Duke Power®
A Duke Energy Company

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December 7, 2004

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

Subject: Duke Energy Corporation
Catawba Nuclear Station, Units 1 and 2
Docket Numbers 50-413 and 50-414
Request for Relief Number 04-CN-001
Reply to Request for Additional Information

Reference: Letter from NRC to Duke Energy Corporation, dated July 6, 2004

Pursuant to 10 CFR 50.4, please find attached the subject reply to the reference letter. The format of the reply is to restate the NRC question, followed by Catawba's response.

There are no regulatory commitments contained in this letter or its attachment.

If you have any questions concerning this material, please call L.J. Rudy at (803) 831-3084.

Very truly yours,

R. Michael Glover /for

Dhiaa M. Jamil

LJR/s

Attachment

A047

xc (with attachment):

W.D. Travers, Regional Administrator
U.S. Nuclear Regulatory Commission, Region II
Atlanta Federal Center
61 Forsyth St., SW, Suite 23T85
Atlanta, GA 30303

E.F. Guthrie, Senior Resident Inspector
U.S. Nuclear Regulatory Commission
Catawba Nuclear Station

S.E. Peters, Project Manager (addressee only)
U.S. Nuclear Regulatory Commission
Mail Stop O-8 G9
Washington, D.C. 20555-0001

REQUEST FOR ADDITIONAL INFORMATION

DUKE POWER COMPANY

CATAWBA NUCLEAR STATION, UNITS 1 AND 2

DOCKET NOS. 50-413 AND 50-414

The U. S. Nuclear Regulatory Commission (NRC) staff has reviewed the licensee's submittal dated February 19, 2004, regarding a request for relief associated with Category B-J full penetration welds of nozzles in vessels, branch connection welds, nominal pipe size 4 or larger. The NRC staff has identified the following information that is needed to enable the continuation of its review.

1. On page 2 of the submittal, you reference the nozzle to branch connection weld 1NC22-WN8, but no further information is provided. Please provide the non-destructive examination worksheets and associated figures for this weld.

Catawba response:

Manufacturer's drawings, profiles, and examination records from the 1993 inspections are attached.

a. Catawba Unit 1 Drawing CNM 1201.01-181/4
b. Catawba Unit 1 Drawing CNM 1201.01-50
c. Catawba Unit 2 Drawing CNM 2201.01-104/4
d. Catawba Units 1 and 2 Drawing CNM 1201.01-50/3A
e. Examination records for Catawba Unit 1 Weld 1NC22-WN8
f. Examination records for Catawba Unit 2 Welds 2NC11-WN8 and 2NC11-WN7

2. For the welds that you are requesting relief, identify the weld material. If a butter was used, identify the butter material. Identify the nominal reactor cooling system pipe diameter and the wall thickness for the branch connections.

Catawba response:

The weld material for all referenced branch connections is 308 stainless steel with no buttering. The reactor coolant loop piping has an inside diameter of 29 inches. The wall thickness of the branch connections are as follows:

a. Weld 1NC22-WN8 is a 12" Schedule 140 (1.125") nozzle.

b. Weld 2NC11-WN7 is a 14" Schedule 160 (1.406") nozzle.
c. Weld 2NC11-WN8 is a 12" Schedule 140 (1.125") nozzle.

3. The American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Section XI, Appendix III, III-4450 states "Welds that cannot be examined from at least one side (edge) using the angle beam technique shall be examined by another volumetric method." On page 2 of your submittal, you state that the connection is not accessible from the inside surface and that radiography cannot be performed because of geometry. Discuss the radiography performed to satisfy Appendix III requirements and explain why radiography has not been proposed or considered.

Catawba response:

The branch connection welds were fabricated by Southwest Fabricating and Welding in accordance with the requirements of ASME Section III, 1974 Edition with no addenda. Radiography was performed in the fabricator's shop where access was available from the inside for placement of the radiographic film. After installation at Catawba Nuclear Station, access is no longer possible from the inside because of the welds connecting the piping section to the main coolant loop. Radiography for inservice inspection is not an option because there is no access for film placement.

4. On page 2 of the submittal, you indicate that the subject welds were volumetrically examined during preservice and the first 10-year inservice inspection (ISI) interval. Discuss the coverage achieved, transducers used, ultrasonic testing (UT) technique (manual/automatic), and availability of the actual data from the inspections. Describe the conditions that exist that have rendered UT ineffective for the second 10-year interval.

Catawba response:

During preservice and inservice inspections for the first interval, ultrasonic examinations were performed using a manual, contact technique. The search units contained dual element, side by side, refracted longitudinal wave transducers having a frequency of 1.0 MHz, a refracted angle of 45 degrees and a focal depth of 2.5 inches. Transducer element shapes were square with a size of 1.0" x 1.0" and rectangular with a size of 0.75" x 1.0". Combinations of flat and contoured wedges were used to scan axially and

circumferentially from the main coolant loop side of the weld to the extent practical.

ASME Section XI, Appendix III paragraphs III-4420 requires coverage of the examination volume in two beam path directions. Paragraph III-4430 requires scanning over the weld crown in two opposing directions. The weld configuration as shown on the attached profile sketches, Figures 1, 2, and 3, only allows scanning from the main coolant loop side of the weld. The aggregate coverage achieved in 1993 was approximately 35% for each weld.

Preservice ultrasonic examination was performed in accordance with the requirements of ASME Section XI, 1974 Edition through the Summer 1975 Addenda. The first interval inservice ultrasonic examination was performed in accordance with the requirements of ASME Section XI, 1980 Edition through the Winter 1981 Addenda. These earlier code editions did not require that personnel demonstrate their capability to determine the difference between geometry and flaws. The second interval code of record is ASME Section XI, 1989 Edition with no addenda. Appendix III, paragraph III-2200 (b) requires such a demonstration.

Beyond these factors is the recent acknowledgement within the industry that no effective UT technique or equipment is currently available to perform code examinations on cast stainless steel materials.

5. On page 2 of the submittal, your proposed alternative is to use liquid penetrant testing (PT) and visual testing (VT-2) in lieu of volumetric examinations. The Code-required PT is performed once per interval. Will the PT be performed more frequently than once per interval? Discuss the PT and VT-2 examination frequency for the remaining ISI interval.

Catawba response:

Duke Energy Corporation will perform the code required examinations at these weld locations for the remainder of the interval. These consist of a liquid penetrant examination (completed) and a VT-2 examination performed after each refueling outage during a system leakage test.

6. If UT examinations are not capable of providing reliable information of weld integrity, provide a discussion of the potential for flaws to develop in the weld area. Influences upon the weld region include: fluid temperature

fluctuations, fluid direction (into or out of the connection nozzle), flow fluctuations, vibrations, cycling, water chemistry, etc.

Catawba response:

Flaws are not likely to develop in the stainless steel branch line nozzle to cast stainless steel reactor coolant system weld locations due to their similar metal properties, clean water chemistry, and relatively low number of thermal cycles. Similar system operating conditions exist at the reactor coolant system to steam generator (SG) nozzle welds where dissimilar metal properties are more likely to experience flaws. However, during the most recent Catawba Unit 2 outage, all eight SG nozzle welds were examined by radiography (this technique was used because of the cast stainless issue) with no service induced flaws being identified.

7. Are any of these welds included in risk-informed examination requirements? Are there other locations with similar materials and operating conditions that can be volumetrically examined?

Catawba response:

The Catawba plant does not have a risk informed inservice inspection (RI-ISI) program, but the McGuire plant does. Since the two plants have nearly identical Westinghouse reactor coolant systems, some conclusions may be drawn by comparing RI examinations required at McGuire with what could be expected for Catawba. Main coolant loop branch connection welds of this type were not evaluated to be within a high safety significant piping segment that required examination. There are circumferential piping welds joining static cast stainless steel elbows to carbon steel nozzles that can be volumetrically examined using radiography at Catawba Unit 2; however, because of the steam generator replacement at Catawba Unit 1, no such welds are in the inservice inspection plan.

8. The ASME Code provides minimum prescriptive-based examination criteria in Section XI, Appendix III. In Appendix III, Supplement 4, Paragraph 4(c), the Code recommends licensees qualify examiners and procedures using welded samples and simulated or actual flaws located in positions where geometry may make them more difficult to detect. The purpose of the examination procedure

qualification is to determine that the proposed examination technique is capable of detecting the specified flaws of interest and that the examination capabilities and limitations are identified.

In the first paragraph of page 2 of the submittal, you indicate that the demonstration used a mock-up of similar materials with flaw depths required by Section XI, Appendix VIII, Supplement 2, 1995 Edition with 1996 Addenda. The Supplement 2 flaw depths can be any through-wall depth and the inspection volume is the inner 1/3 of the through-wall depth. What are the specific flaw depths, orientations, and locations used for the demonstrations? Identify the flaw depths that can be effectively detected.

Catawba response:

The flaw depths used in the demonstration are shown below:

Flaw Depth	Flaw Orientation	Flaw Location	Flaw Length
24.5%	Circumferential	Wrought SS Safe End	0.750"
10%	Circumferential	Cast Stainless Elbow	0.400"
15.5%	Circumferential	Wrought SS Safe End	0.650"
8%	Circumferential	Wrought SS Safe End	0.485"
16%	Circumferential	Cast Stainless Elbow	0.810"

All flaws were normal to the inside surface within manufacturer's tolerance. All scanning was performed from the cast stainless steel elbow. None of the flaws were detected.

9. The ASME Code provides the minimum criteria for performing prescriptive-based UT. The licensee may use additional equipment and expertise to perform an examination. Extensive research, round-robin testing, and demonstrations have been performed on cast austenitic material using different transducer configurations (phase array, SAFT-UT, low frequency twin crystal, etc.) and data manipulation (computer) techniques. Discuss any other

equipment and UT techniques that were considered and were determined ineffective for this application.

Catawba response:

Other ultrasonic techniques were considered and rejected for these welds because of the weld joint geometry and a review of the data contained in EPRI Report TR-107481, "Status of the Ultrasonic Examination of Reactor Coolant Loop Cast Stainless Steel Materials," issued in March 1998. The results of this study indicate that an ultrasonic examination of welds in cast stainless steel main loop piping is unreliable with currently available techniques including Phased Array, SAFT, and EMAT technology when performed from the outside surface. Duke Energy Corporation is aware that Pacific Northwest National Laboratory is investigating low frequency phased array in combination with SAFT to improve flaw detection in cast stainless steel piping and will remain cognizant of changing technology that can be employed in an operating nuclear plant environment. Duke Energy Corporation will employ the latest proven techniques as they become commercially available.

10. With current capabilities for detecting flaws at depths beyond the volume identified in Figure IWB-2500-11, what is the maximum acceptable IWB-3600 flaw depth for each of the subject welds? The maximum depth should include flaw growth (based on the different flaw types, such as, low/high cycle fatigue, creep, primary water stress corrosion cracking) between examinations. Discuss the effectiveness of using UT to detect the maximum flaw depth.

Catawba response:

There are three welds associated with this relief request. Two are the welds between the Loop B hot leg and the pressurizer surge line on Units 1 and 2. The other weld is between the Loop B hot leg and the RHR suction line on Unit 2. These welds are between the centrifugally cast stainless steel piping and stainless steel nozzle forgings. Creep and primary water stress corrosion cracking are not a concern at this location based on properties of the base and weld filler materials.

For Duke Energy Corporation to respond to this question, expensive analytical work would have to be performed to establish a location-specific maximum allowable flaw depth in the piping based on IWB-3600 rules. This would involve:

1) Postulating an initial flaw size and shape,
2) Determining the stresses at the location for all operating conditions,
3) Performing a fatigue crack growth analysis (a validation that stress corrosion cracking and thermal aging in cast austenitic stainless steels are not significant concerns will be required),
4) Determining the maximum flaw dimensions at the end of the evaluation period (10 year interval between inspections), and
5) Comparing the maximum calculated flaw size to the maximum allowable flaw size for normal and upset conditions and for emergency and faulted conditions, then repeating this process to maximize the initial postulated flaw depth considering different flaw shapes while minimizing the margin between the final calculated and allowable flaw sizes.

The intent of this activity is to evaluate a location-specific flaw size with the capability of UT to detect this particular flaw. An estimate for the determination of this location-specific flaw size is roughly $75,000 for the three locations based on other recent analytical fracture mechanics evaluations. Qualified vendors to perform this work are Westinghouse, Structural Integrity Associates, and AREVA.

Alternatively, in the event of flaw development, it can be stated that due to the weld configuration geometry, flaw path propagation would be longer through the weld material than through the pipe material.

11. The inspectability of cast austenitic cast material is dependent on the material microstructure which is dependent on material cleanliness, second phase precipitates, super-cooled liquid, and heat extraction from the mold surface. Because of the variability between similar cast products, the results from a mock-up may also be a variable. Besides material specification and configuration, discuss other comparisons between the subject welds and the mock-up that support the existence of comparable microstructures.

Catawba response:

The demonstration mock-up used a statically cast stainless steel elbow with an equi-axial grain structure. The main

coolant loop piping is made of centrifugally cast stainless steel. The microstructure of the main coolant loop piping is unknown, as only destructive means can determine this and no investigations were performed during construction or preservice inspection.

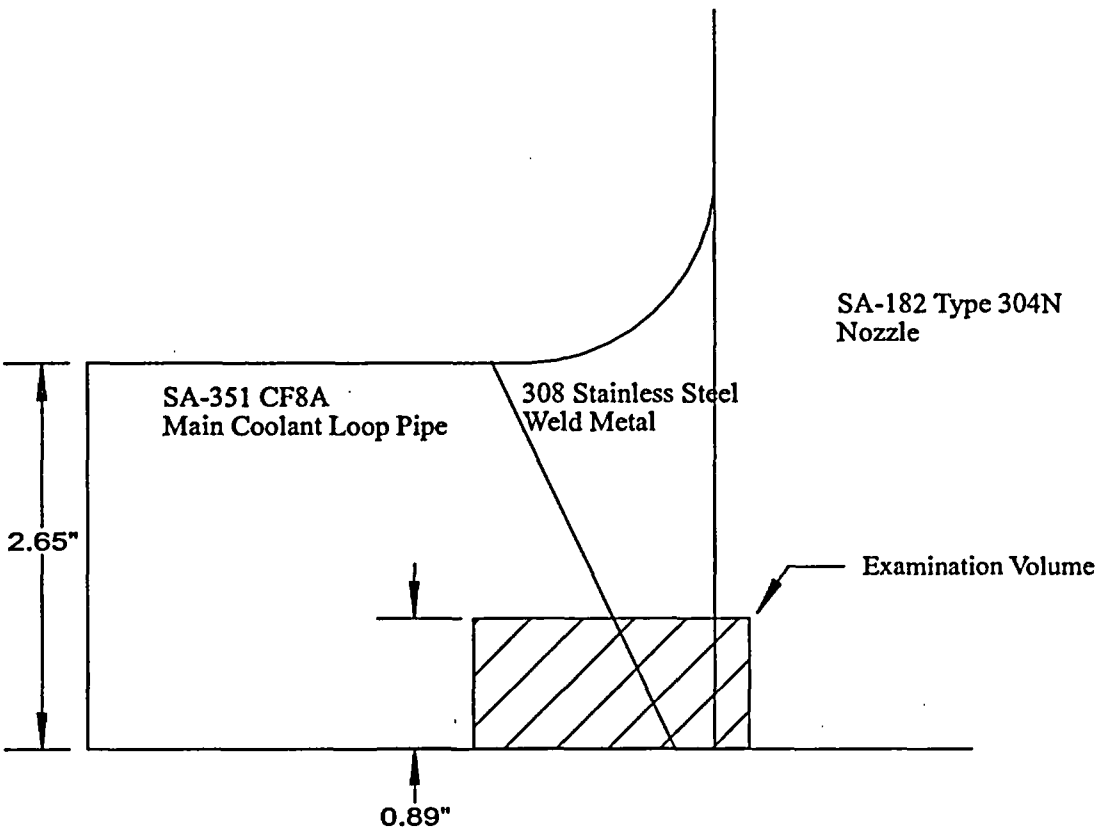
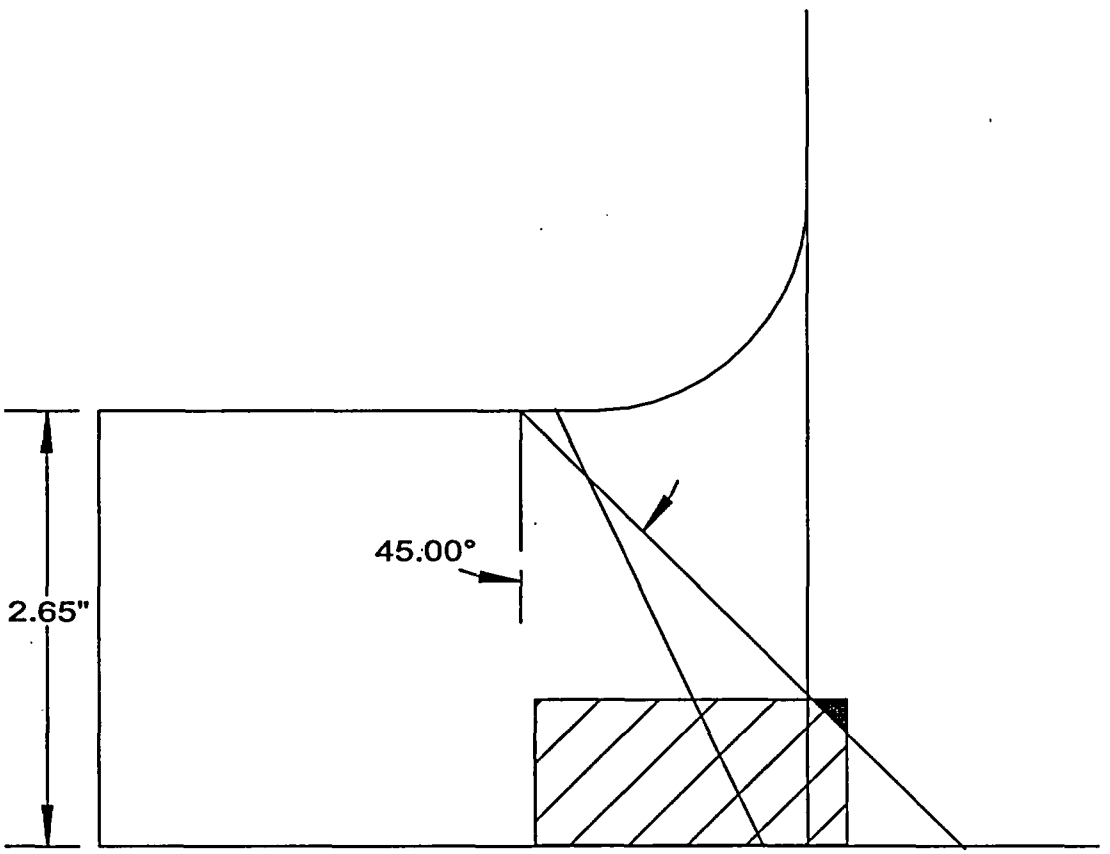
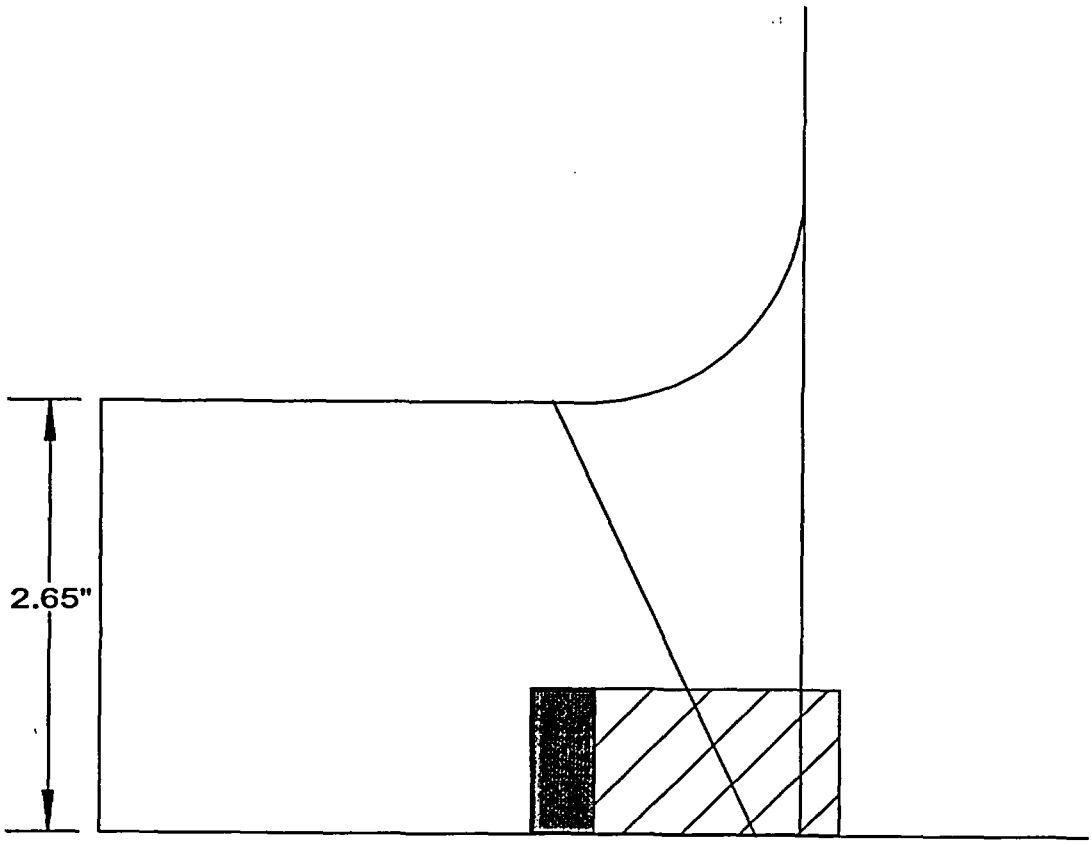


Figure 1 Cross-section Typical Branch Connection



Coverage in the axial direction = 98.8% from one direction
Red triangle shows portion not covered by sound beam.

Figure 2 Typical Coverage Plot



Circumferential scan coverage = 20% in two directions.
Shaded area covered, cross-hatch area no coverage.

Figure 3 Typical Coverage Plot

ULTRASONIC EXAMINATION DATA SHEET FOR PLANAR REFLECTORS

Exam Finish: 1000 | Revision 3

Station: Catawba | Unit: 1 | Component/weld ID: 1NC22-WN8 | Date: 11-11-93

Nominal Material Thickness (in.): 2.3" | Weld Length (in.): 63" | Surface Temperature: 32° C deg F

Measured Material Thickness (in.): 2.65" | Lo: F | Pyrometer S/N: MCNDE27016

Surface Condition: BUFFED

SCANS: 45 [X] 58 dB

45T [X] 58 dB 60 [ ] dB

0 [ ] dB 60T [ ] dB

Other: dB

Configuration: Branch Connection

S1 Flow S2

PIPE to Branch Connection

Examiner: Richard B. Childers Level: II

Examiner: Gary Moss Level: II

Calibration sheet No: 9301009

Procedure: NDE 610 Rev: 1 FC: N/A

Applies only to NDE-620, 640 and 680

Applies to NDE-680 only

Skew angle: N/A

IND NO.	∠	Max % dac	W Max	L Max	MP Max	L1 20%dac HMA 50%dac	L2 20%dac HMA 50%dac	W1 20%dac HMA 50%dac	W2 20%dac HMA 50%dac	Mp1 20%dac HMA 50%dac	Mp2 20%dac HMA 50%dac	Beam Dir	Exam Surf.	Scan	Damps
	45°	NO RECORDABLE INDICATIONS													

Remarks:

Limitations: see NDE-UT-4 [X] None: [ ]

sheet 1 of 3

Reviewed By: Larry Moulder II Level: Date: 11-11-93

Authorized Inspector: Robert M Gill Date NOV 15 1993

Item No: B09.031.003

ATTACHMENT-e page 2 of 7

Component/Weld ID: 1NC 22-WN8 Item No: B09.031.003

remarks:

☐ NO SCAN SURFACE BEAM DIRECTION

☒ LIMITED SCAN ☒ 1 ☐ 2 ☐ 1 ☒ 2 ☒ cw ☒ ccw

FROM L_____ to L_____ INCHES FROM WO 0.0" to 2.0"

ANGLE: ☐ 0 ☒ 45L ☐ 60 other ____ FROM 0 DEG to 360 DEG

Due to Branch Connection weld.

☒ NO SCAN SURFACE BEAM DIRECTION

☐ LIMITED SCAN ☐ 1 ☒ 2 ☒ 1 ☐ 2 ☒ cw ☒ ccw

FROM L_____ to L_____ INCHES FROM WO_____ to _____

ANGLE: ☐ 0 ☒ 45L ☐ 60 other FROM 0 DEG to 360 DEG

Not required by ISI Plan

☐ NO SCAN SURFACE BEAM DIRECTION

☐ LIMITED SCAN ☐ 1 ☐ 2 ☐ 1 ☐ 2 ☐ cw ☐ ccw

FROM L_____ to L_____ INCHES FROM WO_____ to _____

ANGLE: ☐ 0 ☐ 45 ☐ 60 other FROM _____ DEG to _____ DEG

☐ NO SCAN SURFACE BEAM DIRECTION

☐ LIMITED SCAN ☐ 1 ☐ 2 ☐ 1 ☐ 2 ☐ cw ☐ ccw

FROM L_____ to L_____ INCHES FROM WO_____ to _____

ANGLE: ☐ 0 ☐ 45 ☐ 60 other FROM _____ DEG to _____ DEG

Sketch(s) attached ☒ yes ☐ no

Prepared By: Richard B Childers Level: II Date: 11-11-93

Sheet 2 of 3

Reviewed By: Larry Maulden Date: 11-11-93

Authorized Inspector: Robert A McGill Date: NOV 15 1993

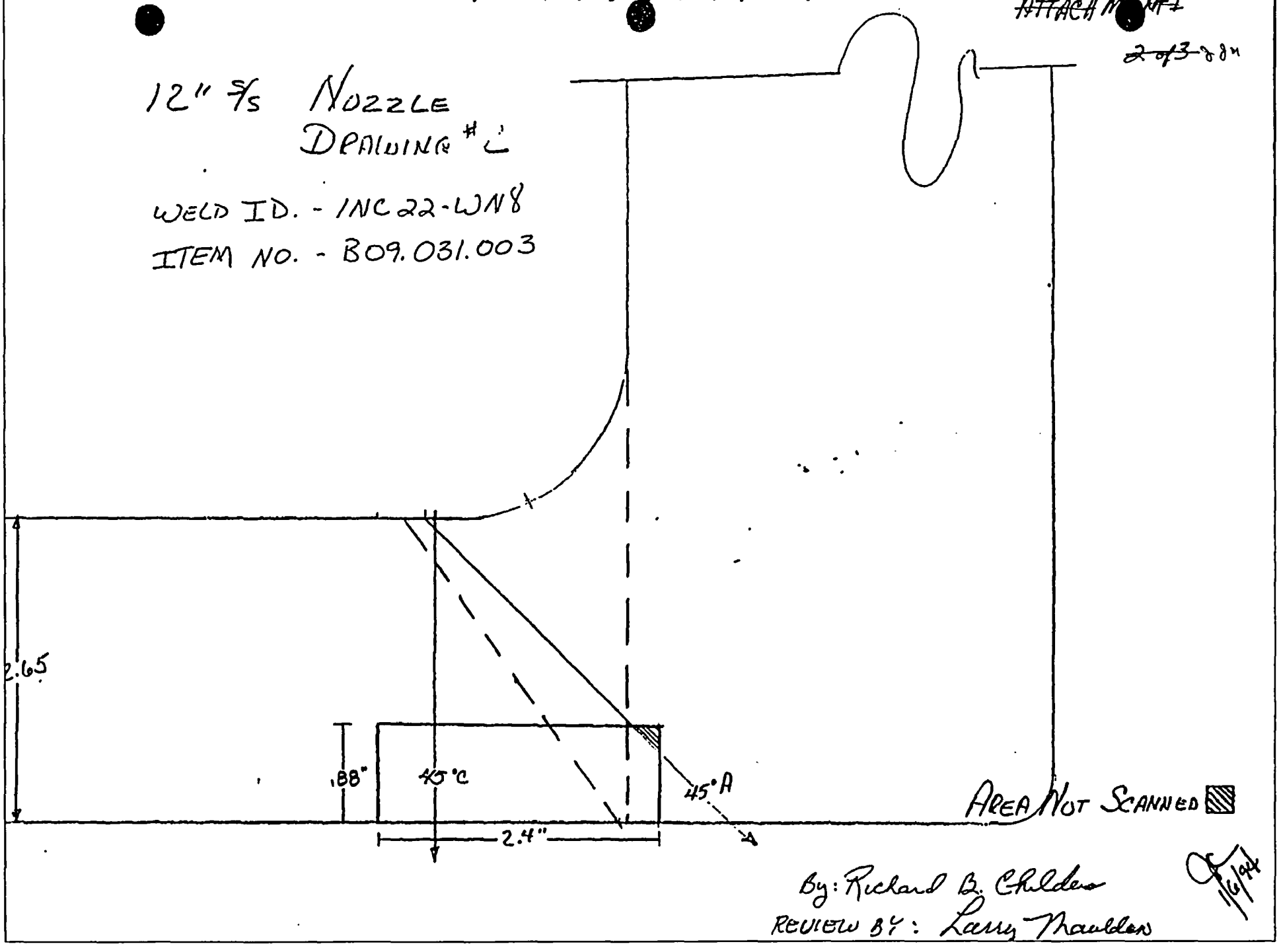
~~ATTACHMENT 1~~

~~2 of 3~~ 8M

12" S/S NOZZLE DRAWING #2

WELD ID. - INC22-WN8

ITEM NO. - B09.031.003



By: Richard B. Childers

REVIEW BY: Larry Mauldon

1/6/14

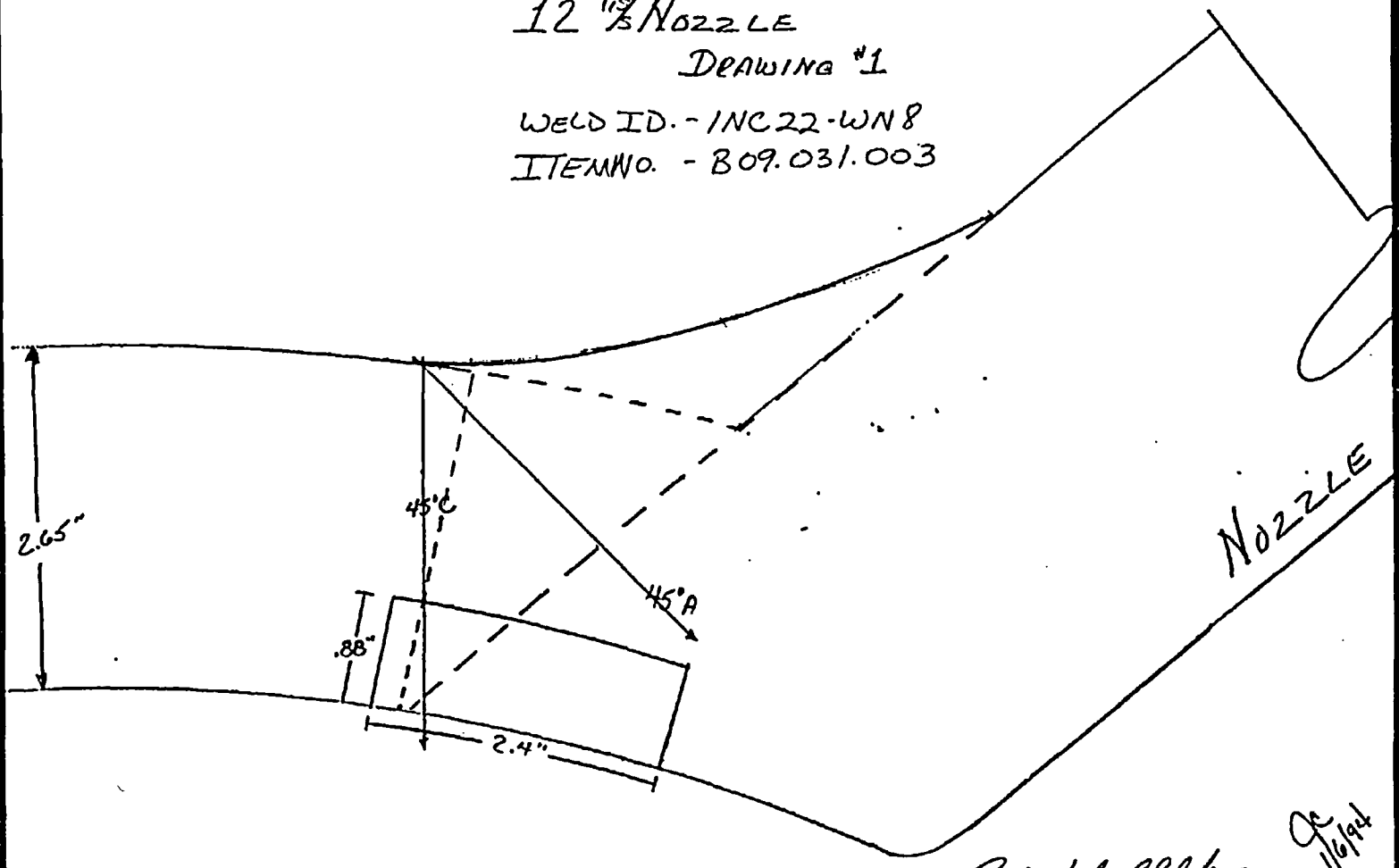
ATTACHMENT-4
Page 4 of 7
3 of 3 pgs

12 1/8" NOZZLE

DRAWING #1

WELD ID. - INC22-WN8

ITEM NO. - B09.031.003



By: Richard L Childers 1/6/94

REVIEWED BY: Larry Maulden

ATTACHMENT 1 for DS 3 of 3

Form 00184 (R4-88) DUKE POWER COMPANY

Station CATAWBA Unit 1 Rev. ____ File No. INC.22-WN8 Sheet 1 Of 3

Subject LIMITED EXAM DATA

12" S/G NOZZLE By Richard L Childers Date 11-11-93

Prob No. B09.031.003 Checked By Larry Trimble Date 11-11-93

ATTACHMENT-2 page 5 of 7

DRAWING #1

CROSS SECTIONAL AREA: .88" X 2.4" = 2.112 sq in.

X 2 SCANS

/4.224 sq in/

AREA of Loss:

AXIAL: 2.112 ÷ 4.224 X 100 = /50%/

CIRC: /No Loss/

DRAWING #2

CROSS SECTIONAL AREA: .88" X 2.9 = 2.112 sq in

X 2 SCANS

/4.224 sq in/

AREA of Loss:

AXIAL: $\frac{25\text{V.F.S}}{2}$ + 2.112 = 2.14325

2.14325 ÷ 4.224 X 100 = 50.739 82

/50.74%/

CIRC: /100%/

	AXIAL		CIRC		
DRAWING #1	50	+	0	÷ 2	= 25
DRAWING #2	50.74	+	100	÷ 2	= 75.37
					100.37

// 100.37 ÷ 2 = 50.185 = 50.19 Loss //

WITH NO LIMITATIONS

// 100 - 50.19 = 49.81% COVERAGE //

∴ // A 45° L-WAVE WAS USED TO SCAN WELD AREA 1 DIRECTION/CIRC. NO SCAN WAS PERFORMED FROM SUR 2 (Nozzle bore) DUE TO NOZZLE WELD CONFIGURATION.

OTHER LIMITATIONS: No

49.81% COVERAGE

DUKE POWER COMPANY

ULTRASONIC CALIBRATION SHEET FOR ANALOG INSTRUMENTS

FORM NDE UT-1A

REVISION 2

Station: Catawba	Unit: 1	Date: 11-11-93	Sheet number: 9301009
Procedure: NDE 610 Rev: 1 FC: N/A		Couplant: Ultragel II	Batch No: 093001
Examiner: Richard L Childers	Level: II	Calibration Block ID: 50386	Pyrometer S/N: MCNDE27016
Examiner: Gary J Moss	Level: II	Calibration Block Temp: 22°C	Cal. due: 940701

REFERENCE BLOCK

ID: 610C
Type: MOD IIW Block Material: s/s

SIMULATOR BLOCK

ID: N/A Signal Amp: Gain:
Reflector Type: Metal Path:

INSTRUMENT

Model: USK-7D
Manufacturer: Krautkramer
Serial No: 32810-922

TRANSDUCER

Type: Single ☐ Dual ☒ Size: 2-.75"X1.0" Freq: 1 Mhz Meas. ∠ 45°
Serial No: 90145 Manufacturer: Megasonics Nominal ∠ 45°

INSTRUMENT SETTINGS

Reject	0
PRF	DUAL
Delay	7.6
Range	5.0"
Velocity	220.9
Frequency	.5-7
Gain	50
Filter	Full Wave
ZERO	9.16

Thru ☐ Pulse/Echo ☒

Jack Used: T x R x

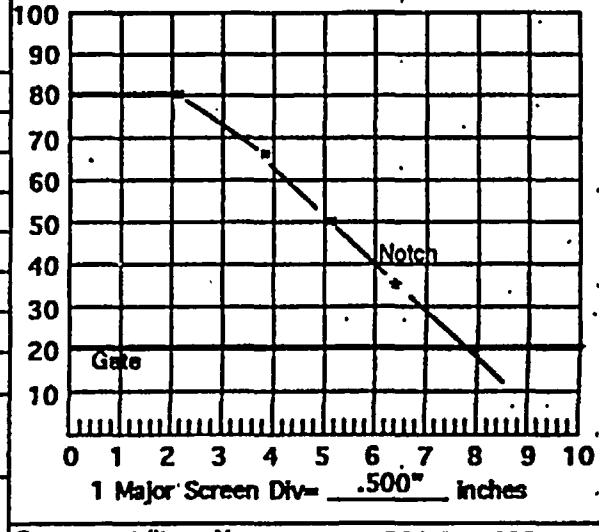
CALIBRATION

Reflector Type:Hole	amplitude % FSH	metal path inches
1/8 node	80 %	.946
2/8 node	66 %	1.52
3/8 node	50 %	2.43
/8 node	%	
/8 node	%	
/8 node	%	
other	%	
opposite notch	36 %	3.19

cal. direction: axial ☒ circ. ☒

Wave Mode: longitudinal: ☒ shear: ☐ surface: ☐

METHOD



1 Major Screen Div= .500" inches

Component/Item No: B09.031.003

CABLES

RG62	☐
RG58	☐
RG174	☒
Belden 8218	☐

Length: 6'

Initial Calibration Time: 0905

CAL CHECKS

Time	Initials
1045	RBC

REMARKS:

New reference is 52dB due to notch gain.

REVIEWED BY: Larry Maulden LEVEL: II DATE: 11-11-93

Authorized Inspector: Robert McGill DATE: NOV 15 1993

ATTACHMENT 2
Page 7 of 7

Form NDE-35A	Revision 1

DUKE POWER COMPANY

STATION CATAWBA UNIT 1

LIQUID PENETRANT EXAMINATION REPORT

Weld/ID No. 1NC22-WN8 Material Type: ☒ SS ☐ CS ☐ Inconel ☐ ____

Diameter 12.00 Schedule/Thickness 02.300

Work Order No. N/A ISI ☒ PSI ☐ Other ☐

Procedure Revision No. 14

Surface Temperature 91°F

M&TE S/N: CNNDE00004

Penetrant Materials Category:
A ☒ A(SE) ☐ B ☐ C ☐ D ☐
A(SE) Approved ____

Penetrant Materials Data:
Batch Numbers
Cleaner 90A04S
Penetrant 78E084
Developer 92D06K
Remover N/A

Fluorescent ☐ Nonfluorescent ☒

Black Light Intensity Verified
Time N/A Date N/A
Light Meter S/N: N/A

SKETCH OF ITEM EXAMINED

Acceptance Standards Used: Appendix A ☐ B ☐ C ☐ E ☐ F ☒ G ☐ H ☐ J ☐ K ☐ Other ☐

Other Acceptance Standards Used: N/A

Indication Number	Indication Type / Dimensions	Reference Documents	Construction Rejectable	ISI Reportable
	NONE			

PIR S/N: N/A Acceptable ☒

Exam Limitations: ☒ None, (100 % Examined) ☐ ____ % Examined

Comments: CNM1201.01-181/4 PC. C TO PC. P1

Examiner Roger L Burnett Level II Date 11-11-93

Examiner ____ Level ____ Date ____

Reviewed By: [illegible] Level II Date 11-11-93

Final Review	Date	ANII Review	Date	Item No.
[signature]	11-11-93	[signature]	11-22-93	B09.031.003A

0072 1138

DUKE POWER COMPANY

ULTRASONIC CALIBRATION SHEET FOR ANALOG INSTRUMENTS

FORM NDE UT-1A
REVISION 2

Station: Catawba | Unit: 2 | Date: 2-11-93 | Sheet number: 9302006

Procedure: NDE 610 Rev: 0 FC: 91-13 91-17 92-02 92-03 92-07 92-14 93-04 | Couplant: Ultragel II | Batch No: 092041

Examiner: [signature] Level: II | Calibration Block ID: 50386 | Pyrometer S/N: MCQUA-32848 Cal. due: 7/28/93

Examiner: Larry Moulder Level: II | Calibration Block Temp: 22°C

REFERENCE BLOCK

ID: 91-6549
Type: D S C Block Material: s/s

SIMULATOR BLOCK

ID: R111 Signal Amp: 62% Gain: 34.5
Reflector Type: Hole Metal Path: .983"

INSTRUMENT

Model: USK-7D
Manufacturer: Krautkramer
Serial No: 32810-950

TRANSDUCER

Type: Single ☐ Dual ☒ Size: 2-.75"X1.0" Freq: 1 Mhz Meas. ∠ 45°
Serial No: 90145 Manufacturer: Megasonics Nominal ∠ 45°

INSTRUMENT SETTINGS

Reject	0
PRF	DUAL
Delay	9.3
Range	5.0"
Velocity	229.6
Frequency	.5-7
Gain	48
Filter	Full Wave

Thru ☐ Pulse/Echo ☒

Jack Used: T x R x

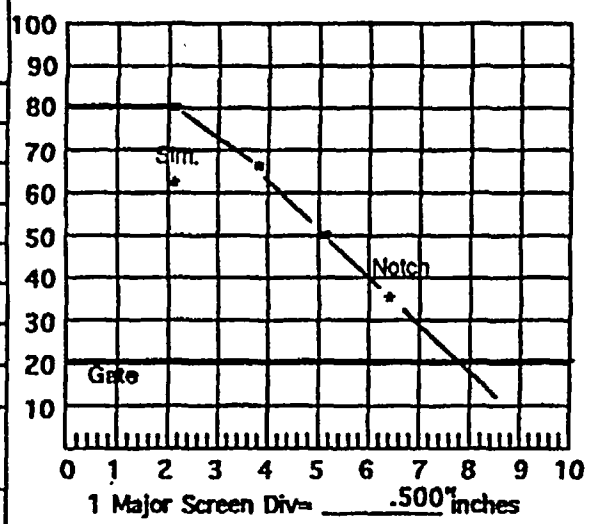
CALIBRATION

Reflector Type:Hole	amplitude % FSH	metal path inches
1/8 node	80 %	.903
2/8 node	66 %	1.729
3/8 node	50 %	2.4
/8 node	%	
/8 node	%	
/8 node	%	
other	%	
opposite notch	36 %	3.19

cal. direction: axial ☒ circ. ☒

Wave Mode:
longitudinal: ☒ shear: ☐ surface: ☐

METHOD



1 Major Screen Div= .500" inches

Component/Item No: B09.031.005 B09.031.006

CABLES

RG62 ☐
RG58 ☐
RG174 ☒
Belden 8218 ☐
Length: 6'

Initial Calibration Time: 0630

CAL CHECKS

Time	Initials
0844	DSB
0916	DSB
1025	DSB

REMARKS: Simulator was performed with pulser on high with gain at 34.5 dB. New reference is 53dB due to notch gain.

REVIEWED BY: W. C. Leaper LEVEL: II DATE: 2-15-93 Authorized Inspector: Robert McGill DATE FEB 18 1993

0 0 7 3 1 3 6 2

DUKE POWER COMPANY

ULTRASONIC EXAMINATION DATA SHEET FOR PLANAR REFLECTORS

Exam Start: 9:02 | Exam Finish: 9:15 | FORM NDE UT-2A Revision 3

Station: Catawba | Unit: 2 | Component/weld ID: 2NC11-WN8 | Date: 2-11-93

Nominal Material Thickness (in.): 2.3" | Weld Length (in.): 63" | Surface Temperature: 25° C deg F

Measured Material Thickness (in.): 2.5" | Lo: F | Pyrometer S/N: MCQUA 32848

Surface Condition: BUFFED

SCANS: 45 [X] 59 dB

45T [x] 59 dB 60 [ ] dB

0 [ ] dB 60T [ ] dB

Other: dB

Configuration: Branch Connection

S1 Flow S2

PIPE to Branch Connection

Examiner: [signature] Level: II

Examiner: [signature] Level: II

Calibration sheet No: 9302006

Procedure: NDE 610 Rev: 0 FC:SEE NOTES

Applies only to NDE-620, 640 and 680

Applies to NDE-680 only

Skew angle: N/A

IND NO.	∠	Max % dac	W Max	L Max	MP Max	L1 20%dac HMA 50%dac	L2 20%dac HMA 50%dac	W1 20%dac HMA 50%dac	W2 20%dac HMA 50%dac	Mp1 20%dac HMA 50%dac	Mp2 20%dac HMA 50%dac	Beam Dir	Exam Surf.	Scan	Damps
	45°	NO RECORDABLE INDICATIONS													

Remarks: 91-13 91-17 92-02 92-03 92-07 92-14 93-04

ucf 4/8/93

Limitations: see NDE-UT-4 [X] None: [ ]

sheet 1 of 25

Reviewed By: W. C. Leaper Level: II Date: 2-15-93

Authorized Inspector: Robert McGill Date FEB 1 8 1993

Item No: B09.031.006

4/15/93

0 0 7 . 1 3 6 3

DUKE POWER COMPANY
ISI LIMITATION REPORT

FORM NDE- UT-4
Revision 1

Component/Weld ID: 2NC 11-WN8 Item No: B09.031.006

remarks: Due to Branch Connection weld.

☐ NO SCAN	SURFACE	BEAM DIRECTION			
☒ LIMITED SCAN	☒ 1 ☐ 2	☐ 1 ☒ 2	☒ cw ☒ ccw		
FROM L_____ to L_____	INCHES FROM WO 0.0" to 2.0"				
ANGLE: ☐ 0 ☒ 45L ☐ 60 other _____	FROM 0 DEG to 360 DEG				
☒ NO SCAN	SURFACE	BEAM DIRECTION			Not required by ISI Plan
☐ LIMITED SCAN	☐ 1 ☒ 2	☒ 1 ☐ 2	☒ cw ☒ ccw		
FROM L_____ to L_____	INCHES FROM WO_____ to _____				
ANGLE: ☐ 0 ☒ 45L ☐ 60 other	FROM 0 DEG to 360 DEG				
☐ NO SCAN	SURFACE	BEAM DIRECTION			
☐ LIMITED SCAN	☐ 1 ☐ 2	☐ 1 ☐ 2	☐ cw ☐ ccw		
FROM L_____ to L_____	INCHES FROM WO_____ to _____				
ANGLE: ☐ 0 ☐ 45 ☐ 60 other	FROM _____ DEG to _____ DEG				
☐ NO SCAN	SURFACE	BEAM DIRECTION			
☐ LIMITED SCAN	☐ 1 ☐ 2	☐ 1 ☐ 2	☐ cw ☐ ccw		
FROM L_____ to L_____	INCHES FROM WO_____ to _____				
ANGLE: ☐ 0 ☐ 45 ☐ 60 other	FROM _____ DEG to _____ DEG				

Sketch(s) attached ☐ yes wel 4.4B ☐ no

Prepared By: Larry Moulder Level: II Date: 2-11-93 Sheet 2 of 5

Reviewed By: W. C. Leeper Date: 2-15-93

Authorized Inspector: Robert McGill Date: FEB 18 1993

4/15/93

ATTACHMENT F page 4 of 11

DUKE POWER COMPANY

Form 00184 (R4-88)

Station CATAWBA Unit 2 Rev. ____ File No. 2NC-WN8 Sheet 3 Of 5

Subject LIMITED EXAM DATA
12" S/G NOZZLE By Larry Trowbridge Date 2-11-93

Prob No. B09.031.006 Checked By W.C. Lee Date 2-15-93

DRAWING #1

CROSS SECTIONAL AREA: .88" X 2.4" = 2.112 sq.in.

X 2 SCANS
/4.224 sq.in/

AREA of LOSS:

AXIAL: 2.112 ÷ 4.224 X 100 = /50%/

CIRC: /No Loss/

DRAWING #2

CROSS SECTIONAL AREA: .88" X 2.4 = 2.112 sq in

X 2 SCANS
/4.224 sq.in/

AREA of LOSS:

AXIAL: $\frac{2.5 \times .5}{2} + 2.4 = 2.43125$

2.43125 ÷ 4.224 X 100 = 57.558 =
/57.6%/

CIRC: /100%/

	AXIAL	CIRC
DRAWING #1	50	0
DRAWING #2	57.6	100
	107.6/2	100/2

53.8 + 50 ÷ 2 = /51.9%/

∴ A 45° L-WAVE WAS USED TO SCAN WELD FROM 1 DIRECTION ONLY. NO SCAN WAS PERFORMED FROM SUR 2 (NOZZLE WELD) DUE TO NOZZLE WELD CONFIGURATION.

∴ NO OTHER LIMITATIONS

/AREA of LOSS 51.9%/

0007 13564

0072 1138

DUKE POWER COMPANY

ULTRASONIC CALIBRATION SHEET FOR ANALOG INSTRUMENTS

FORM NDE UT-1A
REVISION 2

Station: Catawba | Unit: 2 | Date: 2-11-93 | Sheet number: 9302006

Procedure: NDE 610 Rev: 0 FC: 91-13 91-17 92-02 92-03 92-07 92-14 93-04 | Couplant: Ultragel II | Batch No: 092041

Examiner: [signature] Level: II | Calibration Block ID: 50386 | Pyrometer S/N: MCQUA-32848

Examiner: Larry Moeller Level: III | Calibration Block Temp: 22°C | Cal. due: 7/28/93

REFERENCE BLOCK

ID: 91-6549
Type: D S C Block Material: s/s

SIMULATOR BLOCK

ID: R111 Signal Amp: 62% Gain: 34.5
Reflector Type: Hole Metal Path: .983"

INSTRUMENT

Model: USK-7D
Manufacturer: Krautkramer
Serial No: 32810-950

TRANSDUCER

Type: Single ☐ Dual ☒ Size: 2-.75"X1.0" Freq: 1 Mhz Meas. ∠ 45°
Serial No: 90145 Manufacturer: Megasonics Nominal ∠ 45°

INSTRUMENT SETTINGS

Reject	0
PRF	DUAL
Delay	9.3
Range	5.0"
Velocity	229.6
Frequency	.5-7
Gain	48
Filter	Full Wave

Thru ☐ Pulse/Echo ☒

Jack Used: T x R x

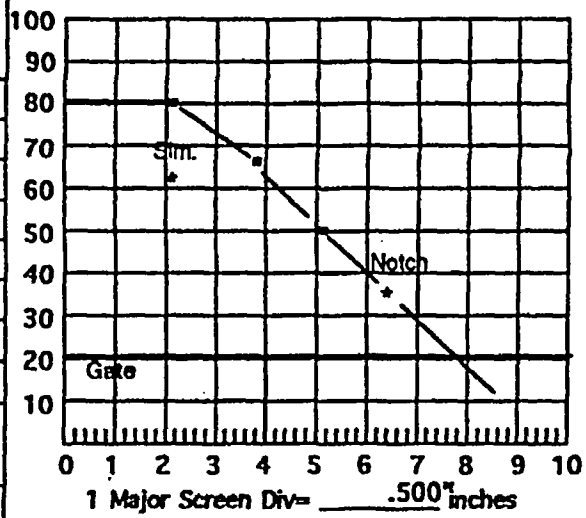
CALIBRATION

Reflector Type:Hole	amplitude % FSH	metal path inches
1/8 node	80 %	.903
2/8 node	66 %	1.729
3/8 node	50 %	2.4
/8 node	%	
/8 node	%	
/8 node	%	
other	%	
opposite notch	36 %	3.19

cal. direction: axial ☒ circ. ☒

Wave Mode: longitudinal: ☒ shear: ☐ surface: ☐

METHOD



1 Major Screen Div= .500" inches

CABLES

RG62 ☐
RG58 ☐
RG174 ☒
Belden 8218 ☐
Length: 6'

Initial Calibration Time: 0630

CAL CHECKS

Time	Initials
0844	DDB
0916	DDB
1025	DDB

Component/Item No: B09.031.005 B09.031.006

REMARKS: Simulator was performed with pulser on high with gain at 34.5 dB. New reference is 53dB due to notch gain.

REVIEWED BY: W. C. Leaper LEVEL: II DATE: 2-15-93 Authorized Inspector: Robert McGill DATE: FEB 18 1993

ATTACHMENT-F page 6 of 11

Form 28294 (RS-90) | Form NDE-25A | Revision 1

DUKE POWER COMPANY

PROJECT CATAWBA

MAGNETIC PARTICLE/LIQUID PENETRANT EXAMINATION REPORT

Weld No. 2NC11-WN8 Unit No. 2 Date 2-11-93

Diameter 12.00 Schedule/Thickness 2.300 Type Material SS ☒ CS ☐

Work Order No. N/A QA Condition 1

Procedure NDE35A-F / Rev 13

NDE-98 Approved N/A

Radiation Level N/A

Inspector	Level
[signature]	II

SKETCH OF ITEM EXAMINED

Indication Number	Indication Dimensions Length/Width/Diameter, etc.	Acceptable	Reportable	Reference Documents
NONE				

MT DATA

MT Method Used

☐ Fluorescent ☐ Nonfluorescent ☐ Wet ☐ Dry

MT Unit Serial No. _____

Particle Batch No. _____

MT Technique Used: N/A

Circular

☐ Direct Contact Amp _____

☐ Central Conductor Amp _____

MT Field Indicator Used

☐ Yes ☐ No

☐ Yoke ☐ AC ☐ DC ☐ Prod

☐ Longitudinal Number Turns in Coil _____

Amp _____

PT DATA

PT Batch Number

Cleaner 91B04K

Penetrant 78E084

Developer 92G07K

Remover N/A

☐ Fluorescent ☒ Nonfluorescent

Black Light Intensity Verified

Time N/A Date _____

Serial No. Light Meter N/A

Serial No. Black Light _____

Remarks CNM 2201.01-104/4

PC C TO PC P1

ANI Review	Date	Final QA Review	Date	Item No.
[signature]	FEB 11 1993	[signature]	2-11-93	B09.031.006A

2/23/93

0007 0810

0073154

DUKE POWER COMPANY

ULTRASONIC EXAMINATION DATA SHEET FOR PLANAR REFLECTORS

Exam Start: 8:45 | Exam Finish: 9:00 | FORM NDE UT-2A | Revision 3

Station: Catawba | Unit: 2 | Component/weld ID: 2NC11-WN7 | Date: 2-11-93

Nominal Material Thickness (in.): 2.3" | Measured Material Thickness (in.): 2.65"

Weld Length (in.): 69" | Lo: A

Surface Temperature: 25° C deg F | Pyrometer S/N: MCQUA 32848

Surface Condition: BUFFED

Examiner: J. Bibb Level: II

Examiner: Larry Mauldin Level: II

Calibration sheet No: 9302006

Procedure: NDE 610 Rev: 0 FC:SEE NOTES

SCANS: 45 [X] 59 dB

45T [X] 59 dB 60 [ ] dB

0 [ ] dB 60T [ ] dB

Other: dB

Configuration: Branch Connection

S1 Flow S2

PIPE to Branch Connection

Applies only to NDE-620, 640 and 680

Applies to NDE-680 only

Skew angle: N/A

IND NO.	∠	Max % dac	W Max	L Max	MP Max	L1 20%dac HMA 50%dac	L2 20%dac HMA 50%dac	W1 20%dac HMA 50%dac	W2 20%dac HMA 50%dac	Mp1 20%dac HMA 50%dac	Mp2 20%dac HMA 50%dac	Beam Dir	Exam Surf.	Scan	Damps
	45°	NO RECORDABLE INDICATIONS													

Remarks: 91-13 91-17 92-02 92-03 92-07 92-14 93-04

WCL 4-9-93

Limitations: see NDE-UT-4 [X] None: [ ]

sheet 1 of 8 6

Reviewed By: W. C. Leaper Level: II Date: 2-15-93

Authorized Inspector Robert McGill Date FEB 18 1993

Item No: B09.031.005

4/15/93

0 0 7 3 . 1 3 5 5

DUKE POWER COMPANY

ISI LIMITATION REPORT

FORM NDE- UT-4
Revision 1

Component/Weld ID: 2NC 11-WN7 Item No: B09.031.005

remarks:

Due to Branch Connection weld.

☐ NO SCAN ☒ LIMITED SCAN — SURFACE: ☒ 1 ☐ 2 — BEAM DIRECTION: ☐ 1 ☒ 2 ☒ cw ☒ ccw

FROM L_____ to L_____ INCHES FROM WO 0.0" to 2.0"

ANGLE: ☐ 0 ☒ 45L ☐ 60 other _____ FROM 0 DEG to 360 DEG

Not required by ISI Plan

☒ NO SCAN ☐ LIMITED SCAN — SURFACE: ☐ 1 ☒ 2 — BEAM DIRECTION: ☒ 1 ☐ 2 ☒ cw ☒ ccw

FROM L_____ to L_____ INCHES FROM WO_____ to _____

ANGLE: ☐ 0 ☒ 45L ☐ 60 other FROM 0 DEG to 360 DEG

Due to Ultrasonic Level Detector and 2.0" nozzle

☒ NO SCAN ☐ LIMITED SCAN — SURFACE: ☒ 1 ☐ 2 — BEAM DIRECTION: ☐ 1 ☒ 2 ☒ cw ☒ ccw

FROM L_____ to L_____ INCHES FROM WO 28" to 38"

ANGLE: ☐ 0 ☒ 45L ☐ 60 other FROM ____ DEG to ____ DEG

☐ NO SCAN ☐ LIMITED SCAN — SURFACE: ☐ 1 ☐ 2 — BEAM DIRECTION: ☐ 1 ☐ 2 ☐ cw ☐ ccw

FROM L_____ to L_____ INCHES FROM WO_____ to _____

ANGLE: ☐ 0 ☐ 45 ☐ 60 other FROM _____ DEG to _____ DEG

Sketch(s) attached ☐ yes ☐ no

Prepared By: Larry Thrasher Level: II Date: 2-11-93 Sheet 2 of 36

Reviewed By: W. C Lagan Date: 2-15-93 Authorized Inspector: Robert McGill Date: FEB 18 1993

4/13/93

ATTACHMENT-F page 9 of 11

0007135.6

Form 00184 (R4-88) DUKE POWER COMPANY

Station CATAWBA Unit 2 Rev. File No 2NC11-WN7 Sheet 3 Of 6

Subject LIMITED EXAM DATA

14" S/S NOZZLE By Larry Rankin Date 2-11-93

Prob No. B.09.031.005 Checked By L.C. Lepp Date 2-15-93

DRAWING #1

CROSS SECTIONAL AREA: .88" x 3.0" = 2.64 sq in.

x 2 SCANS

5.28 sq. in.

AREA of LOSS:

AXIAL: 2.64 ÷ 5.28 x 100 = 50%

CIRC: No Loss

DRAWING #2

CROSS SECTIONAL AREA: .88" x 2.45" = 2.156 sq in.

x 2 SCANS

4.312 sq. in.

AREA of LOSS:

AXIAL: $\frac{.25 \times .25}{2}$ + 2.156 = 2.18725 sq. in.

2.18725 ÷ 4.312 x 100 = 50.724 =

50.7%

CIRC: 100%

	AXIAL	CIRC
DRAWING 1	50%	0%
DRAWING 2	50.7%	100%
	100.7/2	100/2

50.35 + 50 ÷ 2 = 50.175 = 50.2% LOSS

∴ A 45° C-WAVE WAS USED TO SCAN WELD FROM 1 DIRECTION ONLY. NO SCAN WAS PERFORMED FROM SCR. 2 (NOZZLE SIDE) DUE TO NOZZLE WELD CONFIGURATION.

ATTACHMENT-F page 10 of 11

Form 00184 (R4-88) DUKE POWER COMPANY

Station CATAWBA Unit 2 Rev. ___ File No. 2NC11-6N7 Sheet 4 Of 6

Subject LIMITED EXAM DATA
14" S/S NOZZLE

By Larry Thanlin Date 2-11-95

Prob No. B09.031.005 Checked By ___ Date ___

ADDITIONAL LOSS DUE TO PERMANENT HANGER:

69" CIRCUMFERENCE WITH 10" LIMITATION
THEREFORE:

50.2% of Loss for 59" = 59/69 X 50.2 = 42.9%
100% of Loss for 10" = 10/69 X 100 = 14.5%
57.4%

TOTAL AREA OF LOSS

57.4%

0071357

Page 11 of 11

ATTACHMENT-F

0070080 09

Form 25234 (R5-89) | Form NDE-25A | Revision 1

DUKE POWER COMPANY

PROJECT CATAWBA

MAGNETIC PARTICLE/LIQUID PENETRANT EXAMINATION REPORT

Weld No. 2NC11-WN7 Unit No. 2 Date 2-11-93

Diameter 14.00 Schedule/Thickness 2.300 Type Material SS ☒ CS ☐

Work Order No. N/A QA Condition 1

Procedure NDE35A-F / Rev 13

NDE-98 Approved N/A

Radiation Level N/A

Inspector	Level
Kirby L Whitworth	II

SKETCH OF ITEM EXAMINED

Indication Number	Indication Dimensions Length/Width/Diameter, etc.	Acceptable	Reportable	Reference Documents
NONE				

MT DATA

MT Method Used

☐ Fluorescent ☐ Nonfluorescent ☐ Wet ☐ Dry

MT Unit Serial No. _____

Particle Batch No. _____

MT Technique Used: N A

Circular

☐ Direct Contact Amp _____

☐ Central Conductor Amp _____

MT Field Indicator Used

☐ Yes ☐ No

☐ Yoke ☐ AC ☐ DC ☐ Prod

☐ Longitudinal Number Turns in Coil _____

Amp _____

PT DATA

PT Batch Number

Cleaner 91B04K

Penetrant 78E084

Developer 92G07K

Remover N/A

☐ Fluorescent ☒ Nonfluorescent

Black Light Intensity Verified

Time N/A Date

Serial No. Light Meter

Serial No. Black Light

Remarks CNM 2201.01-104/4

PC B TO PC P1

ANI Review	Date	Final QA Review	Date	Item No.
Robert McGill FEB 11 1993		Rm Sea	2-11-93	B09.031.005A

2/23/93

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED: DWG. NO. CN-1680-23R/3 "DUKE POWER COMPANY CATAWBA NUCLEAR STATION UNIT 1 SPIN: RCPCFB" Attachment A WITHIN THIS PACKAGE.. OR BY SEARCHING USING DWG. NO. CN-1680-23 R/3

PROPRIETARY

D-01

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED:

"A.S.M.E. SECTION III CLASS 1 BUTT WELDING NOZZLES"

Attachment B

WITHIN THIS PACKAGE..

D-02

PROPRIETARY

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THAT CAN BE VIEWED AT THE RECORD TITLED:

DWG. NO. CN-2680-1 (R/1) "ADDED AS BUILT DATA" Attachment C

WITHIN THIS PACKAGE.. OR BY SEARCHING USING

PROPRIETARY

D-03

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THAT CAN BE VIEWED AT THE RECORD TITLED:

"A.S.M.E. SECTION III CLASS 1 BUTT WELDING NOZZLES"
Attachment D

WITHIN THIS PACKAGE..

PROPRIETARY

D-04