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November 28, 2005

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

Subject: Duke Energy Corporation
Catawba Nuclear Station, Unit 1
Docket Number 50-413
Request for Relief Number 05-CN-001
Reply to NRC Request for Additional Information

Reference: Letter from Duke Energy Corporation to NRC, dated February 17, 2005

The reference letter requested NRC relief concerning limited weld examinations conducted during the Unit 1 End of Cycle 14 Refueling Outage. On July 11, 2005, the NRC provided a request for additional information to Catawba by facsimile. This letter and its attachment provide Catawba's reply to the request for additional information. The format of the attachment is to restate the NRC question, followed by Catawba's reply.

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,

D.M. Jamil

LJR/s

Attachment

Catawba Nuclear Station 20th Anniversary 1985-2005

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

J.F. Stang, Jr., Project Manager (addressee only)
U.S. Nuclear Regulatory Commission
Mail Stop 8 H4A
Washington, D.C. 20555-0001

ATTACHMENT

REPLY TO NRC REQUEST FOR ADDITIONAL INFORMATION

Catawba Nuclear Station, Unit 1 Relief Request 05-CN-001 - Request for Additional Information

1. Were the UT procedures, equipment, and personnel qualified through a PDI Appendix VIII type of qualification of Section XI of the ASME Code? If so, please provide the specifics (i.e., Supplements etc.)

Reply:

The ultrasonic examination of the heat exchanger nozzle-to-shell welds were performed using a procedure written in accordance with ASME Section XI, Appendix III, 1989 Edition with no addenda. Personnel were qualified in accordance with the requirements of ASME Section XI, Appendix VII, 1995 Edition through the 1996 Addenda. These welds are not within the scope of Appendix VIII.

The ultrasonic examination of the valve-to-pipe weld was performed using personnel, procedures, and equipment qualified in accordance with ASME Section XI, Appendix VIII, Supplement 2, 1995 Edition through the 1996 Addenda.

2. Was a surface examination performed on the area of the welds that were not covered by UT as a supplement to achieve 100% coverage? If not, please provide justification for not attempting to use this approach to supplement the UT examination.

Reply:

Code required surface examinations were performed on the welds. (See three attached data sheets at the end of this response for C02.021.006A, C02.021.007A, and C05.011.208A.)

2.1 Request for Relief 05-CN-001, Examination Category C-A **(Duke Energy Corporation note: This should be Examination Category C-B.)**, Pressure Retaining Nozzle Welds on the Residual Heat Removal Heat Exchanger

2.1.1 In Paragraph A of the submittal (page 3 of 9) it is stated that both the nozzle and shell materials of the Residual Heat Removal (RHR) heat exchanger 1A are SA-240, F304 austenitic stainless steel. However, in Paragraph F (page 4 of 9), under *Potential Failure Mechanisms*, it is stated that the subject nozzle-to-shell welds join two carbon steel components using compatible weld material. Please clarify what type of materials are present in these nozzle-to-shell welds.

Additionally, it is stated that thermal fatigue is the only failure mechanism thought to be probable for these welds. Based on the materials present, discuss all potential failure mechanisms that have been considered for these welds. For instance, if austenitic stainless steel is the actual material, provide a basis for why stress corrosion cracking (SCC) has not been considered at these locations and include any mitigation factors that may influence initiation of SCC at welds 1ARHRHX-5-A and 1ARHRHX-5-B.

Reply:

The statement in Section VIII, Paragraph F of the February 17, 2005 submittal, "welds joins two carbon steel components using compatible weld material", was in error. Welds 1ARHRHX-5-A and 1ARHRHX-5-B are nozzle (SA240 Type 304) to shell (SA240 Type 304) welds on the Residual Heat Removal 1A heat exchanger. The welds join two austenitic base materials at an offset juncture of the 42-1/4" id shell to 14" inlet and outlet nozzles. These materials are 18Cr-8Ni stainless steels and a) have a high corrosion resistance with low contribution of corrosion products to the coolant, b) have good mechanical properties, and c) are highly weldable. Very few service induced problems with stainless steel in PWR primary system applications have been observed in operating plants. There has been limited susceptibility to stress corrosion cracking (SCC) due to chloride contamination and cracking in stagnant borated systems. However, chemistry limits on chlorides, fluorides, sulfides, and dissolved oxygen are controlled by Selected Licensee Commitments (SLC) and other administrative procedures at Catawba to ensure that any favorable conditions for SCC are precluded. Additionally, controls on welding filler material consistent with Regulatory Guide 1.31 also have served to limit the susceptibility of these welds to SCC. These lines are flushed quarterly during periodic testing of the RHR train during normal operation; thus, the concern with SCC of stagnant borated systems is not significant. No other known degradation mechanisms are applicable to this material at this particular location within the system.

2.1.2 Information provided in the licensee's submittal shows the RHR heat exchanger shell wall thickness to be approximately 0.9-inch. The American Society of Mechanical Engineers (ASME) Code requires both volumetric and surface examinations to be performed on these IWC-2500-1, Item C2.21 nozzle-to-shell welds. Confirm which type of surface nondestructive examination technique (magnetic particle or liquid penetrant) was performed on these welds, the percentage coverage obtained, whether any recordable indications were observed, and describe any limitations to these surface examinations.

Reply:

A liquid penetrant examination was performed on the subject welds. 100% coverage of the welds was obtained. No recordable indications were found. These welds had no limitations.

2.1.3 Because of severe design geometries and large weld crown build-ups, it was reported that only 14.25% volumetric coverages were obtained for each of the subject welds. The ASME Code (in IWC-2500-1, Category C-B, footnote 4) allows that in the case of multiple vessels of similar design, size and service, (such as steam generators and heat exchangers), the examinations may be limited to one vessel or distributed among the vessels. Discuss which of these requirements has been implemented at Catawba 1, and whether nozzle-to-shell welds on other RHR heat exchangers could be examined to augment the extremely low coverage on heat exchanger 1A.

Reply:

The 1989 Edition of the ASME Code (in IWC-2500-1, Category C-B, footnote 4) allows in the case of multiple vessels of similar design, size, and service (such as steam generators and heat exchangers), the examinations may be limited to one vessel or distributed among the vessels. For Catawba Unit 1, the welds scheduled for examination during the second inspection interval were distributed among the RHR heat exchangers. The nozzle-to-shell welds on the other RHR heat exchanger have the same configuration, and therefore, the welds would also have had limited volumetric coverage.

2.1.4 Based on the cross-sectional sketches provided in the submittal, it is unclear why increased coverage for scans perpendicular to the weld cannot be performed from the shell side in the 90-degree quadrant. Discuss why no scans were made from the shell side in this nozzle quadrant. Also discuss whether scans could be made from the weld crown, in any of the nozzle quadrants, to maximize coverage. Finally, discuss whether new techniques, such as phased array technology and/or modeling, could increase the ASME Code-required volumetric coverage of these nozzle-to-vessel welds.

Reply:

The examinations were performed only from the nozzle side of the weld for the following reasons:

- **The base material thickness on the vessel shell side of the weld is 0.9 inch. The base material thickness on the nozzle side of the weld is 0.375 inch. The basic calibration block listed in the outage plan and required by Appendix III was suitable only for examination from the nozzle side of the weld. A calibration block suitable for the vessel shell side was not available. The differences in material thickness and the weld joint geometry were unknown until the start of the outage. A calibration block of the appropriate thickness could not be obtained within the period for performing the examinations.**

- **Given the geometric conditions on the vessel shell side of the weld, standard manual examination techniques would have achieved limited additional coverage in the axial direction only in the 90° and 270° quadrants. These examinations were performed in November 2003. Duke Energy Corporation purchased Phased Array ultrasonic equipment in 2005, which will enhance the capability for achieving greater coverage of this weld along the entire length in the axial direction during future examinations.**

- **These welds were not previously examined either for pre-service or prior inservice inspections and there were no existing ultrasonic examination records, because the 1974 Edition, with Summer 1975 Addenda for the pre-service inspection and the 1980 Edition, with Winter 1981 Addenda for the first inspection interval of ASME Section XI for Catawba Unit 1 did not require a volumetric examination for these welds.**

2.2 <u>Request for Relief 05-CN-001, Examination Category F-A, Item F1.40, Supports, Reactor Pressure Vessel (RPV) Nozzle Supports</u>

2.2.1 In Paragraph G of the submittal, it is stated that a corrosion rate of approximately 0.007-inch/year could be expected for carbon steel exposed to water with a boron concentration of 2500 parts per million (ppm) and a temperature of 100° F. A reference is shown as [1], but no reference list is included in the licensee's submittal. Please cite the reference for the degradation rate shown above. If this reference is not publically available, please also provide a copy of the reference.

Reply:

The cited reference is EPRI Report 1000975, Boric Acid Corrosion Guidebook, Revision 1, November 2001. Section 4.4 provides corrosion rates for carbon steel materials in aerated borated water environments. A copy of this document is available to the NRC directly from EPRI at phone (800) 313-3774.

2.2.2 It was reported that some minor degradation of the coating on these supports was observed during the visual VT-3 examination, but no wastage of the underlying steel was evident. Discuss any limitations to this examination such as the presence of boric acid residue, etc. that might obscure the support surface and potentially affect the detection of carbon steel wastage.

Reply:

There were no significant deposits or accumulations of boron residues on support surfaces noted during the inspection. There were no obstructions due to leakage that precluded a visual inspection. There were some minor boron residue trails running down the walls of the nozzle inspection ports (sandboxes) but these thin translucent films did not affect visibility of support condition.

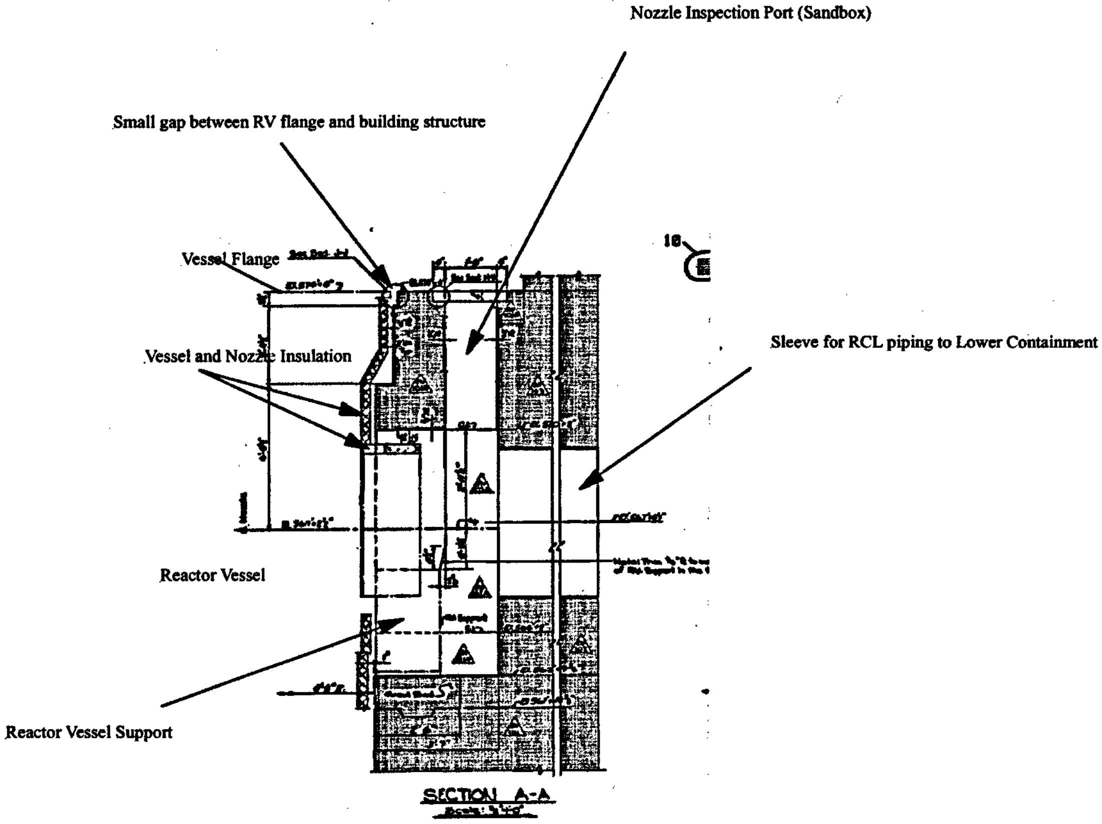
2.2.3 The submittal adequately explains the interferences caused by the RPV insulation and biological shield wall, and states that an area approximately 71-inches long by 36-inches high could not be visual VT-3 examined on the vessel side of each of the subject supports, even with remote camera systems or mirrors. Please report the percentage of the ASME Code examination boundary actually obtained for each of these supports. In addition, discuss whether access to the vessel side of these supports is available by remote means after the refueling canal has been drained and the refueling cavity/RPV seal deflated or removed.

In light of recent events, the potential for boric acid to cause severe wastage on carbon steel components is of significant concern to the staff. Several generic letters and bulletins have been issued to address the potential for degradation due to boric acid in contact with carbon steel (Generic Letter 88-05, Bulletin 2003-02, etc.). Because the vessel side of the subject supports is not currently being visually examined, provide a basis to ensure that wastage is not on-going in these areas. Additionally, discuss whether the subject RPV supports should be examined more frequently than once every 10 years, as is required by ASME Code, given these concerns.

Reply:

Approximately 50% of the support was examined. A pole camera was inserted in each of the four nozzle inspection ports (sandboxes) from above. The entire support was inspected from the outboard side. However, there is no access to the inboard side of the support.

There is no direct access to the vessel side of these supports with the refueling cavity seal removed. The drawing below shows the general configuration and the very limited space (approximately 2") between the reactor vessel and the concrete building structure. The vessel insulation in the gap between the reactor vessel and the building structure limits the access for a borescope or other optical device through the refueling cavity seal gap. Although a small gap is present, there remain two horizontal offsets and the nozzle insulation that preclude an effective visual inspection of this side of the support. The vertical distance (8 to 10 feet below the flange) combined with the horizontal offsets and existing vessel and nozzle insulation prohibit an effective remote visual examination.



The reactor vessel supports are located on four of the eight reactor vessel nozzles. The only potential welds (see note below) that represent a leakage source that could degrade the support from the inboard vessel side are the vessel nozzle to shell welds and the circumferential vessel flange to shell weld. These low alloy steel welds are volumetrically examined every ASME XI inspection interval. Based on these recent successful inspections with no reportable indications and PWR operating experience, a leak at these locations is extremely unlikely. Leakage during refueling activities through the cavity seal is possible but based on corrosion rates and the condition of the support on the sandbox side subjected to similar leakage, there is no concern with any degradation of the structural capacity of the support.

A more frequent inspection of the reactor vessel supports is not warranted based on the currently good structural condition and the relatively low corrosion rates associated with refueling water leakage. Any evidence of leakage from the primary system would be investigated to determine the source of the leak and any effects on targeted components. Since dose rates associated with these inspections are high and pressure boundary leakage is very

unlikely, there is little justification for more frequent examinations.

Note: The nozzle to piping welds (stainless steel - not Alloy 82/182) are located in the sandbox region, outboard of the supports. A leak originating at one of these locations would be evident during normal refueling activities. The effects on a reactor vessel support would be readily visible from the outboard side of the support via Catawba's boric acid corrosion program.

2.3 <u>Request for Relief 05-CN-001, Examination Category C-F-1, Item C5.11, Pressure Retaining Welds in Austenitic Stainless Steel or High Alloy Piping</u>

2.3.1 In sketches and descriptions, the submittal has adequately depicted the geometry encountered with the subject weld configuration, and the limits to volumetric examination. Given the low percentage (approximately 31.5%) of examination volume obtained for this weld, and the ASME Code requirement to only examine 7.5% of all Category C-F-1 welds, it is unclear whether the limited examination provides an adequate margin of safety for the Containment Spray (CS) system. Please describe other Category C-F-1 full penetration CS welds volumetrically examined as part of the second interval ISI program at Catawba 1. Include the population of all CS welds available for inspection, the number of examinations completed (including the subject limited examination), whether any recordable indications have been observed, and describe any limitations to the examinations performed.

Reply:

There were eleven (11) welds, of the total population, available for inspection in the Containment Spray System (NS) that met the criteria for Inspection in Category C-F-1, Pressure Retaining Welds in Austenitic Stainless Steel or High Alloy Piping, Item C5.11, Piping Welds Greater Than or Equal to 3/8 Inches Nominal Wall Thickness for Piping Greater Than NPS 4. Most of the Containment Spray System welds were exempted from examination due to their being less than 3/8 inch wall thickness. The 11 welds were selected for examination, and received an ultrasonic and a dye penetrant examination in the second inspection interval. No recordable indications were observed.

The remainder of the required 7.5% inspection sample, required by ASME Section XI, 1989 Edition, Table IWC-2500-1, were selected

from the weld population in other Class B systems. All of these selected welds received an ultrasonic and a dye penetrant examination in the second inspection interval. No recordable indications were observed.

Ultrasonic examination coverage was limited on four (4) welds during the second inspection interval. Reference the following information for the limitations:

- Item Number C05.011.201 (Weld ID. 1NS1-1) Containment Spray Pump 1A to Reducer Weld

  Examination was performed during End of Cycle 12. Only 60.00% coverage was obtained, due to accessibility limited to one side of the weld. (Reference Request for Relief Serial #01-001, dated November 28, 2001 and the NRC Safety Evaluation Report (SER), dated April 5, 2002.)

- Item Number C05.011.202 (Weld ID. 1NS1-2) Reducer to Flange Weld

  Examination was performed during End of Cycle 12. Only 59.06% coverage was obtained, due to accessibility limited to one side of the weld. (Reference Request for Relief Serial #01-001, dated November 28, 2001 and the NRC Safety Evaluation Report (SER), dated April 5, 2002.)

- Item Number C05.011.203 (Weld ID. 1NS2-1) Reducer to Flange Weld

  Examination was performed during End of Cycle 12. Only 58.15% coverage was obtained, due to accessibility limited to the pipe side of the weld. (Reference Request for Relief Serial #01-001, dated November 28, 2001 and the NRC Safety Evaluation Report (SER), dated April 5, 2002.)

- Item Number C05.011.208 (Weld ID. 1NS6-25) Reducer to Flange Weld

  Examination was performed during End of Cycle 14. Only 31.50% coverage was obtained, due to accessibility limited to one side of the weld.

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Liquid Penetrant Examination

Site/Unit:	Catawba / 1	Procedure:	NDE-35	Outage No.:	CN1E0C14
Summary No.:	C02.021.006A	Procedure Rev.:	19	Report No.:	PT-03-185
Workscope:	ISI	Work Order No.:	98577128	Page:	1 of 1

Code: Section XI, 1989 Cat./Item: C-B-/C2.21.6A Location: N/A

Drawing No.: CN-1561-1.0 Description: Inlet Nozzle to Shell

System ID: ND

Component ID: C02.021.006A/1ARHRHX-5-A Size/Length: 14.0" SS / .375

Limitations: None

Light Meter Mfg.: N/A Serial No.: N/A Illumination: N/A

Temp. Tool Mfg.: FISHER Serial No.: MCNDE32770 Surface Temp.: 86 °F

Comparator Block Temp.: Side A: N/A °F Side B: N/A °F Resolution: Not Used

Lo/Wo Location: 9.1.1.1 Surface Condition: Ground

	Cleaner	Penetrant	Remover	Developer
Brand	MAGNAFLUX	MAGNAFLUX	MAGNAFLUX	MAGNAFLUX
Type	SKC-S	SKL-SP	SKC-S	SKD-S2
Batch No.	01B07K	97A10K	01B07K	03A03K
Time	Evap. 5 Min.	Dwell 10 Min.	Evap. 5 Min.	Develop 7 Min.
	Time Exam Started: N/A		Time Exam Completed: N/A	

Indication No.	Loc L	Loc W	Diameter	Length	Type R/L	Remarks
NRI						

Comments:
FC- 02-30, 03-19, 03-22
Penetrant Category "A" / Acceptance Standard "L"

Results: Accept [✓] Reject [ ] Info [ ] Initial Section XI Inspection

Percent Of Coverage Obtained > 90%: Yes-100% Reviewed Previous Data: No

Examiner Resor, James H.	Level II	Signature [signature]	Date 10/27/2003	Reviewer [signature]	Signature	Date 10-27-03
Examiner N/A	Level N/A	Signature	Date	Site Review R.G. Hudson [signature]	Signature [signature]	Date 11-11-03
Other	Level	Signature	Date	ANII Review [signature] Robert McGill	Signature	Date 11-12-03

ASH 2/3/03

Liquid Penetrant Examination

Duke Energy

Site/Unit:	Catawba / 1	Procedure:	NDE-35	Outage No.:	CN1E0C14
Summary No.:	C02.021.007A	Procedure Rev.:	19	Report No.:	PT-03-186
Workscope:	ISI	Work Order No.:	98577128	Page:	1 of 1

Code: Section XI, 1989 Cat./Item: C-B- /C2.21.7A Location: N/A

Drawing No.: CN-1561-1.0 Description: Outlet Nozzle to Shell

System ID: ND

Component ID: C02.021.007A/1ARHRHX-5-B Size/Length: 14.0" SS / .375

Limitations: None

Light Meter Mfg.:	N/A	Serial No.:	N/A	Illumination:	N/A
Temp. Tool Mfg.:	FISHER	Serial No.:	MCNDE32770	Surface Temp.:	86 °F

Comparator Block Temp.: Side A: N/A °F Side B: N/A °F Resolution: Not Used

Lo/Wo Location: 9.1.1.1 Surface Condition: Ground

	Cleaner	Penetrant	Remover	Developer
Brand	MAGNAFLUX	MAGNAFLUX	MAGNAFLUX	MAGNAFLUX
Type	SKC-S	SKL-SP	SKC-S	SKD-S2
Batch No.	01B07K	97A10K	01B07K	03A03K
Time	Evap. 5 Min.	Dwell 10 Min.	Evap. 5 Min.	Develop 7 Min.
	Time Exam Started: N/A		Time Exam Completed: N/A	

Indication No.	Loc L	Loc W	Diameter	Length	Type R/L	Remarks
NRI						

Comments:
FC- 02-30, 03-19, 03-22
Penetrant Category "A" / Acceptance Standard "L"

Results: Accept ☑ Reject ☐ Info ☐ Initial Section XI Inspection

Percent Of Coverage Obtained > 90%: Yes-100% Reviewed Previous Data: No

Examiner Huhe, Troy	Level II-N	Signature T. Huhe	Date 10/27/2003	Reviewer	Signature [signature] Date 10-27-03
Examiner N/A	Level N/A	Signature	Date	Site Review R.G. Hudson	Signature R.G. Hudson Date 11-?-03
Other	Level	Signature	Date	ANII Review	Signature Robert McGill Date 11-12-03

AJH 2/3/04

Duke Energy.

Liquid Penetrant Examination

Site/Unit:	Catawba / 1	Procedure:	NDE-35	Outage No.:	CN1E0C14
Summary No.:	C05.011.208A	Procedure Rev.:	19	Report No.:	PT-03-269
Workscope:	ISI	Work Order No.:	98577096	Page:	1 of 1

Code: Section XI, 1989 Cat./Item: C-F-1/C5.11.208 Location: N/A

Drawing No.: CN-1NS-6 Description: Pipe to Valve (1NS1B)

System ID: NS

Component ID: C05.011.208A/1NS6-25 Size/Length: 12"/.375"

Limitations: None

Light Meter Mfg.: N/A Serial No.: N/A Illumination: N/A

Temp. Tool Mfg.: FISHER Serial No.: MCNDE32770 Surface Temp.: 80 °F

Comparator Block Temp.: Side A: N/A °F Side B: N/A °F Resolution: Not Used

Lo/Wo Location: N/A Surface Condition: As Ground

	Cleaner	Penetrant	Remover	Developer
Brand	MAGNAFLUX	MAGNAFLUX	MAGNAFLUX	MAGNAFLUX
Type	SKC-S	SKL-SP1	SKC-S	SKD-S2
Batch No.	01B07K ✓	01M07K ✓	01B07K ✓	03A03K ✓
Time	Evap. 5 min.	Dwell 10 min.	Evap. 5 min.	Develop 7 min.

Time Exam Started: N/A Time Exam Completed: N/A

Indication No.	Loc L	Loc W	Diameter	Length	Type R/L	Remarks
NRI						

Comments:
FC 02-30, 03-19, 03-22
Penetrant Category "A"/ Acceptance Standard "F"

Results: Accept ☑ Reject ☐ Info ☐

Percent Of Coverage Obtained > 90%: Yes/100% Reviewed Previous Data: Yes

Examiner Level II Todd, James K.	Signature James K. Todd	Date 11/26/2003	Reviewer Gayle E Houser Level II — Signature: G E Houser — Date: 11/26/2003
Examiner Level II-N Brooks, Jeffery	Signature Jeffery P. Brooks	Date 11/26/2003	Site Review R. G. Hudson — Signature: R. G. Hudson — Date: 12/4/03
Other Level N/A N/A	Signature	Date	ANII Review — Signature: Robert McNeill — Date: 12-18-03

AH 2/03/04