradation, if present, would have been detected during these UT examinations. As a result, reasonable assurance of operational readiness of the subject welds has been provided.

Tightly adhering paint was present on the examination surface and did not interfere with examination. Tangential Scans were performed utilizing skews to maximize coverage.

A review of the plant's corrective action program did not note any failures at this weld. Previous examination data from the U2R12, UT R-146 report were reviewed for the UT examination. No recordable indications were noted.

Section XI, Mandatory Appendix I, I-2110 implements the Appendix VIII, Performance Demonstration Program, for this ultrasonic examination.

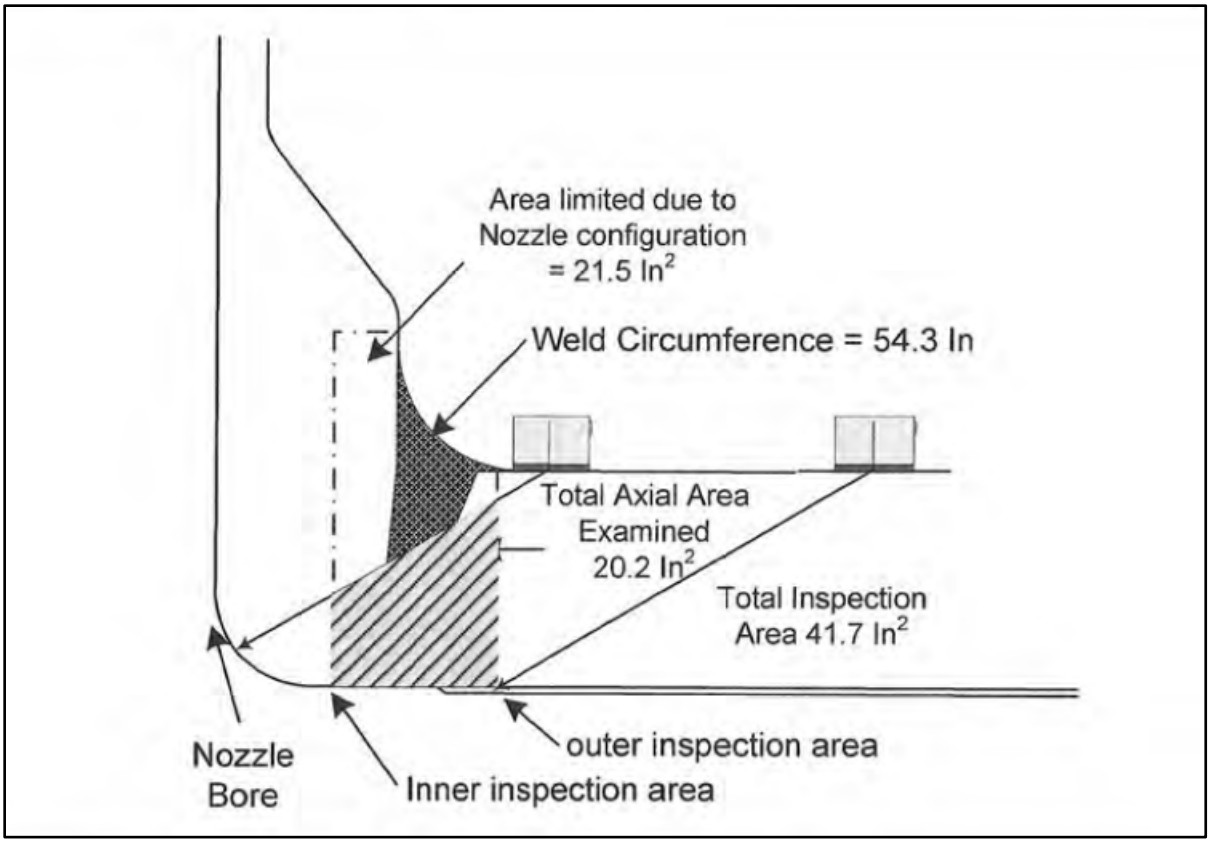


Figure 1.9-2 Weld **N4F-NV**, Radial Scan Examination Coverage

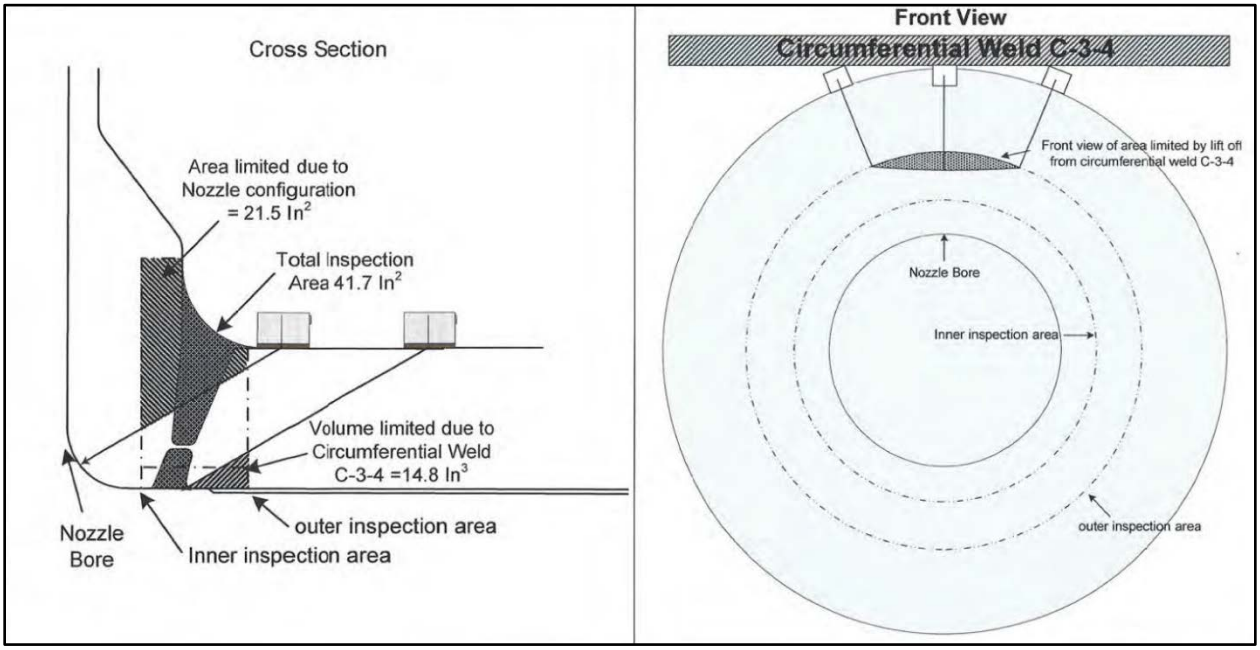


Figure 1.9-3 Weld **N4F-NV**, Radial Scan Examination Limitation from Circumferential Weld C-3-4

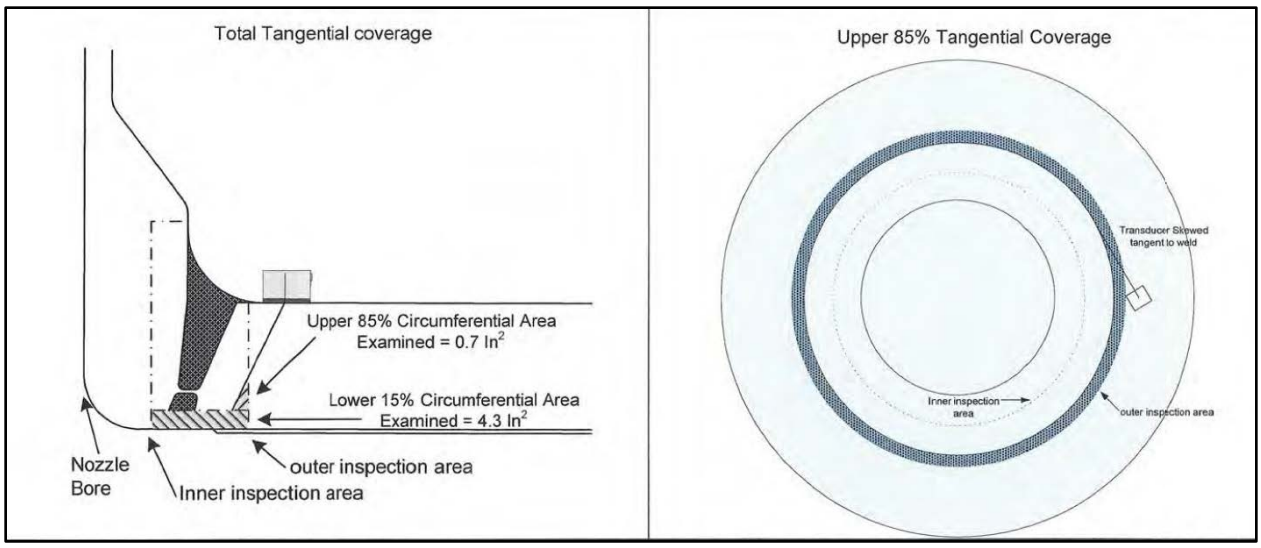


Figure 1.9-4 Weld **N4F-NV**, Tangential Scan Examination Coverage

Table 1.9-1 Weld **N4F-NV**, Scan Coverage and Scan Summary

	Radial Scans	**Tangential Scans**		
	100% Thickness	**Inner 15% (Note 1)**	**Outer 85%**	**Sub-Totals "Tangential"**
Required Exam Volume (Note 2) (Note 3)	2264.3 in^3	4.3 in^2	37.4 in^2	41.7 in^2
Exam Volume Achieved	1082.0 in^3	4.3 in^2	0.7 in^2	5.0 in^2
% Coverage Achieved	**(A) 47.8%**	100%	1.9%	**(B) 12.0%**
TOTAL Coverage Claimed	**(A + B)/2 = (47.8% +12.0%)/2 = 29.9%**			

Note:
1) Feedwater Nozzle-to-Shell weld, N4F-NV, was scanned using the requirements of EPRI Modeling Report IR-2003-19.
2) Examination data reported in square area for required and scanned areas versus exam volume for Tangential scans. Limitations observed in the circumferential directions were consistent 360° around the nozzle.
3) Examination data reported in cubic inches for required and scanned volumes for Radial Scans. Limitations in the circumferential directions from Weld C-3-4.

Wave Modes used: 60°RL and 40° & 60° Shear

1.10 Weld **DRHR-2-03** Valve to Flued Head

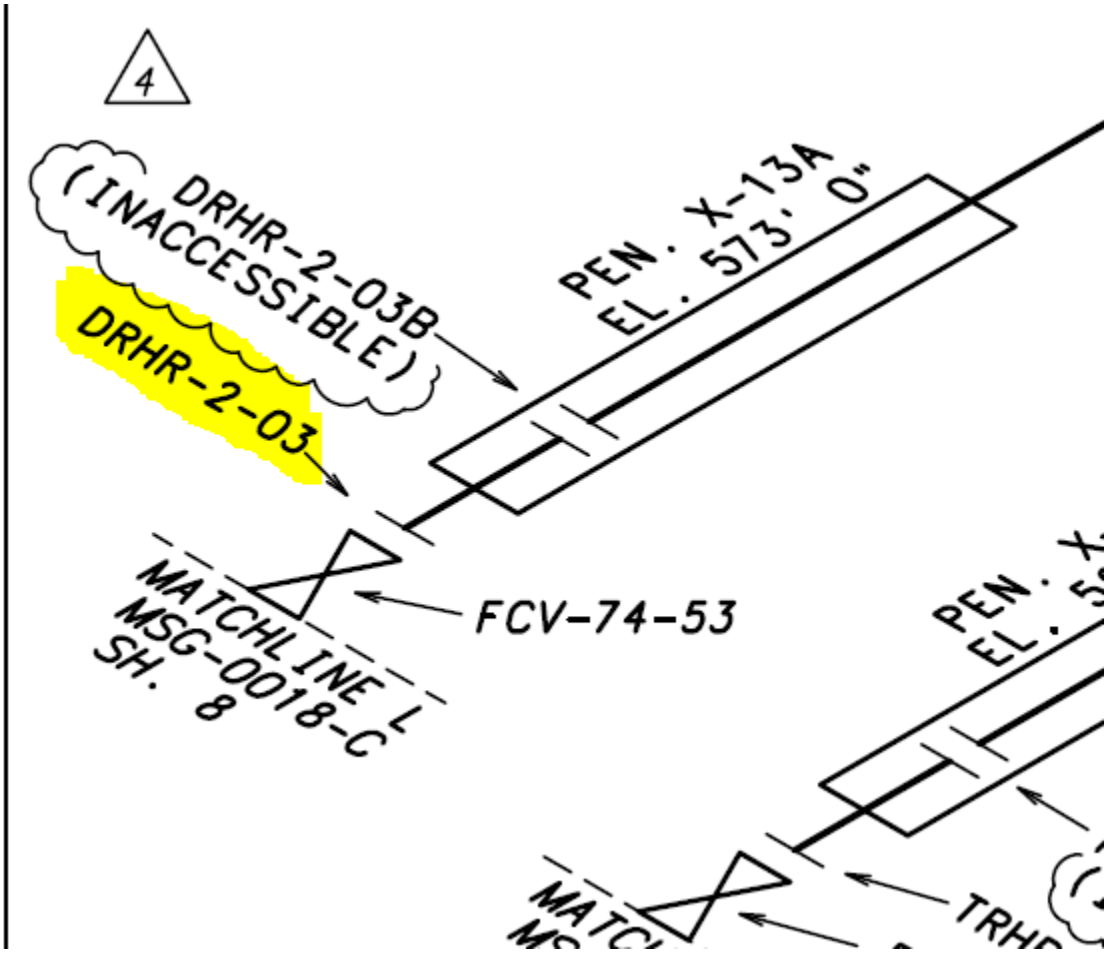


Figure 1.10-1 Weld **DRHR-2-03** (Extracted from Reference Drawing 2-ISI-0221-C-01)

This weld was UT examined in the fourth 10-Year ISI Interval, first period, during the U2R17 refueling outage in 2013 to meet the requirements of the RI-ISI Program. The weld was examined under Item No. R1.16, “Welds Subject to Intergranular or Transgranular Stress Corrosion Cracking (IGSCC or TGSCC)” degradation mechanisms. The NDE data can be found on UT Report No. UT-13-044. The UT examination was limited on the valve side of the weld due to the valve material being cast stainless steel which resulted in total UT coverage of 51.4% as described in Table 1.10-1 and combined with Figure 1.10-2.

UT examination of the subject areas to the maximum extent practical due to the design of the weld joints provides an acceptable level of quality and safety. When considered in aggregate with the entire sample population, reasonable assurance of operational readiness of the subject welds has been provided.

A review of the plant’s corrective action program did not note any failures at this weld. Previous examination data from the U2R13, UT R-022 report were reviewed for the UT examination. No recordable indications were noted.

Section XI, Mandatory Appendix I, I-2220 implements the Appendix VIII, Performance Demonstration Program, for this ultrasonic examination.

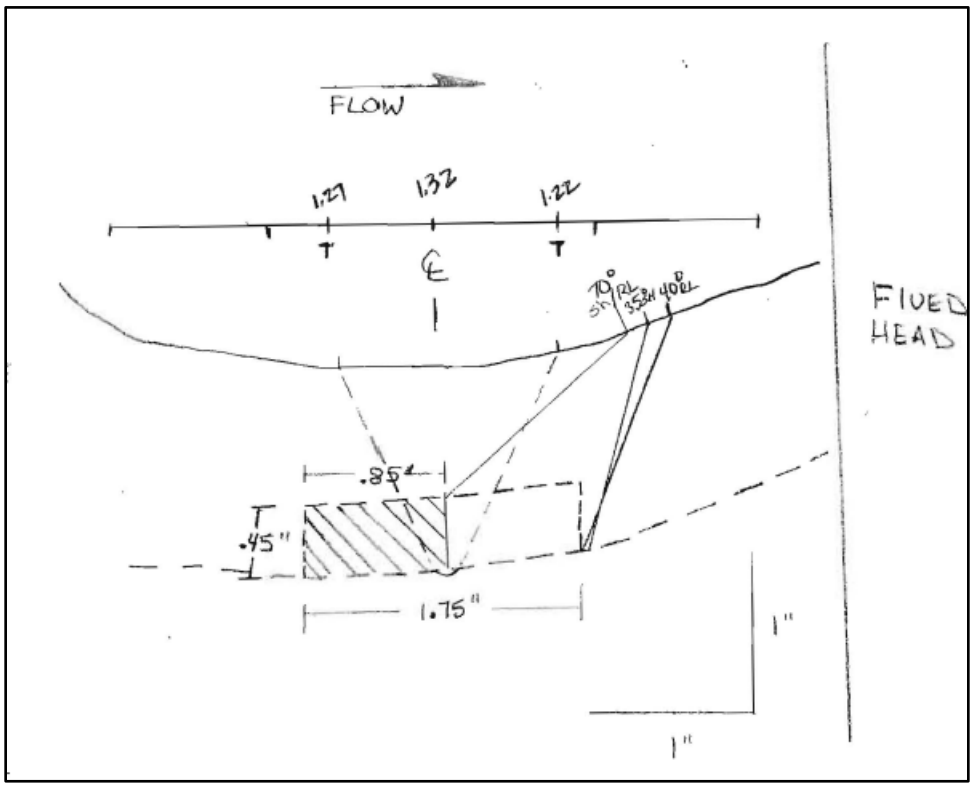


Figure 1.10-2 Weld **DRHR-2-03**, Coverage Plot

Table 1.10-1 Weld **DRHR-2-03** Scan Coverage and Scan Summary

SCANS	% COVERAGE
Axial Coverage (Note 1)	51.4%
Circumferential Coverage (Note 2)	51.4%
Total Coverage	51.4%
Note: 1) Axial scans performed across the weld and far side material. No ASME Section XI credit taken for Cast Material. 2)Circumferential scans performed in the clockwise and counter-clockwise directions.	

Wave Modes used: Phased Array 35-70° Shear and 40-70°RL

1.11 Weld **RWCU-2-003-G003** Penetration to Pipe

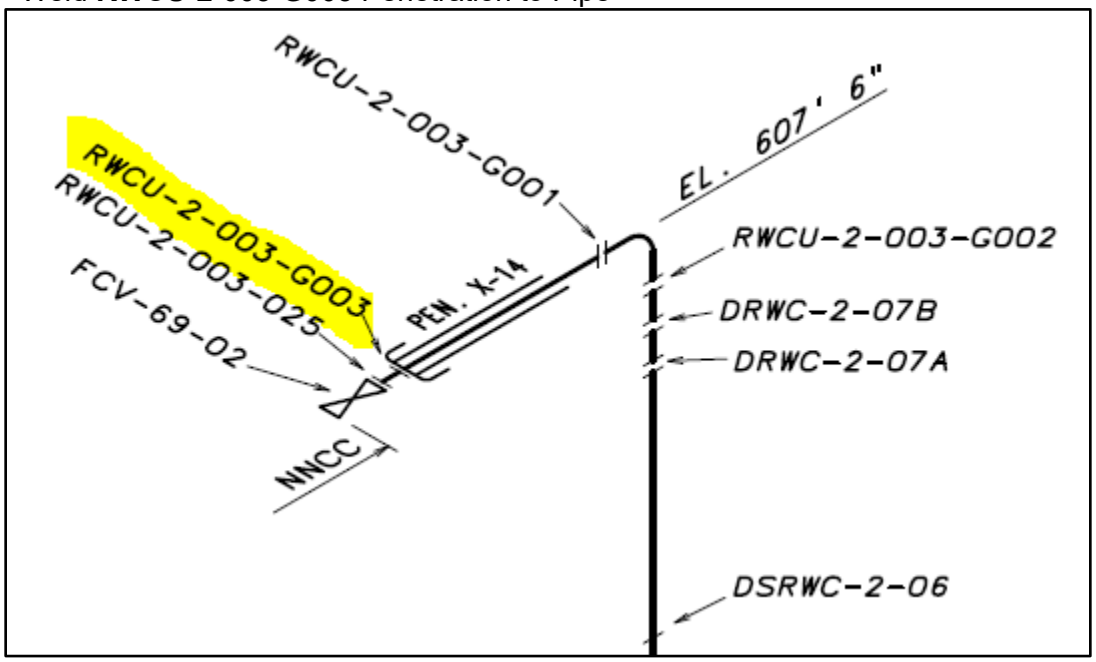


Figure 1.11-1 Weld **RWCU-2-003-G003** (Extracted from Reference Drawing 2-ISI-0272-C-01)

This weld was UT examined in the fourth 10-Year ISI Interval, first period, during the U2R17 refueling outage in 2013 to meet the requirements of the RI-ISI Program. The weld was examined under Item No. R1.16, “Welds Subject to Intergranular or Transgranular Stress Corrosion Cracking (IGSCC or TGSCC)” degradation mechanisms. The NDE data can be found on UT Report No. UT-13-028. The UT examination was limited on the penetration side of the weld due to the configuration of the flued head which resulted in total UT coverage of 75% as described in Table 1.11-1 and Figure 1.11-2.

UT examination of the subject areas to the maximum extent practical due to the design of the weld joints provides an acceptable level of quality and safety. When considered in aggregate with the entire sample population, reasonable assurance of operational readiness of the subject welds has been provided.

A review of the plant’s corrective action program did not note any failures at this weld. Previous examination data from the U2R12, UT R-124 report were reviewed for the UT examination. No recordable indications were noted.

Section XI, Mandatory Appendix I, I-2220 implements the Appendix VIII, Performance Demonstration Program, for this ultrasonic examination.

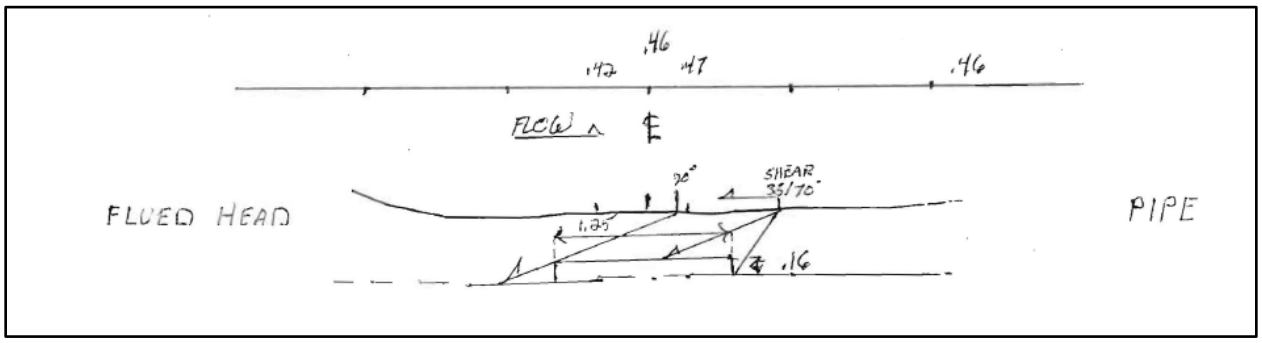


Figure 1.11-2 Weld **RWCU-2-003-G003**, Coverage Plot

Table 1.11-1 Weld **RWCU-2-003-G003** Scan Coverage and Scan Summary

SCANS	% COVERAGE
Axial Coverage (Note 1)	50.0%
Circumferential Coverage (Note 2)	100.0%
Total Coverage	75.0%
Note: 1) Axial scans performed across the weld and far side material. 2) Circumferential scans performed in the clockwise and counter-clockwise directions.	

Wave Modes used: Phased Array 35-70° Shear

1.12 Weld **RWC-2-001-G002** Elbow to Valve

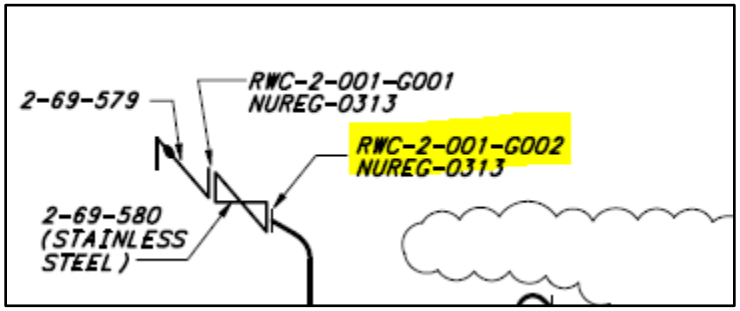


Figure 1.12-1 Weld **RWC-2-001-G002** (Extracted from Reference Drawing 2-ISI-0272-C-01)

This weld was UT examined in the fourth 10-Year ISI Interval, second period, during the U2R18 refueling outage in 2015 to meet the requirements of the RI-ISI Program. The weld was examined under Item No. R1.16, “Welds Subject to Intergranular or Transgranular Stress Corrosion Cracking (IGSCC or TGSCC)” degradation mechanisms. The NDE data can be found on UT Report No. UT-15-037. The UT examination was limited on the valve side of the weld due to the valve material being cast stainless steel and a branch connection for an instrumentation line located on the elbow side of the weld which resulted in total UT coverage of 43.9% as described in Table 1.12-1 and combined with Figure 1.12-2 thru 1.12-3.

UT examination of the subject areas to the maximum extent practical due to the design of the weld joints provides an acceptable level of quality and safety. When considered in aggregate with the entire sample population, reasonable assurance of operational readiness of the subject welds has been provided.

A review of the plant’s corrective action program did not note any failures at this weld. Previous examination data from the U2R13, UT R-029 report were reviewed for the UT examination. No recordable indications were noted.

Section XI, Mandatory Appendix I, I-2220 implements the Appendix VIII, Performance Demonstration Program, for this ultrasonic examination.

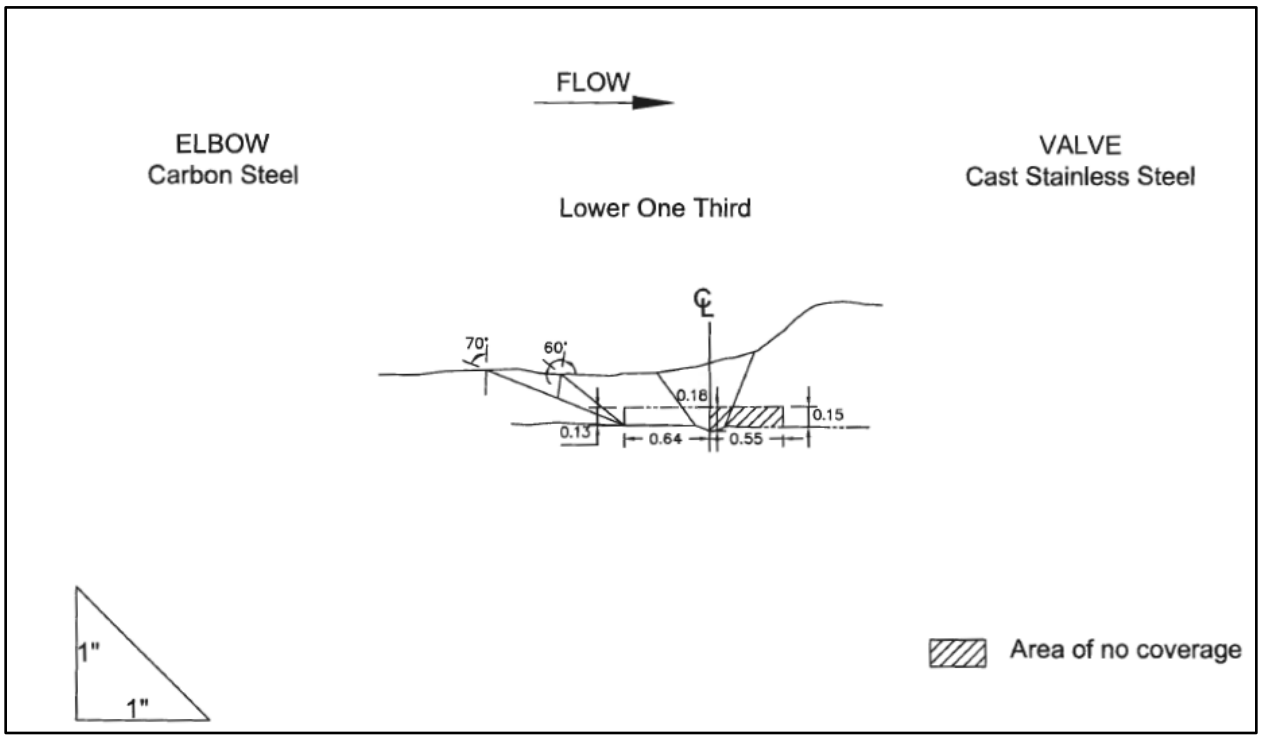


Figure 1.12-2 Weld **RWC-2-001-G002**, Coverage Plot

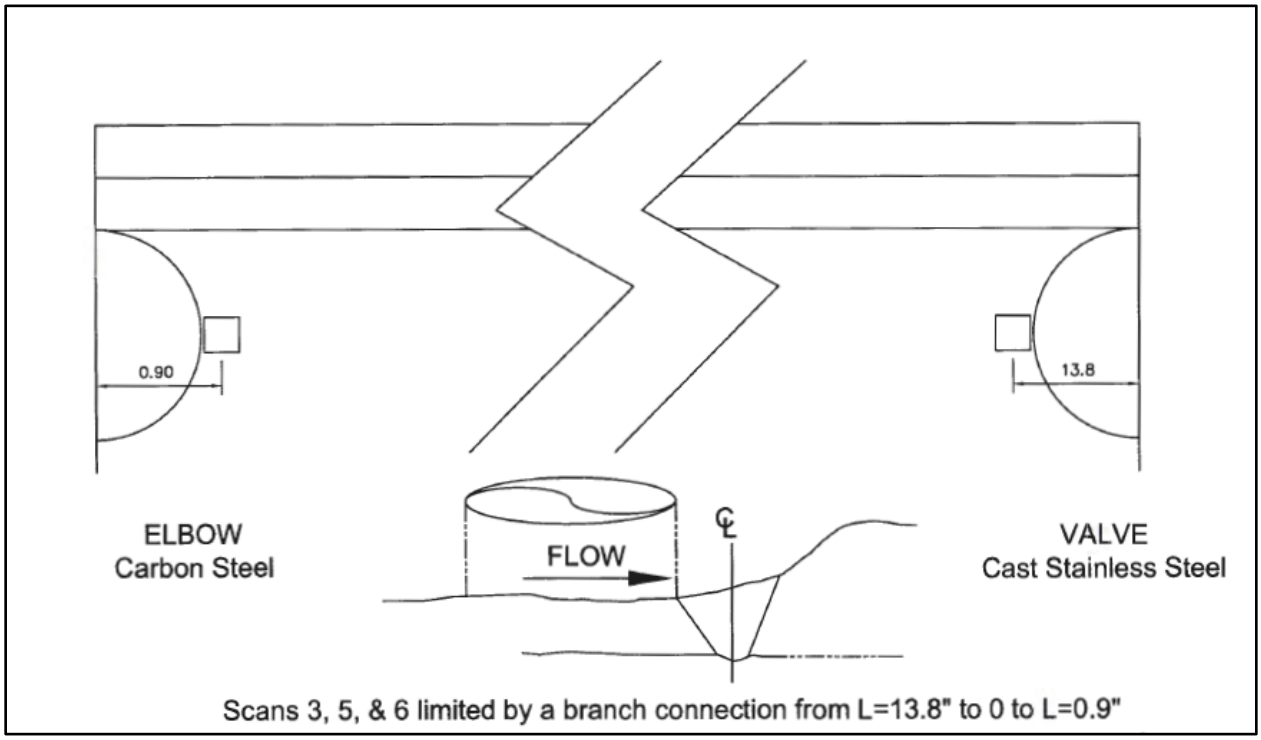


Figure 1.12-3 Weld **RWC-2-001-G002**, Limitation from Instrumentation Line

Table 1.12-1 Weld **RWC-2-001-G002** Scan Coverage and Scan Summary

SCANS	% COVERAGE
Axial Coverage (Note 1)	43.9%
Circumferential Coverage (Note 2)	43.9%
Total Coverage	43.9%
Note: 1) Axial scans performed across the weld and far side material. No ASME Section XI credit taken for cast material. 2) Circumferential scans performed in the clockwise and counter-clockwise directions.	

Wave Modes used: 45° & 70° Shear and 45°, 60°, & 70° RL

1.13 Weld **RWCU-2-003-070** Pipe to Weld-o-let Butt Weld

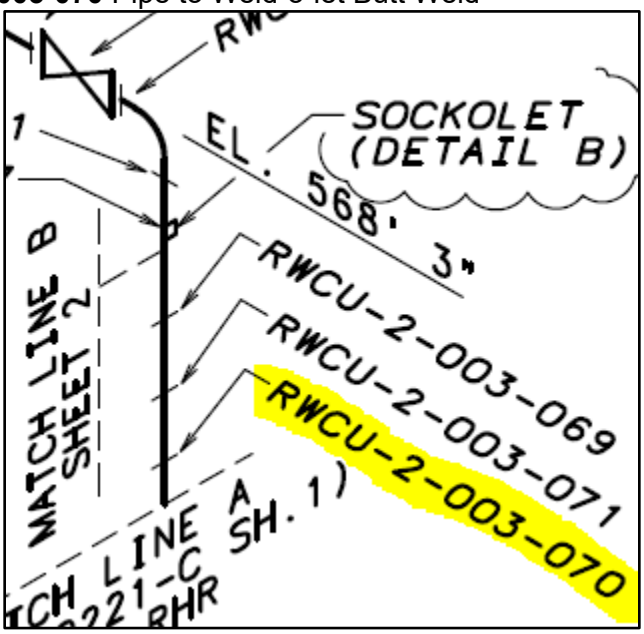


Figure 1.13-1 Weld **RWCU-2-003-070** (Extracted from Reference Drawing 2-ISI-0272-C-01)

This weld was UT examined in the fourth 10-Year ISI Interval, first period, during the U2R17 refueling outage in 2013 to meet the requirements of the RI-ISI Program. The weld was examined under Item No. R1.16, "Welds Subject to Intergranular or Transgranular Stress Corrosion Cracking (IGSCC or TGSCC)" degradation mechanisms. The NDE data can be found on UT Report No. UT-13-076. The UT examination was limited on the weld-o-let side of the weld due to nonparallel surface which resulted in total UT coverage of 73.7% as described in Table 1.13-1 and combined with Figure 1.13-2 thru 1.13-4.

UT examination of the subject areas to the maximum extent practical due to the design of the weld joints provides an acceptable level of quality and safety. When considered in aggregate with the entire sample population, reasonable assurance of operational readiness of the subject welds has been provided.

A review of the plant's corrective action program did not note any failures at this weld. Previous examination data from the U2R16, UT-11-019 report were reviewed for the UT examination. No recordable indications were noted.

Section XI, Mandatory Appendix I, I-2220 implements the Appendix VIII, Performance Demonstration Program, for this ultrasonic examination.

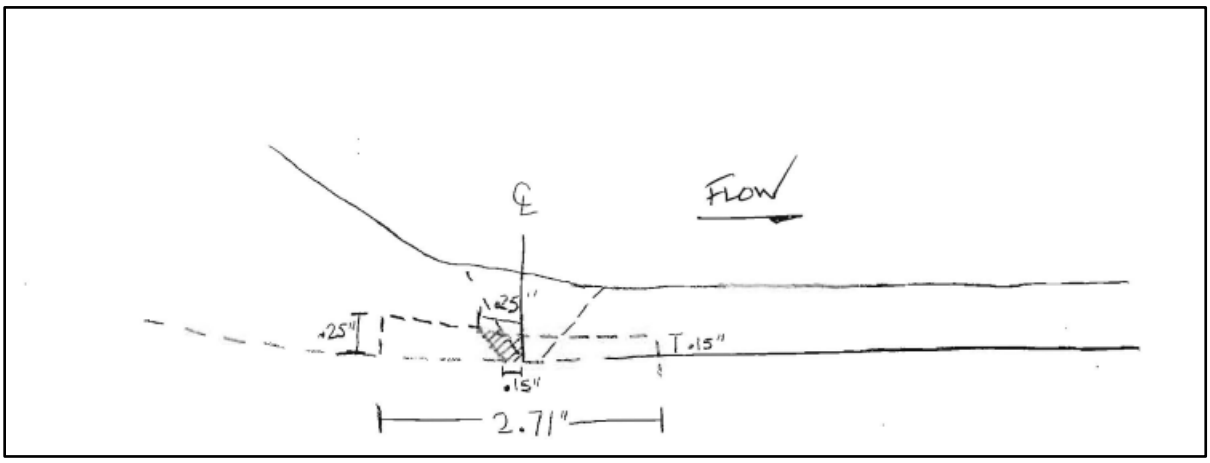


Figure 1.13-2 Weld **RWCU-2-003-070**, Axial Coverage Plot (Dual Side)

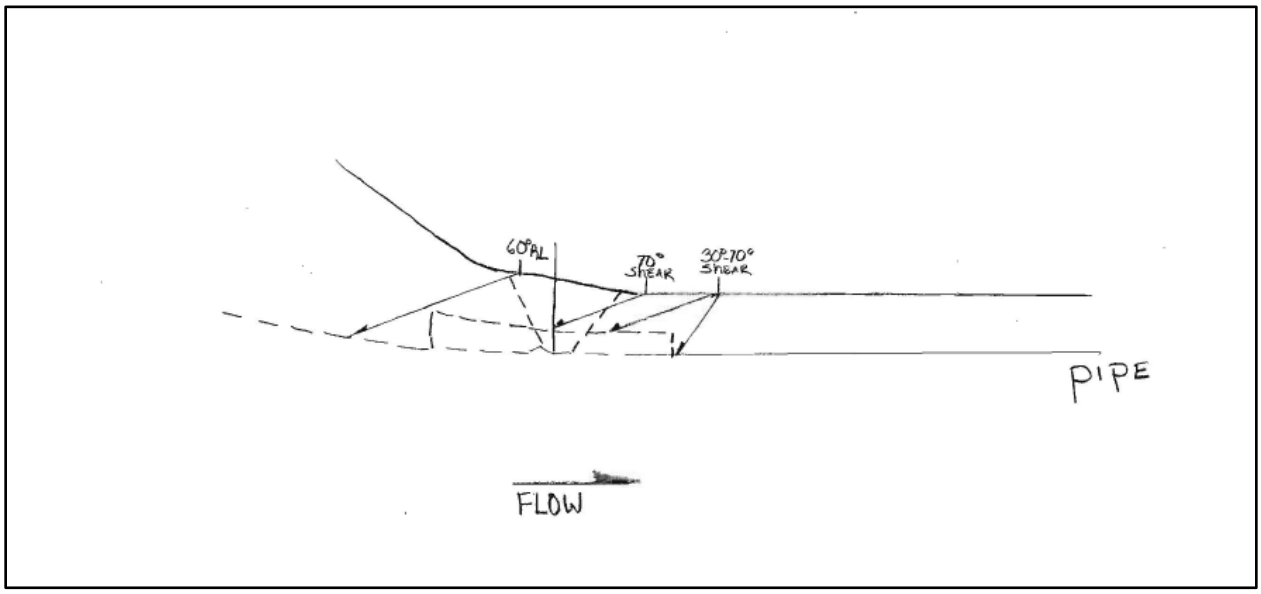


Figure 1.13-3 Weld **RWCU-2-003-070,** Axial Coverage Plot (Single Side) Supplemental Scan

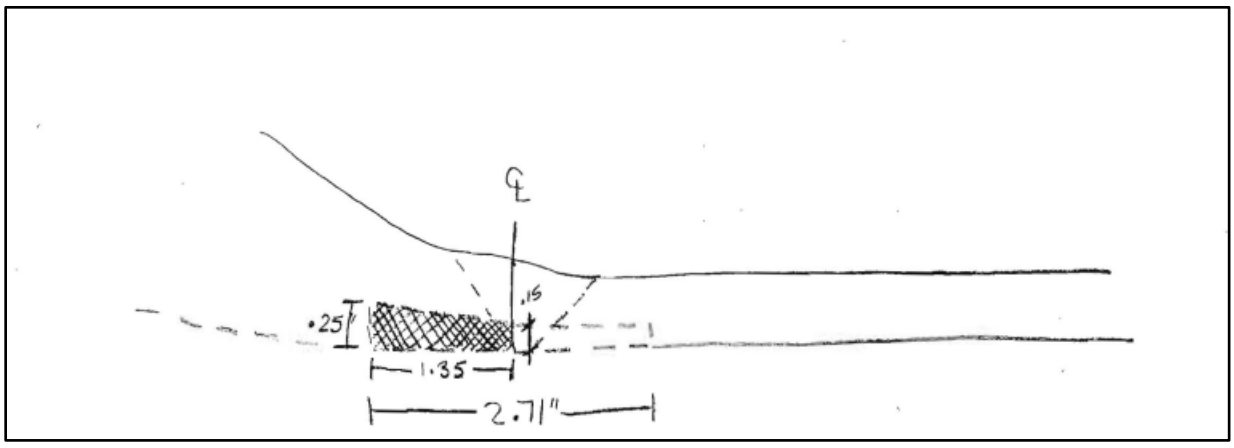


Figure 1.13-4 Weld **RWCU-2-003-070,** Circumferential Coverage Plot

Table 1.13-1 Weld **RWCU-2-003-070** Scan Coverage and Scan Summary

SCANS	% COVERAGE
Axial Coverage (Note 1)	97.3%
Circumferential Coverage (Note 2)	50.2%
Total Coverage	73.7%
Note: 1) Axial scans on the Weld-O-Let side and conservatively across the weld and far side material. 2) Circumferential scans performed in the clockwise and counterclockwise directions. No credit on Weld-O-Let due to non-parallel surface.	

Wave Modes used: Phased Array 35°-70° Shear and 60° RL

1.14 Weld **KR-2-25** Pipe to Tee

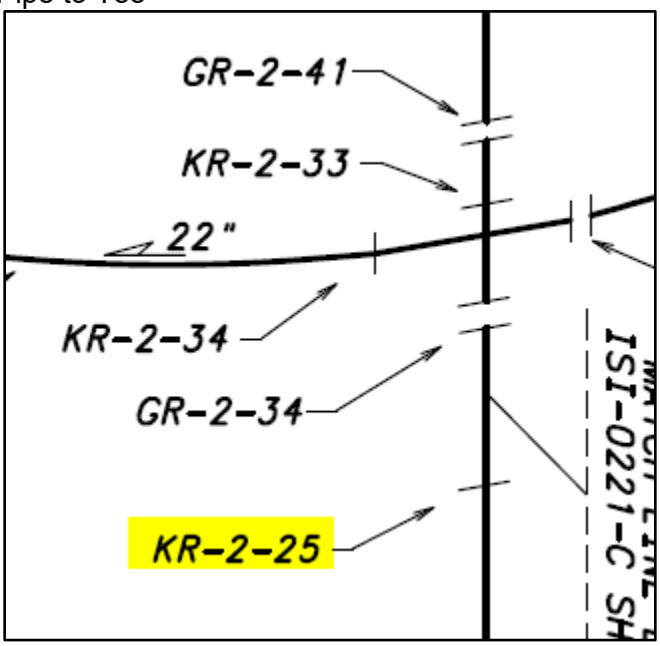


Figure 1.14-1 Weld **KR-2-25** (Extracted from Reference Drawing 2-ISI-0270-C-02)

This weld was UT examined in the fourth 10-Year ISI Interval, first period, during the U2R17 refueling outage in 2013 to meet the requirements of the RI-ISI Program. The weld was examined under Item No. R1.16, "Welds Subject to Intergranular or Transgranular Stress Corrosion Cracking (IGSCC or TGSCC)" degradation mechanisms. The NDE data can be found on UT Report No. UT-13-072. The UT examination was limited due to configuration which resulted in total UT coverage of 50% as described in Table 1.14-1 and combined with Figure 1.14-2.

UT examination of the subject areas to the maximum extent practical due to the design of the weld joints provides an acceptable level of quality and safety. When considered in aggregate with the entire sample population, reasonable assurance of operational readiness of the subject welds has been provided.

A review of the plant's corrective action program did not note any failures at this weld. Previous examination data from the U2R12, UT R-066 report were reviewed for the UT examination. No recordable indications were noted.

Section XI, Mandatory Appendix I, I-2220 implements the Appendix VIII, Performance Demonstration Program, for this ultrasonic examination.

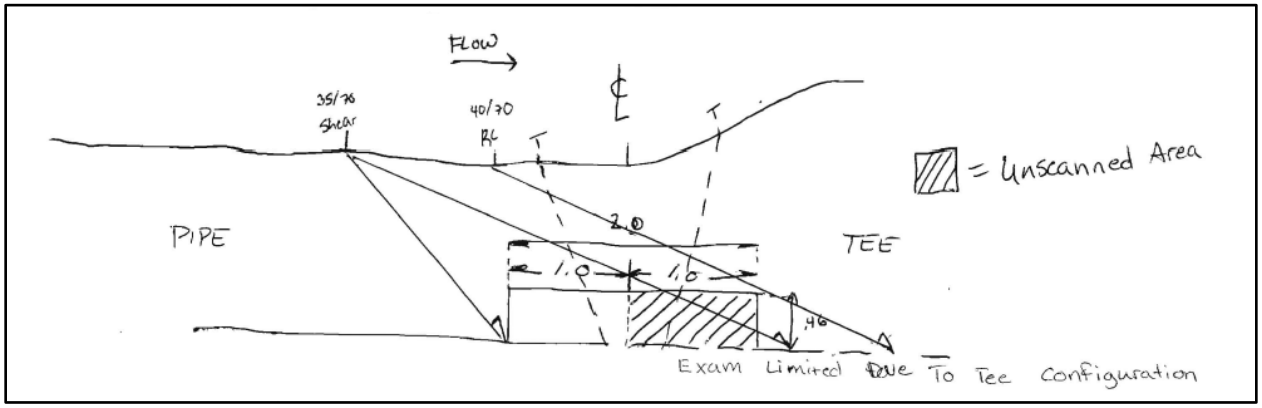


Figure 1.14-2 Weld **KR-2-25**, Coverage Plot

Table 1.14-1 Weld **KR-2-25** Scan Coverage and Scan Summary

SCANS	% COVERAGE
Axial Coverage (Note 1)	50.0%
Circumferential Coverage (Note 2)	50.0%
Total Coverage	50.0%
Note: 1) Axial scans performed across the weld and far side material. 2) Circumferential scans performed in the clockwise and counterclockwise directions. No credit on Tee Side of the weld.	

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Wave Modes used: Phased Array 35°-70° Shear and 40°-70° RL

1.15 Weld **KR-2-03** Pipe to Tee

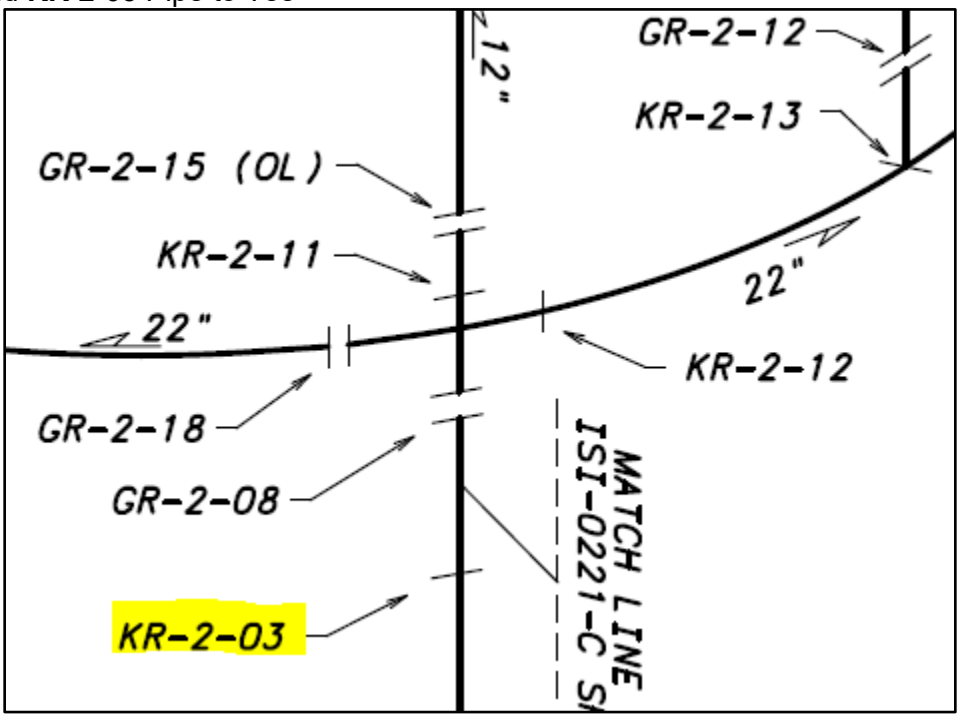

Figure 1.15-1 Weld **KR-2-03** (Extracted from Reference Drawing 2-ISI-0270-C-01)

This weld was UT examined in the fourth 10-Year ISI Interval, second period, during the U2R18 refueling outage in 2015 to meet the requirements of the RI-ISI Program. The weld was examined under Item No. R1.16, "Welds Subject to Intergranular or Transgranular Stress Corrosion Cracking (IGSCC or TGSCC)" degradation mechanisms. The NDE data can be found on UT Report No. UT-15-011 The UT examination was limited on the Tee of the weld due to configuration which resulted in total UT coverage of 83.86% as described in Table 1.15-1 and combined with Figure 1.15-2 thru 1.15-3.

UT examination of the subject areas to the maximum extent practical due to the design of the weld joints provides an acceptable level of quality and safety. When considered in aggregate with the entire sample population, reasonable assurance of operational readiness of the subject welds has been provided.

A review of the plant's corrective action program did not note any failures at this weld. Previous examination data from the U2R13, UT R-043 report were reviewed for the UT examination. No recordable indications were noted.

Section XI, Mandatory Appendix I, I-2220 implements the Appendix VIII, Performance Demonstration Program, for this ultrasonic examination.

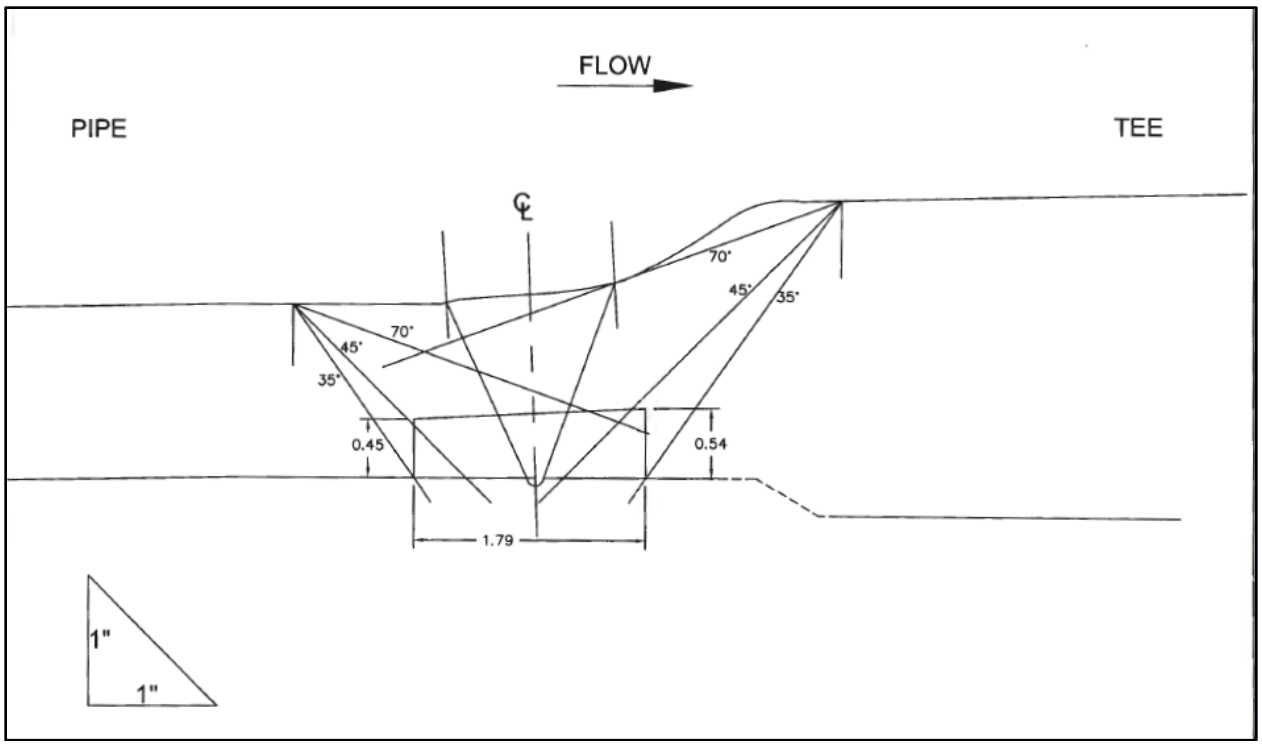

Figure 1.15-2 Weld **KR-2-03**, Axial Scan Coverage

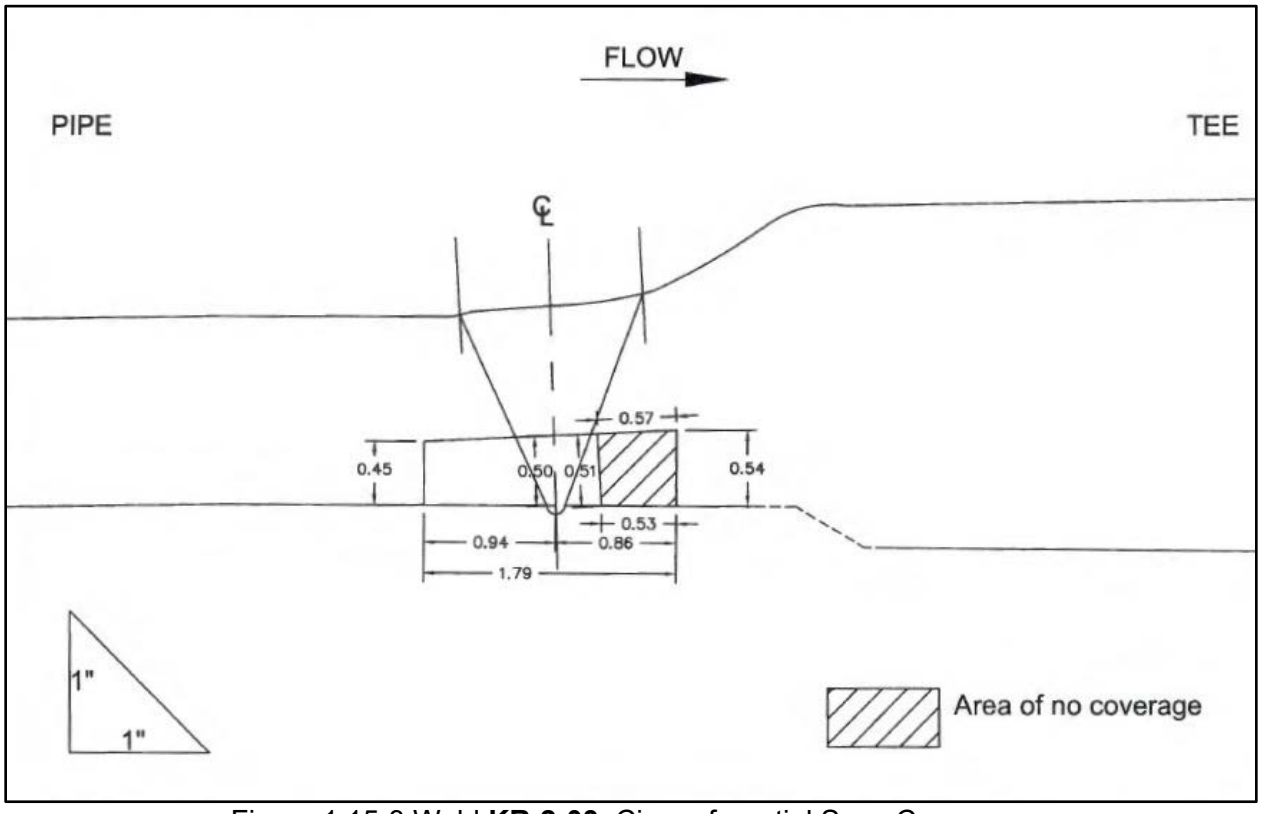

Figure 1.15-3 Weld **KR-2-03,** Circumferential Scan Coverage

Table 1.15-1 Weld **KR-2-03** Scan Coverage and Scan Summary

SCANS	% COVERAGE
Axial Coverage	100%
Circumferential Coverage (Note 1)	67.7%
Total Coverage	83.86%
Note: 1) Circumferential scans limited due to Tee configuration.	

Wave Modes used: Phased Array 35°-70° Shear

1.16 Weld **DCS-2-05** Pipe to Valve

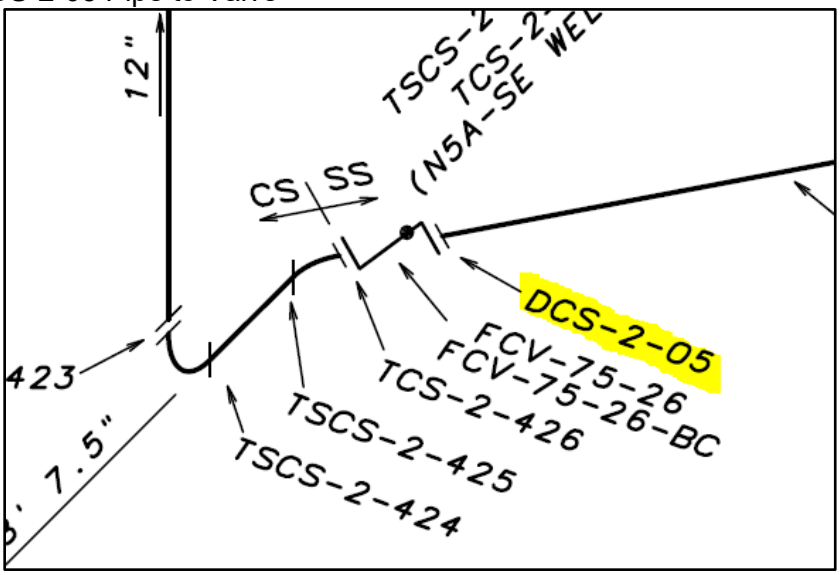

Figure 1.16-1 Weld **DCS-2-05** (Extracted from Reference Drawing 2-ISI-0271-C-01)

This weld was UT examined in the fourth 10-Year ISI Interval, second period, during the U2R18 refueling outage in 2015 to meet the requirements of the RI-ISI Program. The weld was examined under Item No. R1.16, "Welds Subject to Intergranular or Transgranular Stress Corrosion Cracking (IGSCC or TGSCC)" degradation mechanisms. The NDE data can be found on UT Report No. UT-15-002. The UT examination was limited on the valve side of the weld due to the valve material being cast stainless steel which resulted in total UT coverage of 50% as described in Table 1.16-1 and combined with Figure 1.16-2.

UT examination of the subject areas to the maximum extent practical due to the design of the weld joints provides an acceptable level of quality and safety. When considered in aggregate with the entire sample population, reasonable assurance of operational readiness of the subject welds has been provided.

A review of the plant's corrective action program did not note any failures at this weld. Previous examination data from the U2R08, R-0226 report were reviewed for the UT examination. Indication attributed to weld root geometry were noted on report UT-15-002 and the previous report R-0226.

Section XI, Mandatory Appendix I, I-2220 implements the Appendix VIII, Performance Demonstration Program, for this ultrasonic examination.

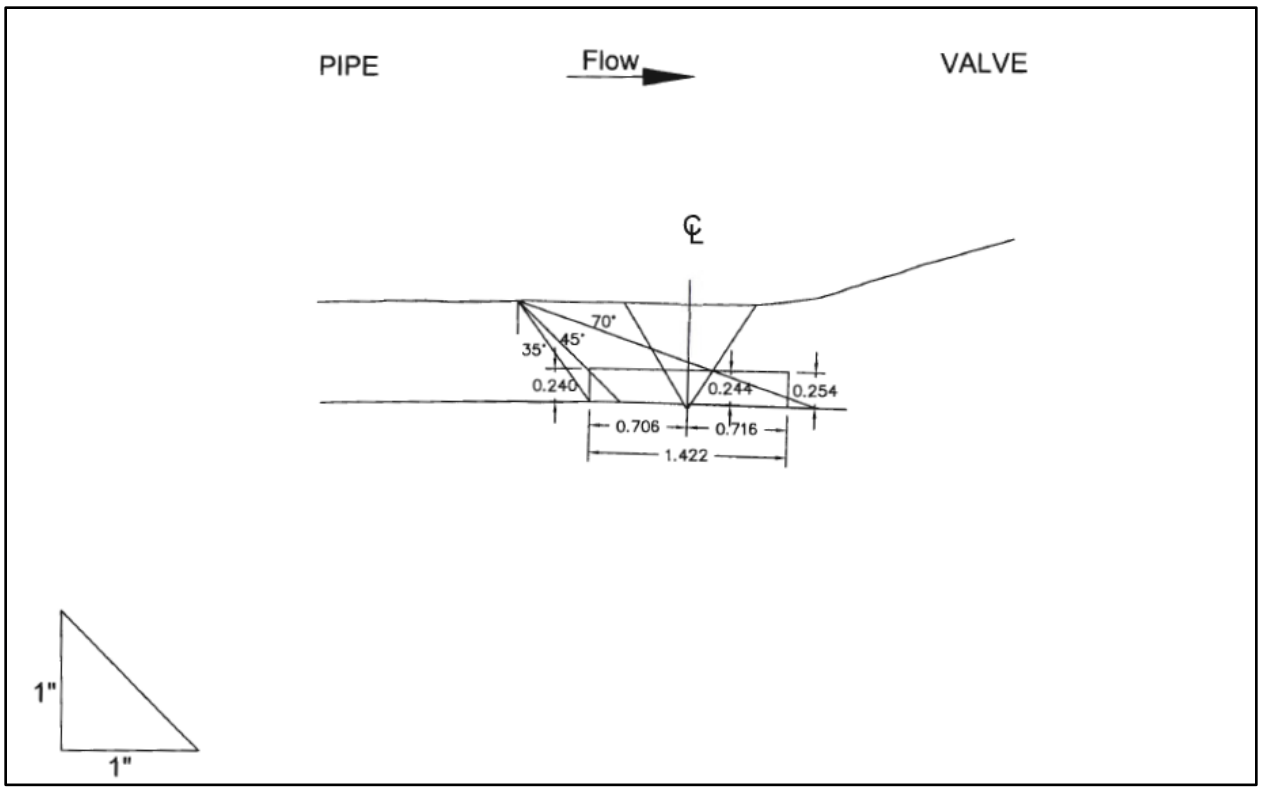

Figure 1.16-2 Weld **DCS-2-05**, Coverage Plot

Table 1.16-1 Weld **DCS-2-05** Scan Coverage and Scan Summary

SCANS	% COVERAGE
Axial Coverage (Note 1)	50.0%
Circumferential Coverage (Note 2)	50.0%
Total Coverage	50.0%
Note: 1) Axial scans performed across the weld and far side material. No ASME Section XI credit taken for Cast Material. 2) Circumferential scans performed in the clockwise and counterclockwise directions.	

Wave Modes used: Phased Array 35°-70° Shear

1.17 Weld **DCS-2-14** Pipe to Valve

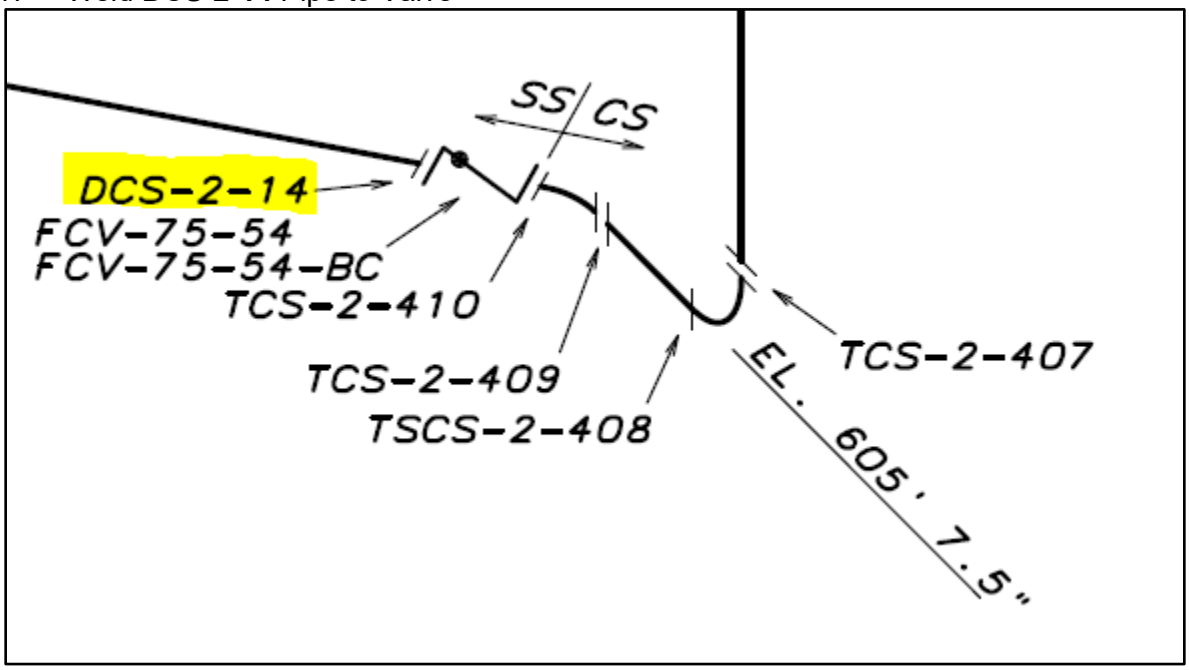

Figure 1.17-1 Weld **DCS-2-14** (Extracted from Reference Drawing 2-ISI-0271-C-01)

This weld was UT examined in the fourth 10-Year ISI Interval, second period, during the U2R18 refueling outage in 2015 to meet the requirements of the RI-ISI Program. The weld was examined under Item No. R1.16, "Welds Subject to Intergranular or Transgranular Stress Corrosion Cracking (IGSCC or TGSCC)" degradation mechanisms. The NDE data can be found on UT Report No. UT-15-034. The UT examination was limited on the valve side of the weld due to the valve material being cast stainless steel which resulted in total UT coverage of 50% as described in Table 1.17-1 and combined with Figure 1.17-2.

UT examination of the subject areas to the maximum extent practical due to the design of the weld joints provides an acceptable level of quality and safety. When considered in aggregate with the entire sample population, reasonable assurance of operational readiness of the subject welds has been provided.

A review of the plant's corrective action program did not note any failures at this weld. Previous examination data from the U2R08, R-0224 report were reviewed for the UT examination. Indication attributed to weld root geometry were noted on report UT-15-034 and the previous report R-0224.

Section XI, Mandatory Appendix I, I-2220 implements the Appendix VIII, Performance Demonstration Program, for this ultrasonic examination.

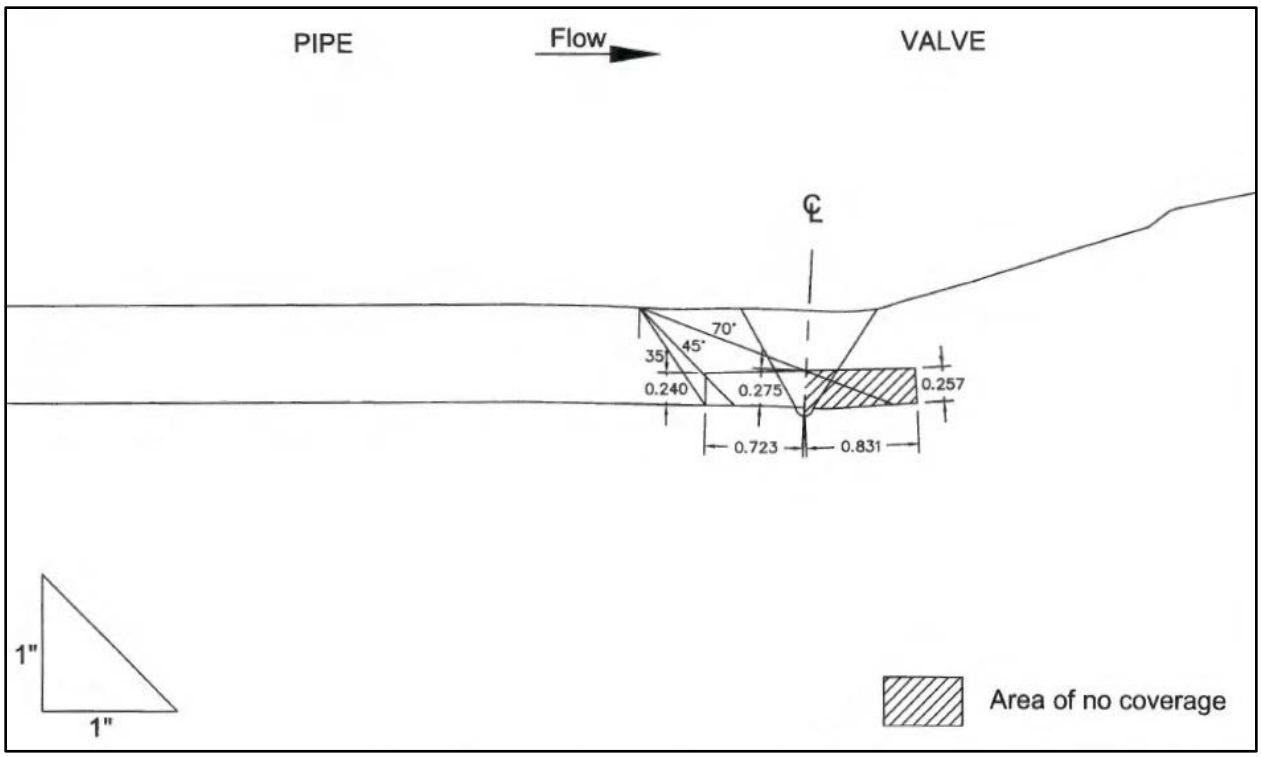

Figure 1.17-2 Weld **DCS-2-14**, Coverage Plot

Table 1.17-1 Weld **DCS-2-14** Scan Coverage and Scan Summary

SCANS	% COVERAGE
Axial Coverage (Note 1)	50.0%
Circumferential Coverage (Note 2)	50.0%
Total Coverage	50.0%
Note: 1) Axial scans performed across the weld and far side material. No ASME Section XI credit taken for Cast Material. 2) Circumferential scans performed in the clockwise and counterclockwise directions.	

Wave Modes used: Phased Array 35°-70° Shear