Progress Energy

10 CFR 50.55a(a)(3)(i)

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

Subject: Brunswick Steam Electric Plant, Unit Nos. 1 and 2
Docket Nos. 50-325 and 50-324/License Nos. DPR-71 and DPR-62
Response to Request for Additional Information Regarding Relief Request RR-36, Use of Ultrasonic Examinations in Lieu of Radiographic Non-Destructive Examinations (NRC TAC Nos. MC8064 and MC8065)

References: Letter from Edward T. O'Neil to the U.S. Nuclear Regulatory Commission (Serial: BSEP 05-0100), "Relief Request RR-36, Use of Ultrasonic Examinations in Lieu of Radiographic Non-Destructive Examinations," dated August 9, 2005 (ADAMS Accession Number ML052280213)

Ladies and Gentlemen:

On August 9, 2005, Carolina Power & Light Company (CP&L), now doing business as Progress Energy Carolinas, Inc., requested approval of a relief request for the Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2. The relief request involves an alternative to the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section III, NB-5200, to allow use of ultrasonic examinations of welds instead of radiographic examinations following repairs or replacements.

On January 3, 2006, the NRC provided an electronic request for additional information (RAI) concerning the welds, pipe sizes, and materials involved; the justification for applying ultrasonic examinations to wall thicknesses as low as 0.200 inches; the Code requirements that will be used for qualifications and examinations; the applicable preservice and inservice Code requirements; and information on the use of manual versus automated ultrasonic examination and the access limitations involved. The response to this RAI is provided in Enclosure 1.

In order to expedite review and approval of Relief Request RR-36 in support of upcoming BSEP, Unit 1 refueling outage activities, CP&L has revised the scope of the relief request to apply only to the specific welds being replaced during the upcoming Unit 1 refueling outage. A revised copy of Relief Request RR-36 is provided in Enclosure 2. A copy of ASME Code Case N-659 is provided in Enclosure 3.

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Please refer any questions regarding this submittal to Mr. Leonard R. Beller, Supervisor - Licensing/Regulatory Programs, at (910) 457-2073.

Sincerely,

Edward T. O'Neil
Manager - Support Services
Brunswick Steam Electric Plant

WRM/wrm

Enclosures:
1. Response to Request for Additional Information Regarding Relief Request RR-36
2. Relief Request RR-36
3. ASME Section III Code Case N-659

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Response to Request for Additional Information Regarding Relief Request RR-36

Background

On August 9, 2005, Carolina Power & Light Company (CP&L), now doing business as Progress Energy Carolinas, Inc., requested approval of a relief request for the Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2. The relief request involves an alternative to the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section III, NB-5200, to allow use of ultrasonic examinations of welds instead of radiographic examinations following repairs or replacements.

On January 3, 2006, the NRC provided an electronic request for additional information (RAI) concerning the welds, pipe sizes, and materials involved; the justification for applying ultrasonic examinations to wall thicknesses as low as 0.200 inches; the Code requirements that will be used for qualifications and examinations; the applicable preservice and inservice Code requirements; and information on the use of manual versus automated ultrasonic examination and the access limitations involved. The response to this RAI follows.

NRC Question 1:

Provide a list of the welds to be covered by this request for relief. Include the following for each weld: Unit, ASME Code Class, system/location, weld thickness, pipe size (diameter and wall thickness), pipe material, and weld material.

Response:

In order to expedite review and approval of the request for relief to support upcoming BSEP, Unit 1 refueling outage activities, CP&L has revised the scope of the request for relief to apply only to the specific welds associated with replacement of the 1B21-F016 and 1B21-F019 main steam drain line isolation valves during the upcoming Unit 1 outage.

The following welds are associated with the planned replacement of the 1B21-F016 and 1B21-F019 isolation valves:

1-B21-1275	For the upstream pipe to valve V5016 in the drywell
1-B21-1276	For the downstream pipe to valve V5016 in the drywell
1-B21-1278	For the upstream pipe to valve F016 in the drywell
1-B21-1279	For the downstream pipe to valve F016 in the drywell
1-B21-1287	For the upstream pipe to valve F019 in the MSIV pit

Two sketches are attached which depict the piping configuration of the main steam drain line for the F016 and F019 valves.

For the main steam drain line containing the 1B21-F016, 1B21-F019, and 1B21-V5016 isolation valves, information on the pipe size and material and weld thickness involved are listed below.

Unit:	1
ASME Code Class:	1
System/location:	Nuclear Steam Supply System / Drywell and Main Steam Isolation Valve Pit
Weld thickness:	0.438 inch nominal thickness
Pipe size:	3-inch nominal pipe size Schedule 160 (0.438 inch nominal thickness)
Pipe material:	SA-333 Gr. 6 (pipe); SA-216 Gr. WCB (valve)
Weld material:	ER 70S-6

NRC Question 2:

The request is to expand the application of Code Case N-659 from 0.500 inches to 0.200 inches. Provide technical justification for using ultrasonic testing (UT) in lieu of radiography testing (RT) for welds (identified in question 1) having weld thicknesses less than 0.500 inches.

Response:

The use of the UT method for full penetration butt welds with a nominal wall thickness of 0.200 inches to 6 inches has been in the ASME Code, Section XI for many years. The lower value of 0.200 inches, for the UT method, was technically accepted for use in the 1977 Edition of the Code (i.e., Appendix III). Appendix III of the 1989 Edition of the Code continues to allow the use the UT method on piping systems with a nominal wall thickness of 0.200 inches. Since the lower value of 0.200 inches has been approved for use by the Board of Nuclear Codes and Standards and regulatory authority, CP&L saw no technical reason for limiting our request for relief to 0.500 inches.

In addition, the use of the UT method on nominal wall thicknesses below 0.500 inch has been technically proven by the Performance Demonstration Initiative (PDI). PDI generic procedures for austenitic and ferritic piping have been successfully qualified using crack implant samples with minimum thicknesses of 0.237 inch.

For additional assurance, CP&L has purchased a mock-up containing a surface connected and subsurface planar flaws oriented parallel to the fusion line. The through-wall and length dimensions of these flaws meet the same requirements specified in Code Case

N-659. CP&L will use this mock-up to demonstrate the effectiveness of the UT method on materials with nominal wall thicknesses below 0.500 inches.

In order to expedite review and approval of Relief Request RR-36 in support of upcoming BSEP, Unit 1 refueling outage activities, CP&L has revised the scope of the relief request to apply only to the specific welds being replaced during the upcoming Unit 1 refueling outage. As a result of the revision, the weld thickness for the proposed UT examination will be 0.438 inch rather than 0.200 inch.

NRC Question 3:

Code Case N-659 has specific criteria for qualifying personnel and procedures to examine through-wall weldments. Discuss which section and appendices of the ASME Code (Section III, Section V, Section XI, Appendix VIII) will be used for the repair/replacement nondestructive examination (NDE) qualification and examination activities.

Response:

Repair/replacement NDE examination activities will be performed using the 2001 Edition, with no addenda, of the ASME Code, Section V, Article 5. This is consistent with the requirements of Code Case N-659. The procedure will meet the requirements of the ASME Code, Section V, Article 5 and will be qualified using the qualification block mock-up discussed earlier. As required by Code Case N-659, the qualification block must contain flaws with through-wall dimensions no larger than the diameter of the applicable side-drilled hole in Figure T-542.2.1 of Section V and with lengths no longer than the shortest unacceptable elongated discontinuity length listed in ASME Code, Section III, paragraph NB-5330 for the thickness of the weld being examined. The procedure will be considered qualified if the implanted flaws are detected and length sized correctly.

Personnel performing these examinations will also meet the requirements of ASME Section V (i.e., 2001 Edition with no Addenda). Section V requires personnel to be qualified in accordance with SNT-TC-1A, *Personnel Qualification and Certification in Nondestructive Testing* or American National Standards Institute/American Society for Nondestructive Testing (ANSI/ASNT) CP-189, *ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel.* CP&L written practice, NDE Procedure-A, *Nuclear NDE Program and Personnel Process* meets the requirements of SNT-TC-1A and ANSI/ASNT CP-189.

NRC Question 4:

The UT requirements for Section III may not be the same as for Section XI preservice and inservice examinations. Discuss which sections and appendices of the ASME Code will be used for preservice and inservice inspection (ISI) NDE qualification and examination activities, if required for the subject welds. List which welds covered by this relief request require preservice and ISI.

Response:

The welds covered by the request for relief are exempt from volumetric and surface examination as allowed by the ASME Code, Section XI, IWB-1220. The only ISI preservice examination that will be performed on the subject welds will be a VT-2 examination, as required by the ASME Code, Section XI, IWA-4700.

NRC Question 5:

The request is to record indications using less precise location criteria than the permanent record provided by RT and the criteria in Code Case N-659. The permanent record provides a baseline for geometric, metallurgical and fabrication indications. Discuss how the proposed manual phased array system meets the intent of the Code and the code case requirement for providing a permanent retrievable record for look-backs should a problem be identified in any of the subject welds after being returned to service. For the subject welds, provide information on access and limitations hindering the use of an automated data acquisition system, automated positioning with manual movement or RT. Provide a cross section sketch of the welds showing the restrictions.

Response:

The proposed alternative will provide a permanent retrievable record. The data collected with the manual phased array system will be stored on the onboard hard drive during scans and later transferred to a CD-ROM for storage and retrieval. No gating or thresholding of the signal response from any required examination volume will be performed on the data collected. This will ensure availability of the unfiltered data and permanent electronic data storage for subsequent comparison of examinations if needed.

The equipment that CP&L will use records the scanning positions by documenting the scan increments according to file numbers (i.e., scanning position 0 to 2 inches recorded on file number "weld-A-1," scanning position 2 to 4 inches recorded on file number "weld A-2," and so on). Although indication lengths cannot be measured directly from the captured images, CP&L will obtain actual length measurements of identified indications during the scanning process and document them in the final report.

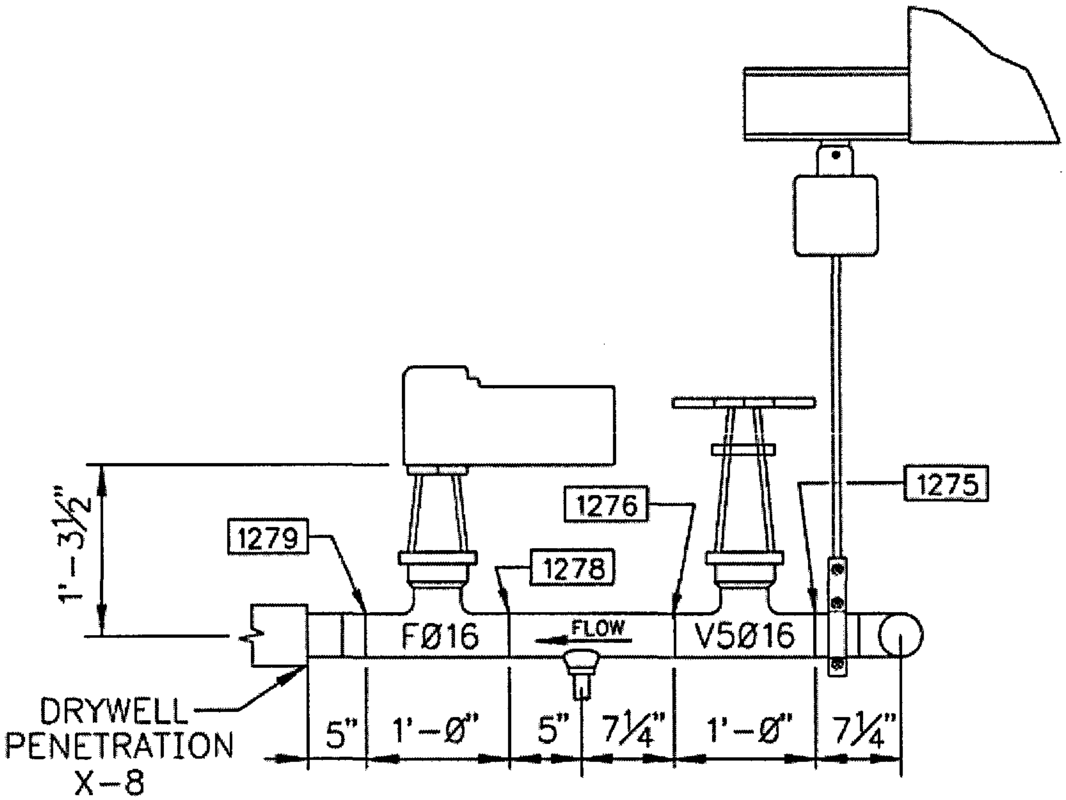
The computer aided data acquisition also provides second/third party reviewable examination results. This method of data storage/retrieval is equivalent to that provided by other commercial automated UT systems currently being used in the nuclear industry. The ASME Code has also accepted the use of digital media for storage of radiographic images in the 2004 Edition of the ASME Section V, Article 2 Mandatory Appendix.

CP&L believes the use of this method meets the intent of the Code Case. By using computer aided data acquisition and manually length sizing, CP&L will have a permanent retrievable record that can be used should a problem be identified in any of the subject welds after being returned to service.

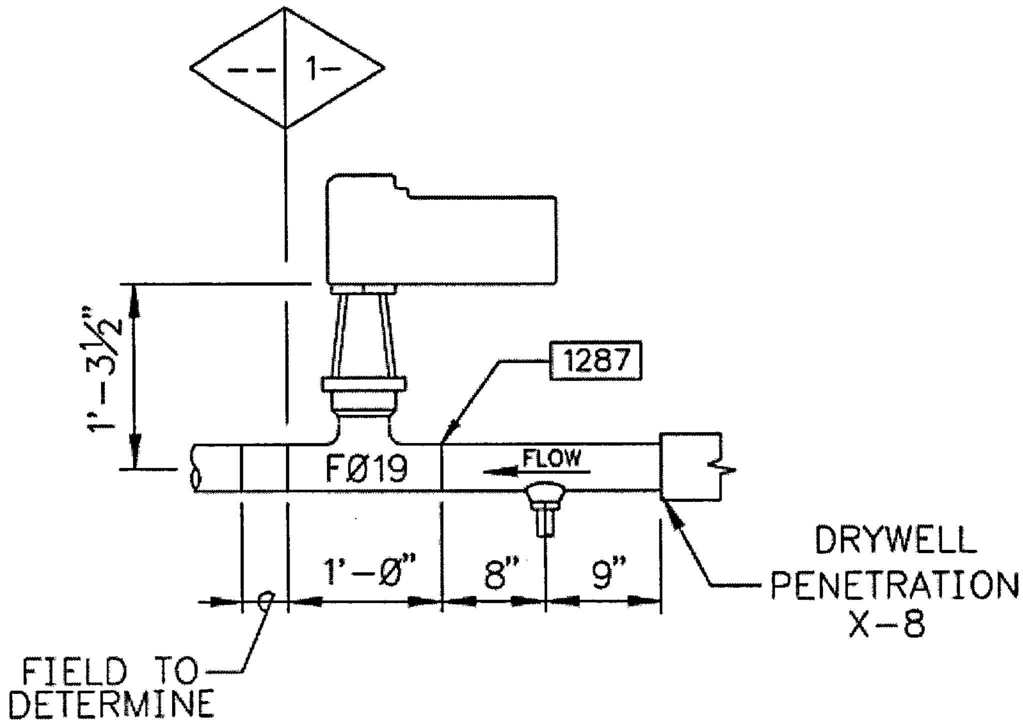
As previously stated, in order to expedite review and approval of the request for relief to support upcoming BSEP, Unit 1 refueling outage activities, CP&L has revised the scope of Relief Request RR-36 to apply only to the specific welds associated with replacement of the 1B21-F016 and 1B21-F019 main steam drain line isolation valves during the upcoming Unit 1 refueling outage. The plant modification replacing the 1B21-F016 and 1B21-F019 main steam drain line isolation valves will install three valves in a system that was previously designed for two valves. As a result, the unobstructed length of piping adjacent to each valve will be significantly less than originally designed. Manual pipe scanners are available to allow encoding of data, but are limited to a minimum pipe diameter of 4 inches. The pipe containing the welds addressed by this relief is 3 inches in diameter. If used, scanners need to be mounted adjacent to the weld on a smooth pipe surface. For off-the-shelf scanning equipment, the typical clearance needed is 12 to 18 inches to allow the scanner arm to extend and retract. The configurations of the welds addressed in this request allow a maximum clearance of less than 8 inches. These welds are pipe-to-valve configurations which limit scanner placement to the pipe side due to the irregular shaped surfaces of the valves in question. The pipe side access restriction for each weld is discussed below:

1-B21-1275	Welded in-tee fitting upstream of weld
1-B21-1276	Welded sockolet downstream of weld
1-B21-1278	Welded sockolet upstream of weld
1-B21-1279	Drywell penetration downstream of weld
1-B21-1287	Welded sockolet upstream of weld

The drawings shown in Attachments 1 and 2 show the access restrictions discussed above. The access restrictions listed above do not prohibit the use of RT; however, the use of UT will allow inspections to take place in parallel with other outage activities within the vicinity of the MSIV drain line. RT will require evacuation of the drywell and MSIV pit for a minimum of four hours for each location. Repairs or RT reshots would result in additional impact to the outage schedule. There is also less risk of accidental radiation exposure using UT versus RT.



LOOKING NORTH



LOOKING NORTH

10 CFR 50.55a Request Number RR-36

Proposed Alternative In Accordance with 10 CFR 50.55a(a)(3)(i)

- Alternative Provides Acceptable Level of Quality and Safety -

1. ASME Code Components Affected

Code Class:	Class 1
Category:	Not applicable.
System:	Nuclear Steam Supply System
Location:	Drywell and Main Steam Isolation Valve Pit
Unit:	Unit 1
Pipe Size:	3-inch nominal pipe size Schedule 160 (0.438 inch nominal thickness)
Pipe Material:	SA-333 Gr. 6 (pipe); SA-216 Gr. WCB (valve)
Weld Material:	ER 70S-6
Weld Thickness:	0.438 inch nominal thickness
Affected Components:	ASME Code, Section XI, Class 1 piping welds
1-B21-1275	For the upstream pipe to valve V5016 in the drywell
1-B21-1276	For the downstream pipe to valve V5016 in the drywell
1-B21-1278	For the upstream pipe to valve F016 in the drywell
1-B21-1279	For the downstream pipe to valve F016 in the drywell
1-B21-1287	For the upstream pipe to valve F019 in the MSIV pit

2. Applicable Code Edition and Addenda

The Code of Record for the third 10-year inservice inspection interval at the Brunswick Steam Electric Plant (BSEP), Units 1 and 2, is the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, 1989 Edition, with no addenda.

The third 10-year inservice inspection interval began May 11, 1998, and will conclude on May 10, 2008.

3. Applicable Code Requirement

The ASME Code, Section XI, IWA-4120(a) and IWA-7210(b), requires that items used for repair or replacement meet the owner's design specification and original construction Code for the component.

The ASME Code, Section III, NB-5200, "Required Examination of Welds," requires that circumferential welded joints in piping, pumps, and valves be examined using the radiographic (RT) method and either liquid penetrant or magnetic particle examination methods.

The ASME Code, Section XI, IWA-4700, "Pressure Test," requires the performance of a hydrostatic test following repairs by welding. ASME Code Case N-416-3, "Alternative Pressure Test Requirement for Welded Repairs, Fabrication Welds for Replacement Parts and Piping Subassemblies, or Installation of Replacement Items by Welding, Class 1, 2, and 3 Section XI, Division 1," allows a system leakage test in lieu of the performance of a hydrostatic pressure test. However, Code Case N-416-3 requires that non-destructive examination (NDE) methods and acceptance criteria for welded repairs, fabrication, and installation joints meet the applicable subsection requirements of the 1992 Edition of the ASME Code, Section III. This ASME Code Case is listed in NRC Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," Revision 14, as being conditionally accepted provided the provisions of IWA-5213, "Test Condition Holding Times," 1989 Edition, are used.

4. <u>Reason for Request</u>

The bases for the NDE requirements in the design specification used during the construction of the two Brunswick units were the 1965 and 1968 Edition of the ASME Code, Section III, which dealt only with pressure vessels at that time; the 1967 Edition of United States of America Standard (USAS) B31.1.0; the 1965 Edition of American National Standards Institute (ANSI) B31.7; and the collective engineering opinion of what the anticipated NDE requirements of the 1971 Edition of the ASME Code, Section III (i.e., this edition introduced requirements for piping) would be.

In 1987, a piping specification and Code reconciliation was performed and established the 1986 Edition of the ASME Code, Section III, as the specification requirement for NDE of piping classified as ASME Class 1, 2, and 3. The 1967 Edition of USAS B31.1.0 remained the Code of Record for design.

During the third inspection interval, Carolina Power & Light Company (CP&L), now doing business as Progress Energy Carolinas, Inc., is implementing the alternative requirements specified in ASME Code Case N-416-3. This ASME Code Case is listed in NRC Regulatory Guide 1.147, Revision 14, as being conditionally accepted provided the provisions of IWA-5213, "Test Condition Holding Times," 1989 Edition, are used. The Code Case allows a system leakage test in lieu of the performance of a hydrostatic pressure test. To use this alternative, the NDE methods and acceptance criteria for welded repairs, fabrication, and installation joints must meet the applicable subsection requirements of the 1992 Edition of the ASME Code, Section III. Later revisions to Code Case N-416 may be implemented by CP&L following their incorporation into Regulatory Guide 1.147.

In both the 1986 and 1992 Edition of the ASME Code, Section III, the use of the radiographic examination (RT) method is required in subarticle NB-5200. The use of the ultrasonic examination (UT) method as an acceptable alternative is not allowed for circumferential welded joints in piping.

Since the performance of the RT method involves the use of highly radioactive isotopes, inadvertent or accidental exposure of personnel can and has occurred within the nuclear industry. To remove the inherent hazards associated with industrial radiography, CP&L proposes to use a qualified UT method in lieu of the RT method specified in the ASME Code, Section III. CP&L has evaluated the use of this alternative method and determined that its use will provide a level of quality and safety that is equivalent or superior to RT.

5. Proposed Alternative and Basis for Use

Proposed Alternative

In accordance with 10 CFR 50.55a(a)(3)(i), CP&L proposes to use a qualified UT method as an acceptable alternative to the RT method specified in CP&L's specification for NDE (i.e., the 1986 Edition of the ASME Code, Section III) for weld repairs, fabrication of welds for replacement parts and piping subassemblies, or installation of replacement items. CP&L plans to continue using ASME Section XI Code Case N-416-3. Since Section XI Code Case N-416-3 requires use of the RT method mandated by the 1992 Edition of the ASME Code, Section III, use of a qualified UT method as an alternative to the RT method mandated by the 1992 Edition of the ASME Code, Section III, is also proposed by CP&L.

This proposed alternative method is similar to the guidance provided in ASME Section III Code Case N-659 and, is described below. A copy of ASME Section III Code Case N-659 is provided in Enclosure 3.

Where the UT method will be performed in lieu of RT, the following requirements will be implemented:

1. The nominal weld thickness will be 0.438 inch or greater.

2. The ultrasonic examination area will include 100 percent of the volume of the entire weld, plus 0.5T on each side of the weld, where T is the nominal thickness of the weld.

3. The UT will be performed using two techniques.

   (a) The first will be a manual UT in accordance with the ASME Code, Section V, Article 5, up to and including the 2001 Edition. A straight beam and two angle beams having nominal angles of 45 and 60 degrees will generally be used; however, other pairs of angle beams may be used, provided the measured difference between the angles is at least 10 degrees.

   (b) The second technique will be a manual phased array technique capable of recording the scans and generating angles of propagation that encompass the angles used during the manual technique (i.e., from 40 to 65 degrees). Examination scans will be in four directions: two beam path directions perpendicular to the weld axis and two beam path directions parallel to the weld

axis. Where the examination scan perpendicular to the weld is limited on one side, the second leg of the V-path may be used to achieve the two beam path directions provided that the detection capability of that technique is included in the procedure demonstration described in paragraphs 4 and 5 below.
A supplemental straight beam will also be used to scan the weld and adjacent base metal.

4. A written procedure will be prepared and followed. The procedure will be demonstrated to perform acceptably on a qualification block or specimen that includes a weld with both surface and subsurface flaws as described in paragraph 6 below.

5. The qualification block material will conform to the requirements applicable to the calibration block and in addition meet the following requirements.

   (a) The material from which blocks are fabricated will be one of the following: a nozzle dropout from the component; a component prolongation; or material of the same material specification, product form, and heat treatment condition as one of the materials joined. For piping, if material of the same product form and specification is not available, material of similar chemical analysis[1], tensile properties, and metallurgical structure[2] may be used.

   (b) Where two or more base material thicknesses are involved, the calibration block thickness will be of a size sufficient to contain the entire examination path.

   (c) Qualification block configuration will contain a weld representative of the joint to be ultrasonically examined, including, for austenitic materials, the same welding process.

6. The qualification block will include at least two planar flaws in the qualification block weld, one surface and one subsurface oriented parallel to the fusion line. The flaws will be no larger in the through-wall direction than the diameter of the applicable side-drilled hole in the calibration block shown in Figure T-542.2.1 of ASME Code, Section V, Article 5, and no longer than the shortest unacceptable elongated discontinuity length listed in NB-5330 of the ASME Code, Section III, for the thickness of the weld that will be examined.

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[1] Chemical composition should be within the same ranges as required in the original material specification. The chemical ranges of the calibration block may vary from the material specification if: (1) it is within the chemical range for the components specification to be inspected, and (2) the phase and grain shape are maintained in the same ranges produced by the thermal process required by the material specification.

[2] Same phase and grain shape as produced by the thermal process for the original specification.

7. The UT method will not be applied to weld examination volumes that include cast product forms or austenitic corrosion-resistant-clad piping butt welds.

8. A documented examination plan will be provided showing the transducer placement, movement, and component coverage that provides a standardized and repeatable methodology for weld acceptance. The examination plan will also include the ultrasonic beam angles used, beam directions with respect to weld centerline, and volume examined for each weld.

9. The ultrasonic examination will be performed using a computer data acquisition system that records the UT data. The UT data will be recorded in unprocessed form. A complete data set with no gating, filtering, or thresholding for response from the examination volume in paragraph 2 above will be included in the data record.

10. Personnel who acquire and analyze ultrasonic data will be qualified and trained using the same type of equipment as in paragraph 9 above, and demonstrate their capability to detect and characterize the flaws using the procedure as described in paragraph 4 above.

11. The evaluation and acceptance criteria will be in accordance with the applicable requirements of NB-5330 of the ASME Code, Section III. Flaws exceeding the applicable acceptance criteria will be repaired, and the weld subsequently re-examined using the same UT method that detected the flaw.

12. For welds subject to inservice inspection UT examination, the examination and evaluation will also meet preservice requirements specified in the ASME Code, Section XI, 1989 Edition.

13. Review and acceptance of the UT procedure by the Authorized Nuclear Inservice Inspector will be obtained.

14. All other related requirements of Repair/Replacement Program will be met.

Basis for Use

In accordance with 10 CFR 50.55a(a)(3)(i), relief is being requested on the basis that the proposed alternative provides an acceptable level of quality and safety to that of the applicable Code requirement.

The RT and UT methods are complementary, and are not directly comparable or equivalent. Depending on flaw type (i.e., volumetric or planar) and orientation, the RT method may be superior to the UT method or vice versa.

The RT method is most effective in detecting changes in material density, such as volumetric type flaws (i.e., slag and porosity), and planar type flaws with detectable density differences, such as lack-of-fusion and open cracks that are oriented in a plane parallel to the X-ray beam.

However, the RT method is limited in detecting small changes in density such as tight, irregular planar flaws and non-optimal oriented planar flaws with respect to the X-ray beam. The RT method is also limited in determining depth characteristics. The flaws that are easiest for the RT method to detect are associated with construction (i.e., 3-dimensional) with the exception of tight planar flaws from the welding process.

In contrast, the UT method is capable of detecting the features in a component that reflect sound waves. The degree of reflection depends largely on the physical state of matter on the opposite side of the reflective surface and to a lesser extent on specific physical properties of that matter. For instance, sound waves are almost completely reflected at metal-gas interfaces, and partially reflected at metal-to-solid interfaces. Discontinuities that act as metal-gas interfaces, like cracks, laminations, shrinkage cavities, bursts, flakes, pores, and bonding faults, are easily detected.

The UT method is less effective in detecting flaws in a plane parallel to the sound beam, because of target size, and volumetric type flaws such as slag, porosity, and other inhomogeneities, because of sound dispersion from irregular surfaces. The UT method may also have difficulty in detecting discontinuities (i.e., flaws) that are present in the shallow layer immediately beneath the surface and in separating discontinuities from background noises that are caused by certain metal characteristics like large grains in stainless steels. However, current UT techniques involving partial reflection of sound waves have successfully detected flaws parallel to the sound beam and volumetric type flaws, and the UT method is capable of characterizing flaws.

In the proposed alternative, the examination coverage consists of scanning with angle beam transducers in two opposite directions perpendicular to the weld axis, in two opposite directions parallel to the weld axis, and with a straight beam transducer scanning through-wall. The scan volume is 100 percent of the weld volume and the adjacent base material for a distance of one-half the nominal through-wall weld thickness on each side. Where the scan perpendicular to the weld is limited on one side, a full V-path will be used for the second direction provided the procedure is qualified for a full V-path. These scans provide assurance that planar flaws, regardless of orientation, will be detected and non-planar, construction flaws will be easier to discern from inhomogeneities. In addition, an examination of the weld area for laminar flaws with a straight beam scan will be performed.

The proposed qualification process will assure that the UT procedure contains sufficient detail and that the personnel have the necessary skills for detecting various types of flaws. In order to detect construction and material type flaws occurring axially, circumferentially, and volumetrically, the coverage will include 100 percent of the weld volume and adjacent base metal as discussed above.

The proposed alternative will require that detected flaws will be evaluated in accordance with the acceptance criteria of NB-5330 (i.e., for Class 1 items) of the ASME Code, Section III, which is the same for flaws detected by RT.

To the extent practical, the guidance outlined in ASME Section III Code Case N-659 was followed. Two exceptions were taken regarding weld material limitation and the use of an automated computer data acquisition system.

Since CP&L has piping with material wall thickness less than 0.500 inch, the proposed alternative reduces the minimum weld thickness to 0.438 inch and greater. Performing UT of weld materials less than 0.500 inch has been demonstrated through the Performance Demonstration Initiative (PDI) process using cracks located within the lower one-third volume, and the use of UT on materials less than 0.500 inch thickness is allowed per Appendix III of the ASME Code, Section XI, 1989 Edition. Use of a qualification block, as required by Code Case N-659, will also demonstrate the procedure's ability to inspect welds less than 0.500 inch.

To meet the requirement of using an automated computer data acquisition system, CP&L proposes the use of a manual phased array technique. The manual phased array system electronically generates and displays sector scan images which can be stored and recalled for subsequent review. Sector scans represent the angular coverage of the volume at a specific probe position and contain signal amplitude and reflector depth information plotted against the sweep angle of the ultrasonic beam. This system is also capable of processing a B-Scan image of each scan angle. Scanning positions can be recorded by documenting the positions according to file numbers. Flaw depth and through-wall dimensions can be measured using cursors. Actual measurements will be taken to record positions and lengths of recordable reflectors.

In summary, the objective of the examination method specified in NB-5200 for new welds is to detect flaws as a means to measure the quality of the workmanship. Based on the evaluation performed by CP&L using an alternative, qualified UT method would provide results equivalent or superior to the single RT method specified by the ASME Code, Section III, for detecting construction related flaws. As such, workmanship quality will be verified and intent of the ASME Code, Section III, met.

6. Duration of Proposed Alternative

Use of the alternative is proposed for the remainder of the current 10-year inservice inspection interval.

7. Precedents

This proposed alternative is similar, but not identical, to a relief request submitted by the Callaway Plant in a letter dated November 18, 2004 (i.e., ADAMS Accession Number ML043450359), as approved by NRC letter dated May 19, 2005 (i.e., ADAMS Accession Number ML050760129).

8. References

1. Title 10 of the Code of Federal Regulations, Part 50, Section 55a, Codes and Standards (i.e., 10 CFR 50.55a).

2. ASME Code, Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, 1989 Edition (no Addenda).

3. ASME Code Case N-659, Use of Ultrasonic Examination In Lieu of Radiography for Weld Examination, Section III, Division 1

4. ASME Code, Section V, Nondestructive Examination

5. ASME Code, Section III, Rules for the Construction of Nuclear Power Plants

6. EPRI Technical Report 1003545, Alternative Volumetric Examination Methods: UT in Lieu of RT for Repair/Replacement Activity

7. NRC Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," Revision 14, August 2005.

ASME Section III Code Case N-659

Approval Date: September 17, 2002

See Numeric Index for expiration and any reaffirmation dates.

Case N-659
Use of Ultrasonic Examination in Lieu of Radiography for Weld Examination Section III, Division 1

Inquiry: Under what conditions and limitations may an ultrasonic examination be used in lieu of radiography where radiography is required by NB-5200, NC-5200, ND-5200 and substitution of ultrasonic examination would not otherwise be permitted?

Reply: It is the opinion of the Committee that all welds in material $\frac{1}{2}$ in. or greater in thickness may be examined using the ultrasonic (UT) method in lieu of the radiographic (RT) method, provided that all of the following requirements are met:

(a) The ultrasonic examination area shall include 100% of the volume of the entire weld, plus 0.5*T* of each side of the welds, where *T* is the thickness of the weld. The ultrasonic examination area shall be accessible for angle beam examination in four directions, two directions perpendicular to the weld axis and two directions parallel to the weld axis. Where perpendicular scanning is limited on one side of the weld, a technique using the second leg of the V-path may be credited as access for the second perpendicular examination direction provided that the detection capability of that technique is included in the procedure demonstration described in (c) and (d) below.

(b) The ultrasonic examination shall be performed in accordance with Section V, Article 5 up to and including the 2001 Edition. A straight beam and two angle beams having nominal angles of 45 and 60 deg should generally be used; however, other pairs of angle beams may be used provided the measured difference between the angles is at least 10 deg. Alternatively, ultrasonic examination may be performed by a procedure qualified in accordance with the performance demonstration methodology of Section XI, Appendix VIII provided the entire volume of the weld examination is included in the demonstration.

(c) A written procedure shall be followed. The procedure shall be demonstrated to perform acceptably on a qualification block or specimen with both surface and subsurface flaws as described in (d) below.

(d) The qualification block material shall conform to the requiremnts applicable to the calibration block. The material from which blocks are fabricated shall be one of the following: a nozzle dropout from the component; a component prolongation; or material of the same material specification, product form, and heat treatment condition as one of the materials joined. For piping, if material of the same product form and specification is not available, material of similar chemical analysis, tensile properties, and metallurgical strusture may be used. Where two or more base material thicknesses are involved, the calibration block thickness shall be of a size sufficient to contain the entire examination path. The qualification block configuration shall contain a weld representative of the joint to be examined, including, for austenitic materials, the same welding process. The qualification blocks shall include at least two planar flaws in the weld, one surface and one subsurface oriented parallel to the fusion line, no larger in the through-wall direction than the diameter of the applicable side-drilled hole in the calibration block shown in Fig. T-542.2.1 of Section V, Article 5, and no longer than the shortest unacceptable elongated discontinuity length listed in NB-5330, NC-5330, or ND-5330 for the thickness of the weld being examined. Where a Section XI, Appendix VIII, performance demonstration methodology is used, supplemental qualification to a previously approved procedure may be demonstrated through the use of a blind test with appropriate specimens that contain a minimum of three different construction-type and fabrication-type flaws distributed throughout the thickness of the specimen.

(e) This Case shall not be applied to weld examination volumes that include cast products forms or corrosion-resistant-clad austenitic piping butt welds.

(f) A documented examination plan shall be provided showing the transducer placement, movement and component coverage that provides a standardized and repeatable methodology for weld acceptance. The examination plan shall also include ultrasonic beam angle used, beam directions with respect to weld centerline, and volume examined for each weld.

(g) The evaluation and acceptance criteria shall be in accordance with NB-5330, NC-5330, or ND-5330, as acceptable.

(h) For welds subject to inservice ultrasonic examination, the examination and evaluation shall also meet the requirements of the applicable Edition of Section XI for preservice examination.

(i) The ultrasonic examination shall be performed using a device with an automated computer data acquisition system.

(j) Data shall be recorded in unprocessed form. A complete data set with no gating, filtering, or thresholding for response from examination volume in (a) shall be included in the data record.

(k) Personnel who acquire and analyze UT data shall be qualified and trained using the same type of equipment as in (i), and demonstrate their capability to detect and characterize the flaws using the procedure as described in (c).

(l) Review and acceptance of the procedure by the Authorized Nuclear Inspector is required.

(m) All other related requirements of the applicable subsection shall be met.

(n) Flaws exceeding the acceptance criteria referenced in this Case shall be repaired, and the weld subsequently reexamined using the same ultrasonic examination procedure that detected the flaw.

(o) This Case number shall be recorded on the Data Report.