Duke Energy

T. PRESTON GILLESPIE, JR.
Vice President
Oconee Nuclear Station

Duke Energy
ON01VP / 7800 Rochester Hwy.
Seneca, SC 29672

864-873-4478
864-873-4208 fax
T.Gillespie@duke-energy.com

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

Subject: Duke Energy Carolinas, LLC (Duke Energy)
Oconee Nuclear Station Units 1, 2, and 3
Docket Numbers 50-269, 50-270, and 50-287
Relief Request 10-ON-002 Request for Additional Information (RAI) Response

On April 29, 2011, Duke Energy submitted Relief Request 10-ON-002 (ADAMS Accession No. ML11124A131) pursuant to 10 CFR50.55a(g)(5)(iii), requesting NRC approval from the requirement to examine 100% of the volume specified by the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, 1998 Edition with 2000 Addenda (as modified by Code Case N-460).

On February 2, 2012, the NRC Staff electronically requested additional information regarding this relief request. This request for additional information (RAI), along with the Duke Energy response, is enclosed. In addition there are three attachments, A, B, and C to this letter. Attachment A contains cross-sectional coverage plot. Attachment B contains an example of a weld examination that produced recordable indications that required disposition. Attachment C provides clarification to the original relief request by replacing the word "shear" with the word "longitudinal" in the third paragraph of section 32.4. Please remove Section 32.4 of the Relief Request 10-ON-002 and replace with Attachment C of this RAI response.

This submittal document contains no regulatory commitments.

If you have any questions or require additional information, please contact Corey Gray at (864)873-6325.

Sincerely,

TPGillespie
T. Preston Gillespie Jr.,
Site Vice President

Enclosure: Oconee Nuclear Station Units 1, 2, and 3 Relief Request 10-ON-002
Request for Additional Information (RAI) Response
Attachment A: Cross-Sectional Coverage Plot
Attachment B: Example of Weld Examination
Attachment C: Clarification Page Section 32.4 "Impracticality of Compliance"

A047
NRR

Xc w/att: Victor Mcree
Region II Administrator
U. S. Nuclear Regulatory Commission
Marquis One Tower
245 Peachtree Center Ave., NE, Suite 1200
Atlanta, Ga 30303-1257

John Stang
Project Manager
U. S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Mail Stop O-8 G9A
Washington, DC 20555

Xc w/o attachment

Andy Sabisch
NRC Senior Resident Inspector
Oconee Nuclear Station

Susan Jenkins
Section Manager
Division of Waste Management
Bureau of Land and Waste Management
SC Dept. of Health & Environment Control
2600 Bull St.
Columbia, SC 29201

Enclosure

Oconee Nuclear Station Units 1, 2, and 3
Relief Request 10-ON-02 Request for Additional Information (RAI)
Response

2.0 REQUEST FOR ADDITIONAL INFORMATION

2.1 Request for Relief 10-ON-002, Part A, ASME Code, Section XI, Table IWB-2500-1, Examination Category B-D, Item B3.110, Full Penetration Welded Nozzles in Vessels (Oconee, Units 2 and 3)

2.1.a) The licensee has provided only general, and somewhat vague, information regarding impracticality of obtaining ASME Code-required volumetric examinations. For example, the licensee's statement "limitation was caused by the design of the nozzle," is inadequate to describe the basis for not obtaining the ASME Code-required examination volumes.

Submit detailed and specific information to support the bases for limited examination in all requests for relief in ASME Code, Section XI, Table IWB-2500-1, Examination Category B-D, and therefore, demonstrate impracticality. Include detailed descriptions (written and/or sketches, as necessary) of the interferences to applied Nondestructive (NDE) techniques.

Duke Response: Pressurizer Nozzle to Head and Shell welds were examined to the maximum extent practical for the nozzle geometries. Coverage calculations and sketches illustrating the areas were provided in Attachments B and C in Relief Request 10-ON-002.

The coverage limitations for all category B-D welds were caused by the curvature of the scanning surface in the nozzle as it transitions from pipe to vessel. The curvature does not allow the sound wave to be directed into the entire required examination volume. To obtain the required coverage, the nozzle would need to be redesigned and replaced. This is impractical.

2.1.b) As applicable, describe NDE equipment (ultrasonic (UT) scanning apparatus), details of the listed obstructions (size, shape, proximity to the weld, etc.) to demonstrate accessibility limitations, and discuss whether alternative methods or advanced technologies that are qualified under ASME Code Section XI, Appendix VIII requirements could have been employed to maximize ASME Code coverage.

Duke Response: As described above, the limitation was caused by the curvature of the nozzle scanning surface. The sketches in Attachments B and C of the relief request show the nozzles are welded into the vessel which creates a scanning and coverage limitation on the nozzle side of the welds. Orientation of the nozzle in regard to the weld produced limited coverage of the nozzle to shell welds. Cross-sectional sketches (i.e. Attachment C, pg. 3 of 69 thru 8 of 69) that are provided are intended to illustrate the maximum coverage obtainable from each shear wave angle used in each examination. There were no other obstructions that limited coverage.

Alternative NDE methods such as radiography would not be practical because there is no access for film placement. Use of manual or automated UT, including phased array qualified under ASME Section XI, Appendix VIII would not increase coverage due to the limitation created by the configuration of the nozzle, as stated above.

2.1.c) It is not always clear from the information in the licensee's submittal which UT wave mode corresponds to each insonification angle. Please clarify the wave modality and insonification angles used for all UT examinations performed on the pressurizer (PZR) nozzle-to-head welds listed in ASME Code, Section XI, Table IWB-2500-1, Examination Category B-D.

Duke Response: The examinations were conducted using manual scanning employing combinations of 45°, 60° and 70° shear waves plus a straight beam longitudinal wave. This information is provided within the relief request for each weld under the subsection of Impractically of Compliance (i.e. 10-ON-002 pg. 44 of 77, Section 22.4)

2.1.d) For some of the ASME Code, Section XI, Table IWB-2500-1, Examination Category B-D welds there was conflicting information presented in the written descriptions and the examination data. Section X.7 (where X is a specific relief request section number) of the written description stated "acceptable results" and the examination data sheets had a check mark next to "Reject" under results, even when there was a check mark next to "No" indications found. In other cases the examination data had a check mark next to "Yes" for indication and "Accept" under results and there was no mention in the written description of any indications being detected.

Duke Response: Duke Energy procedures require any ASME Code, Section XI examination that do not meet the requirement of Code Case N-460 to be marked "reject" for tracking purposes regardless of whether or not indications were noted. Therefore, limited exams without indications were marked "reject".

2.1.e) State whether any indications were discovered as a result of ASME Code-required examinations, and how these indications have been dispositioned.

Duke Response: There were two indications that were reported in welds 2-PZR-WP26-4/O2.B3.110.0006 and 2-PZR-WP26-5/O2.B3.110.0007 within the entire Category B-D welds submitted for relief. In each case, the indications were dispositioned as geometric reflectors from the inside diameter of the component, using procedure guidance (i.e. skewing, use of higher angles) and indication plotting.

2.1.f) For PZR lower head-to-surge nozzle Weld 3-PZR-WP-15, the licensee stated in Section 22.4 that the "scanning requirements described in ASME Code, Section V, Article 4, T-441.1.2(a), T-441.1.3, T-441.1.4, T-441.1.5, and T-441.1.6 could not be met." Besides not meeting the ASME Code, Section XI volumetric code coverage, please specifically describe which, if any, other requirements that could not be met under ASME Code, Section V, Article 4.

Duke Response: The reference of ASME Code, Section V, Article 4, T-441.1.2(a), T-441.1.3, T-441.1.4, T-441.1.5, and T-441.1.6 listed above is specific to scanning requirements only. All other examination requirements of ASME Section V, Article 4, except as noted in the relief request, were fully met.

2.2 Request for Relief 10-ON-002, Part B, ASME Code, Section XI, Table IWB-2500-1, Examination Category B-J, Item B9.11, Pressure Retaining Welds in Piping (Oconee, Units 1, 2, and 3)

2.2.a) Please describe NDE equipment (UT scanning apparatus) and discuss whether alternative methods or advance technologies that have been qualified under ASME Code, Section XI, Appendix VIII requirements could have been employed to maximize ASME Code coverage.

Duke Response: Six of the Category B-J, Item B9.11 welds were manually inspected using the EPRI PDI-UT-2 piping procedure. For five of these welds, no other alternate methods or advance technologies would have increased the coverage due to the coarse grained, anisotropic structures of the cast stainless steel material on the Reactor Coolant Pump Casing Nozzle to Safe-End welds. The cast stainless material was scanned with 60 and 70 degree longitudinal waves to interrogate the upper 2/3 region as a "best effort" exam. To obtain additional coverage, the cast material would need to be replaced, which is impractical.

For the sixth category B-J weld, pipe to valve weld 3HP-241-3, no other techniques could have increased the coverage due to the valve taper. The curvature of the taper prevents interrogation of the required volume for the circumferential scans. No additional coverage can be obtained from the valve taper unless the valve is redesigned and replaced. This is impractical.

2.2.b) For some of the ASME Code, Section XI, Table IWB-2500-1, Category B-J welds there appears to be conflicting information presented in the written descriptions and the examination data. Section X.7 (where X is a specific relief request section number) of the written description stated "acceptable results" and the examination data sheets had a check mark next to "Reject" under results even when there was a check mark next to "No" indications found.

Duke Response: Duke Energy procedures require ASME Code, Section XI examinations that do not meet the requirement of Code Case N-460 to be marked "reject" for tracking purposes regardless of whether indications were noted. Therefore, limited exams without indications were marked reject".

2.2.c) State whether any indications were discovered as a result of ASME Code-required examination, and how these indications have been dispositioned.

Duke Response: No indications were discovered for the Category B-J limited welds reported in RR 10-ON-002.

2.2.d) The licensee's submittal states that the subject weld areas were interrogated with a combination of 45-and 60-degree shear waves, and in some cases, 60- and 70-degree longitudinal waves (L-waves) were applied to detect circumferentially-oriented flaws. The licensee's submittal further states that examinations were performed in accordance with ASME Code, Section XI Appendix VIII, (performance demonstration initiative (PDI)), and consisted of single-sided examinations from the pipe side of the welds. Confirm the insonification angles and wave modalities used to examine each of the subject welds.

Duke Response: For Category B-J welds, it has been confirmed the primary insonification angles and wave modalities used were the 45 and 60 degree shear waves, supplemental by insonification angles and wave modalities of 60 and 70 degree longitudinal waves on the cast stainless steel components in the upper 2/3 region.

Sixty degree longitudinal waves were used to supplement the limited coverage by the shear waves in the lower 1/3 region of the stainless pipe to valve component. The lower 1/3 region supplemental coverage was obtained by scanning from the pipe side to interrogate the valve side weld.

2.2.e) Discussions with the industry's PDI administrator, the Electric Power Research Institute (EPRI), indicate that ASME Code, Section XI, Supplement 2 qualifications require refracted longitudinal wave methods to be applied, if possible. If only shear wave techniques were used (as in Pipe-to-Valve Weld 3HP-241-3) to examine the subject stainless steel welds, please clarify why refracted longitudinal wave techniques where not used as part of a "best effort" examination. The L-wave method has been shown capable of detecting planar inside diameter (ID) surface-breaking flaws on the far-side of wrought stainless steel welds. Recent studies[1,2] recommend the use of both shear and L-waves to obtain the best detection results, with minimum false calls, in austenitic welds.

Duke Response: The requirements of the ASME Code, Section XI, Supplement 2 pertaining to refracted longitudinal wave methods are to be applied during single sided exams when axial scanning can only be performed from one side of the weld. There is no PDI-UT-2 procedure recommendation for interrogation using longitudinal

wave when the shear waves obtain full coverage in each axial scan direction.

The inspection of weld 3HP-241-3 is limited in the circumferential scan direction due to the valve taper. The EPRI PDI-UT-2 procedure does not require best effort scans in the circumferential direction. Axial scanning of weld 3HP-241-3 with 60 degree shear waves was performed from each side of the weld and 100% coverage in each axial scan direction was obtained. Attachment C, page 43 of 69 shows weld profile plot of axial scans from each side of weld obtaining full coverage.

2.2.f) In cases where L-waves were used, it appears that the "best effort" examinations involved both 60- and 70-degree longitudinal waves. "Best effort" coverage percentages were presented for the 60-degree L-wave but there was no coverage mentioned for the "best effort" examination for the 70-degree L-wave. Please state if any additional "best effort" coverage that was obtained using the 70-degree L-wave.

Duke Response: The weld coverage calculations that are reported in this Relief Request are based on the primary inspection angles only. "Best effort" coverage calculation is for information only. The 70 degree L-wave was used along with the 60 degree L-wave as a "best effort" exam to interrogate the upper 2/3 volume of the cast stainless steel material. There was no additional coverage obtained by this "best effort" examination.

2.3 <u>Request for Relief 10-ON-002, Part C, ASME Code, Section XI, Table IWC-2500-1, Examination Category C-A, Item C1.20, Pressure Retaining Welds in Pressure Vessels (Oconee, Units 2 and 3)</u>

The licensee has provided only general, and somewhat vague, information regarding impracticality of obtaining ASME Code-required volumetric examinations. The licensee's statement of "four physical scanning limitations" is inadequate to describe the bases for not obtaining the ASME Code-required examination volumes. No sketches with dimensional information showing the causes of limited accessibility have been included or descriptions of the four physical limitations.

Please submit detailed and specific information to support the bases for limited examination in all requests for relief in ASME Code, Section XI, Table IWC-2500-1, Examination Category C-A, and therefore, demonstrate impracticality.

2.3.a) Include detailed descriptions (written and/or sketches, as necessary) of the interferences to applied NDE techniques.

Duke Response: The limitations encountered on this weld were four welded pads each 15 inches wide x 30 inches long with a vertical support welded to each pad. The pads and supports completely covered the weld and adjacent base material over a total length of 60

inches. Attachment C, provides and describes this information (i.e. pg. 46 of 69 provides this information and states no scan occurred from surfaces 1 and 2 in each of the required scan directions. Under remarks, the physical location and dimensions of the limitations are described).

2.3.b) As applicable, describe NDE equipment (UT scanning apparatus), details of the listed obstructions (size, shape, proximity to the weld, etc.) to demonstrate accessibility limitations, and discuss whether alternative methods or advanced technologies that have been qualified under ASME Code, Section XI, Appendix VIII requirements could have been employed to maximize ASME Code coverage.

Duke Response: This weld was examined using a manual, contact angle beam technique under the requirements of ASME Section XI, Appendix III. As stated in above response, the limitations were due to the fact that the obstructing support pads completely restricted scanning in the four areas described. Other techniques that may have been utilized would have encountered the same scanning limitations.

2.3.c) Clarify the wave mode(s) and insonification angles used for all UT examinations. If only shear wave techniques were used to examine the subject stainless steel welds, please explain why refracted longitudinal wave (L-wave) techniques where not used. The L-wave method has been shown capable of detecting planar inside diameter (ID) surface-breaking flaws on the far-side of wrought stainless steel welds. Recent studies[1,2] recommend the use of both shear and L-waves to obtain the best detection results, with minimum false calls, in austenitic welds.

Duke Response: Shear waves were used exclusively because access was available from both sides of the weld over the unobstructed length. The Duke Energy procedure for the examination of welds in pressure vessels 2 inches and less in thickness requires use of refracted longitudinal waves to examine stainless steel welds when access is limited to one side. In this case however, in the area of the limitation, the obstructions covered both sides of the weld and adjacent base material.

2.3.d) Provide cross-sectional coverage plots to describe ASME Code volumes examined.

Duke Response: Cross-sectional coverage plots are provided in Attachment A of the RAI response. Each of these two welds was limited due to the presence of four weld pads that completely restricted any scanning in the area of the weld pads. The four weld pads completely covered the weld and adjacent base metal. The examination achieved 100% coverage in the accessible areas.

2.4 Request for Relief 10-ON-002, Part D, ASME Code, Section XI, Table IWC-2500-1, Examination Category C-F-1, Items C5.11 and C5.21, Pressure Retaining Welds in Austenitic Stainless Steel or High Alloy Piping (Units 1, 2, and 3)

2.4.a) For some of the ASME Code, Section XI, Table IWC-2500-1, Examination Category C-F-1 welds there appears to be conflicting information presented in the written descriptions and the examination data. Section X.7 (where X is a specific relief request section number) of the written description stated "acceptable results" and the examination data sheets had a check mark next to "Reject" under results even when there was a check mark next to "No" indications found. In other cases the examination data had a check mark next to "Yes" for indication and "Reject" under results and there was no mention in the written description of any indications being detected or what was done to correct for any unacceptable indications.

Duke Response: Duke Energy procedures require ASME Code, Section XI examination that do not meet the requirement of Code Case N-460 to be marked "reject" for tracking purposes regardless of whether or not indications were noted. Therefore, limited exams without indications were marked "reject".

2.4.b) Clarify whether any indications were discovered as a result of ASME Code-required examination and how these indications have been dispositioned.

Duke Response: The two examinations of welds 3HP-501-23/O3.C5.21.0058 and 1LP-208-4/O1.C5.11.0076 (see Attachment B) produced recordable indications that required dispositioning. The indications were dispositioned and determined to be geometric using EPRI procedure PDI-UT-2, Section 9.5.

2.4.c) The licensee's submittal states that the subject weld areas were interrogated with a combination of 38-, 45-and/or 60-degree shear waves, and in some cases, 60- and 70-degree longitudinal waves (L-waves) were applied to detect circumferentially-oriented flaws. The licensee's submittal further states that examinations were performed in accordance with ASME Code, Section XI. Appendix VIII, and consisted of single-sided examinations from the pipe side of the welds.

Confirm the insonification angles and wave modalities used to examine each of the subject welds. Discussions with the industry's Performance Demonstration Initiative (PDI) administrator, the EPRI, indicate that ASME Code, Supplement 2 qualifications require refracted longitudinal wave methods to be applied, if possible. If only shear wave techniques were used to examine the subject stainless steel welds, please explain why refracted longitudinal wave techniques where not used as part of a "best effort" examination. The L-wave method has been shown capable of detecting planar ID surface-breaking flaws on the far-side of wrought stainless steel welds. Recent studies[1,2] recommend the use of both shear and L-waves to obtain the best detection results, with minimum false calls, in austenitic welds. If both shear and L-waves were used please state the "best effort" coverage achieved on the near- and far-side of

the subject weld volumes.

Duke Response

It has been confirmed the primary insonification angles and wave modalities used are to be 38, 45 and 60 degree shear waves. Supplemental insonification angles and wave modalities used were 60 degree longitudinal waves and 70 degree shear waves on single sided exams to supplement the missed coverage by the shear waves in the lower 1/3 region.

The requirements of the ASME Code, Section XI, Supplement 2 pertaining to 60 degree refracted longitudinal wave or 70 degree shear wave methods are to be applied during single sided exams when axial scanning can only be performed from one side of the weld. Each limited axial examination reported in Category C-F-1 was examined with a 60 degree refracted longitudinal wave or a 70 degree shear wave. Per EPRI procedure PDI-UT-2 the "best effort" examination wave mode is dependent on the pipe wall. The weld coverage calculations that are reported in this Relief Request are based on the primary inspection angles only. "Best effort" coverage calculations are included for information only.

References

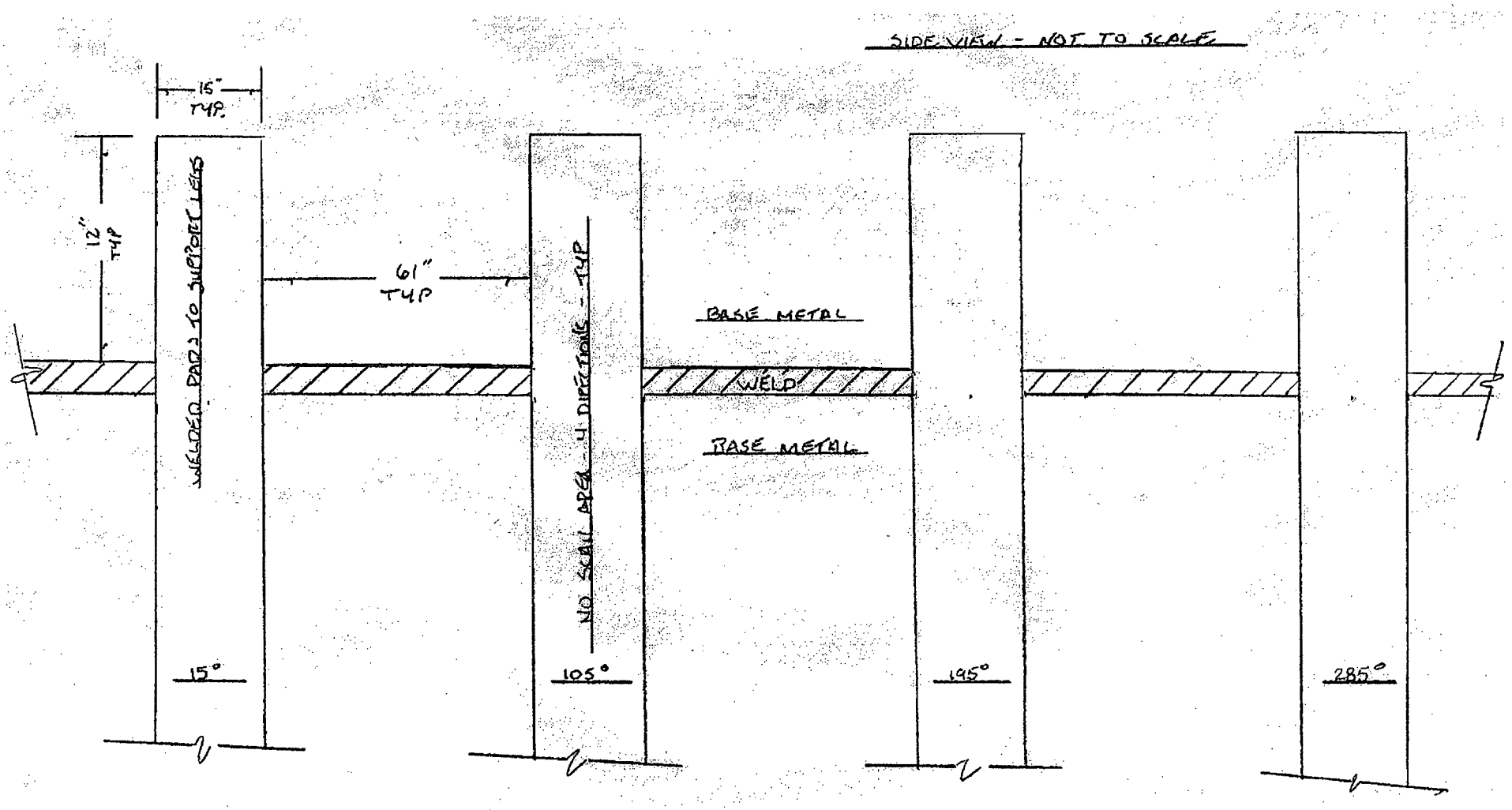
1. F. V. Ammirato, X. Edelmann, and S.M. Walker, Examination of Dissimilar Metal melds in BWR Nozzle-to-Safe End Joints, 8th International Conference on NDE in the Nuclear Industry, ASM International, 1987.

2. P. Lemaitre, T.D. Koble, and S.R. Doctor, PISC III Capability Study on "*Wrought-to-Wrought Austenitic Steel Welds: Evaluation at the Level of Procedures and Techniques, Effectiveness of Nondestructive Examination Systems and Performance Demonstration, PVP-Volume 317, NDE-Volume 14, ASME, 1995.*"

Attachment A

Cross-Sectional Coverage Plot

Attachment A



Attachment B

Example of Weld Examination

Attachment B

Duke Energy.

Ultrasonic Indication Report

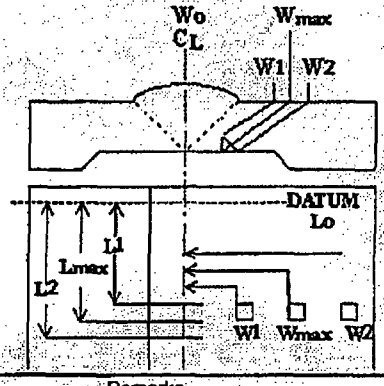
Site/Unit:	Oconee / 1	Procedure:	PDI-UT-2	Outage No.:	O1-24
Summary No.:	O1.C5.11.0076	Procedure Rev.:	C	Report No.:	UT-08-069
Workscope:	ISI	Work Order No.:	01759029	Page:	2 of 4

Search Unit Angle: 60L °

Wo Location: Centerline of Weld

Lo Location: 9.1.1.1

- (●) Piping Welds
- ( ) Ferritic Vessels ≥ 2"T
- ( ) Other



MP	Metal Path	Wmax	Distance From Wo To S.U. At Maximum Response	
RBR	Remaining Back Reflection	W1	Distance From Wo At	Of Max (Forward)
L	Distance From Datum	W2	Distance From Wo At	Of Max (Forward)

Comments:

Scan #	Indication No.	% Of DAC	W Max W	W Max MP	Forward Of Max W1	Forward Of Max MP	Backward Of Max W2	Backward Of Max MP	L1 Of Max	L Max	L2 Of Max	RBR Amp.	Remarks
S1	1	100+2 db	1.6	2.326	N/A	N/A	N/A	N/A	N/A	360	N/A	N/A	Geometry - 360 INT.

Examiner Stauffer, Lester, E.	Level III-N	Signature	Date 4/27/2008	Reviewer	Signature / Date 4-30-08
Examiner Tucker, David K.	Level II-N	Signature	Date 4/27/2008	Site Review N/A	Signature / Date
Other N/A	Level N/A	Signature	Date 4/27/2008	ANI Review	Signature / Date 5/2/08

Attachment B

Duke Energy.

Supplemental Report

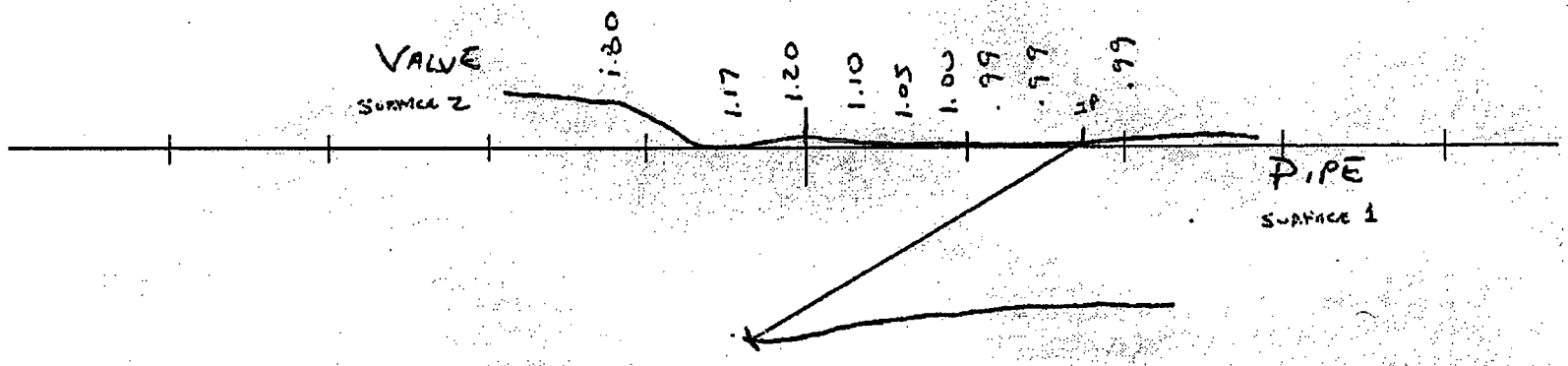
Report No.: UT-08-069

Summary No.: O1.C5.11.0076

Examiner:	Stauffer, Lester, E.	Level:	III-N	Reviewer:		Date:	4-30-08
Examiner:	Tucker, David K.	Level:	II-N	Site Review:	N/A	Date:	
Other:	N/A	Level:	N/A	ANII Review:		Date:	5/2/08

Comments: **Indication #1 - Determined to be geometry - 360 INT.**

Sketch or Photo: Z:\UT\IDDEAL\ProfileLine2.jpg



Attachment C

Clarification Page
Section 32.4 "Impracticality of Compliance"

32.4 Impracticality of Compliance

This is a cast stainless steel flow restrictor welded to wrought stainless steel pipe. This weld has a diameter of 10.0 inches and a wall thickness of 1.0 inches.

Scanning requirements are described in 10CFR.50.55a(b)(2)(xv) (A)(1). The aggregate coverage was calculated from the following:

- 60° shear waves obtained 50% coverage in one axial direction (S1 - pipe)
- 60° shear waves obtained 0% coverage in one axial direction (S2 - restrictor)
- 45° shear waves obtained 50% coverage in one circ. direction (CW).
- 45° shear waves obtained 50% coverage in one circ. direction (CCW).
- The aggregate coverage was calculated to be (50% + 0% + 50% + 50%)/4 = 37.5%.

The ultrasonic examination was performed using Appendix VIII qualified personnel, procedures, and equipment. A 60° refracted longitudinal wave was used to examine the far side of the examination volume but is not included in the percent of coverage.

The limitation was caused by the taper on the cast stainless steel flow restrictor side which prevents scanning the entire volume from four orthogonal directions. In order to obtain more coverage the weld would have to be re-designed to allow scanning from the restrictor side. This is impractical.

The Oconee Inservice Inspection Plan allows the use of Code Case N-460, which requires greater than 90% volumetric coverage. Therefore, the available coverage will not meet the acceptance criteria of this Code Case.