AmerGen Energy Company, LLC
200 Exelon Way
Kennett Square, PA 19348

www.exeloncorp.com

AmerGen SM
An Exelon Company

10 CFR 50.55a

5928-06-20560
September 28, 2006

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Three Mile Island, Unit 1
Facility Operating License No. DPR-50
NRC Docket No. 50-289

Subject: Request for Relief to utilize Code Case N-659, "Use of Ultrasonic Examination in Lieu of Radiography for Weld Examination Section III, Division 1"

Pursuant to 10 CFR 50.55a(a)(3)(ii), AmerGen Energy Company, LLC (AmerGen) is proposing an alternative to the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section III, "Rules for Construction of Nuclear Power Plant Components", on the basis that compliance with the specified requirements of this code results in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Specifically, AmerGen proposes an alternate nondestructive examination method based on Code Case N-659 ("Use of Ultrasonic Examination in Lieu of Radiography for Weld Examination Section III, Division 1", September 17, 2002) for the replacement of seven (7) Alloy 82/182 welds and associated Alloy 600 safe ends on the Three Mile Island, Unit 1 pressurizer.

We request your review and approval of this request (Attachment 1) by September 30, 2007 in order to support modifications planned for the Three Mile Island, Unit 1 refueling outage in Fall 2007.

There are no commitments contained in this letter.

If you have any questions, please contact Mr. Thomas R. Loomis (610-765-5510).

Respectfully,

9.27 Pamela B. Cowan

Pamela B. Cowan
Director - Licensing & Regulatory Affairs
AmerGen Energy Company, LLC

Attachments: 1) Relief Request No. 2006-TMI-01

cc: S. J. Collins, Regional Administrator, Region I, USNRC
D. M. Kern, USNRC Senior Resident Inspector, TMI
F. Saba, Project Manager, USNRC
R. Guzman, Project Manager, USNRC
File No. 05056

# ATTACHMENT 1

## Relief Request No. 2006-TMI-01

## ATTACHMENT 1

**Relief Request No. 2006-TMI-01**

**Proposed Alternative**
**in Accordance with 10 CFR 50.55a(a)(3)(ii)**

**--Compliance with Requirements Results in Hardship**
**Without a Compensating Increase in Quality and Safety—**

Pursuant to 10CFR50.55a(a)(3)(ii), AmerGen Energy Company, LLC (AmerGen) requests NRC approval to use an alternative to the 1998 Edition, including Addenda through 2000, of Section III of the ASME Boiler and Pressure Vessel Code. Information is being submitted in support of our determination that compliance with the specified requirements of this code results in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

I. ASME Code Component(s) Affected

ASME Section III Code Class 1 Reactor Coolant System butt welds between the Pressurizer (PZR) Level and Sample Tap Nozzles and their respective Safe Ends at Three Mile Island, Unit 1 (TMI).

A total of six (6) level tap nozzle safe ends are planned for replacement in the pressurizer (PZR), three (3) in the steam space, and three in the water space, as well as one (1) sample tap nozzle safe end. This amounts to a total of seven (7) weld and safe end replacements in the TMI PZR. The existing ISI weld numbers for the TMI PZR level and sample safe end-to-nozzle tap welds are: RC-291BM, RC-293BM, RC-295BM, RC-297BM, RC-299BM, RC-301BM, and RC-312BM. A sketch of the repaired PZR level and sample tap nozzle configuration is provided in Figure 1.

II. Applicable Code Edition and Addenda

ASME Code, Section XI 1995 Edition, including Addenda through 1996.

ASME Code, Section III 1998 Edition, including Addenda through 2000.

III. Applicable Code Requirements

ASME Code, Section XI, IWA-4221 requires that items used for replacement meet the Owner's Requirements and original Construction Code for the component. As an alternative, IWA-4221 allows the use of later editions of ASME Code Section III provided the requirements of IWA-4222 through IWA-4226, as applicable, are met. AmerGen intends to apply ASME Section III 1998 Edition with Addenda through 2000 and Code Case N-659 ("Use of Ultrasonic Examination in Lieu of Radiography for Weld Examination Section III, Division 1," September 17, 2002), to the extent identified in this relief request, for the repair of the welds identified in this relief request.

ASME Code, Section III, NB-5221 requires that nondestructive examinations include radiography for Category B weld joints in Class 1 vessels as part of final weld acceptance during construction. The welds included in this relief request are ASME Code Section III Category B Welds. For the components identified above, relief is requested from the radiography requirements of ASME Code Section III, paragraph NB-5221.

IV. Reason for Request

AmerGen plans to replace the PZR level tap and sample tap nozzle safe ends (and associated weld material) composed of Alloy 600 material, with corrosion resistant, low carbon stainless steel material. The design of the replacement safe ends and welds is configured to be similar to those in the original designs.

ASME Code, Section XI, IWA-4221(b), states that Section III may apply for items used for replacement provided the requirements of IWA-4222 through IWA-4226 are met. ASME Code, Section III, NB-5200, requires that Category B weld joints in vessels be examined using the radiographic (RT) method and either liquid penetrant or magnetic particle examination methods.

The geometry of the safe end-to-nozzle weld joint configuration makes RT very difficult and time consuming due to the steep thickness taper and small inner diameter of the nozzle (see Figure 1 for a sketch of the modified configuration). This configuration yields less than desirable RT results for detecting weld metal defects and presents a significant potential for reexamination due to radiographic density variation. AmerGen believes that the present safe end-to-nozzle weld geometry does not lend itself to an RT technique that detects unacceptable flaws at a high confidence level. AmerGen has determined that performing RT on this weld geometry will require approximately 28 hours per weld due to a large number of required exposures. Since performance of RT involves the use of highly penetrating radioactive isotopes, there exists a personnel safety risk of inadvertent or accidental exposure. Outage duration and costs are significantly increased due to the fact that parallel path outage work within the vicinity is not possible while performing radiography on these welds. AmerGen has evaluated an alternative ultrasonic examination method and determined that its use will provide an acceptable level of confidence for detecting weld metal defects and provides an acceptable level of quality and safety.

In summary, compliance with the requirements of ASME, Section III, NB-5221 would result in hardship without a compensating increase in the level of quality and safety.

V. Proposed Alternative and Basis for Use

The alternative involves ultrasonic examinations of Class 1 repair/replacement welds in lieu of radiography. The alternative ultrasonic examination will be performed to satisfy the construction code requirement for radiography. This proposed alternative ultrasonic examination will eliminate the hardships associated with performing

radiography, while ensuring an adequate level of safety and quality. The alternative ultrasonic examination provides adequate verification that the Class 1 welds and adjacent base material are free of unacceptable flaws that could adversely affect structural integrity.

Prior to the use of the alternative examination, the effectiveness of the ultrasonic examination techniques will be demonstrated on a qualification block containing a weld with representative flaws as required by ASME Code Case N-659.

The proposed alternative method will meet the requirements of ASME Code Section III Code Case N-659, "Use of Ultrasonic Examination in Lieu of Radiography for Weld Examination Section III Division 1," with stated exceptions identified below. AmerGen's strategy to meet the requirements of the code case is discussed below. Where literal compliance may not be met, supplemental actions are specified.

(a) *Case Requirement:* The ultrasonic examination area shall include 100% of the volume of the entire weld, plus 0.5T 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.

*AmerGen Strategy:* AmerGen must take exception to the requirement for examination to include 100% of the volume of the weld, plus 0.5T on each side of the weld. Due to the weld configuration and component geometry, there is a transition area from the cylindrical (flat) nozzle region into the conical (tapered) weld and safe-end. Examination coverage within this transition area is limited because the transition geometry causes liftoff of the ultrasonic transducer. Based on plots for estimated coverage, at least 90% of the weld volume, plus 0.5T on each side of the weld will be examined during a phased array ultrasonic examination. Preliminary examination coverage drawings are provided in Figures 2 and 3. The drawings show an estimated weld volume coverage of 98% for axial scans performed from the safe-end side; and 91% estimated weld volume coverage for axial scans performed from the nozzle side. Circumferential scans are expected to produce examination coverages that are similar to the axial scan coverage percentage. Further refinements to the UT technique during development may result in examination coverages greater than preliminary estimates for all directions. In addition to the qualification block described in (d) below, axial and circumferential notches are being placed in the taper and transition area regions of a special technique demonstration block to validate detection in these regions. The liquid penetrant examination required by ASME Code Section III will supplement these UT coverage limitations.

b) *Case Requirement:* 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.

*AmerGen Strategy:* The ultrasonic examination will be performed in accordance with ASME Code, Section V, 1998 Edition through the 2000 Addenda, Article 5, using an automated phased array system. The requirements for straight and angle beam examination, as discussed above, will be satisfied by using the phased array ultrasonic technology which sweeps the sound beam through the required range of angles as shown in Figures 2 and 3.

(c) *Case Requirement:* 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.

*AmerGen Strategy:* A procedure will be developed and demonstrated on the qualification block described in (d) below.

(d) *Case Requirement:* The qualification block material shall conform to the requirements 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 structure may be used. Where two or more base material thicknesses are involved, the calibration block thickness shall be of 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.

*AmerGen Strategy:* A calibration block that is designed in accordance with the requirements of ASME Code Section V, Article 5, will be used. The thickness of the block will be sufficient to contain the entire examination beam path. The qualification block conforms to the requirements applicable to the calibration block, as well as the material and weld requirements discussed above. The qualification block materials are composed of the same material specifications, product forms, and heat treatment conditions as the actual PZR nozzles, welds, and safe ends. Additionally, the weld of the qualification block is formed by the same welding process as will be used in the field. The qualification block will include one surface crack and two subsurface lack of

side-wall fusion flaws oriented parallel to the fusion line. The flaw dimensions will be no larger than the specifications of ASME Code, Section V, 1998 Edition, through the 2000 Addenda, Article 5, and NB-5330, ASME Code, Section III, 1998 Edition, including Addenda through 2000. In addition to the above described block, an additional stainless steel block simulating the nozzle configuration will be used to demonstrate detection of flaws in the transition areas previously described as examination limitations in (a) above. The blocks will contain axial and circumferential notches installed in the taper and transition areas in order to document detection capability in these areas.

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

*AmerGen Strategy:* The welds being examined do not include cast product forms or corrosion-resistant-clad austenitic piping butt welds.

(f) *Case Requirement:* 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.

*AmerGen Strategy:* Coverage drawings, utilizing a full sectorial scan in conjunction with linear multiple-line scans will be prepared. Various scan techniques that employ full use of steering, sweeping, and skewing will be applied. A final documented examination plan containing the information required above will be prepared and will be available on site for review. Figures 2 and 3 provide the preliminary coverage plan and angles.

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

*AmerGen Strategy:* The evaluation and acceptance criteria will be in accordance with NB-5330.

(h) *Case Requirement:* 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.

*AmerGen Strategy:* These welds are exempt from Section XI volumetric preservice and in-service examinations due to their size.

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

*AmerGen Strategy:* The ultrasonic examination will be performed using a device with an automated computer data acquisition system.

(j) *Case Requirement:* 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.

*AmerGen Strategy:* Data will be recorded in its raw form and the results will be fully documented when creating data records.

(k) *Case Requirement:* 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).

*AmerGen Strategy:* UT Level II or Level III examiners will acquire and analyze the data. The examination personnel capability to detect and characterize the flaws using the examination procedure will be demonstrated prior to inspection.

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

*AmerGen Strategy:* Review and acceptance of the procedure by the Authorized Nuclear Inservice Inspector will be achieved prior to beginning examinations.

(m) *Case Requirement:* All other related requirements of the applicable subsection shall be met.

*AmerGen Strategy:* Related requirements of the applicable subsection will be met.

(n) *Case Requirement:* 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.

*AmerGen Strategy:* Flaws exceeding the acceptance criteria will be repaired and reexamined using the same ultrasonic examination procedure that detected the flaw.

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

*AmerGen Strategy:* The Data Report will reference Code Case N-659.

*Summary:* As discussed previously, the requirement specified in ASME Code Section III, that Class 1 Category B welded joints be examined using RT, results in a significant hardship without a compensating increase in the level of quality and safety.

Based on review of the weld joint configuration it has been determined that performing RT would be difficult, requiring approximately 28 hours per weld to perform. Even with multiple exposures, there is not a high confidence that unacceptable weld metal defects will be detected. The performance of RT involves the use of highly penetrating radioactive isotopes. Using a qualified ultrasonic examination method will eliminate the personnel safety risks associated with radiographic operations. Allowing parallel path outage work to progress uninterrupted during ultrasonic examination of the welds will reduce outage duration and costs.

Qualified ultrasonic methods are an acceptable alternative to radiography as allowed in ASME Code Case N-659. NRC staff approval is requested in accordance with 10 CFR 50.55a(a)(3)(ii).

VII. Duration of Proposed Alternative

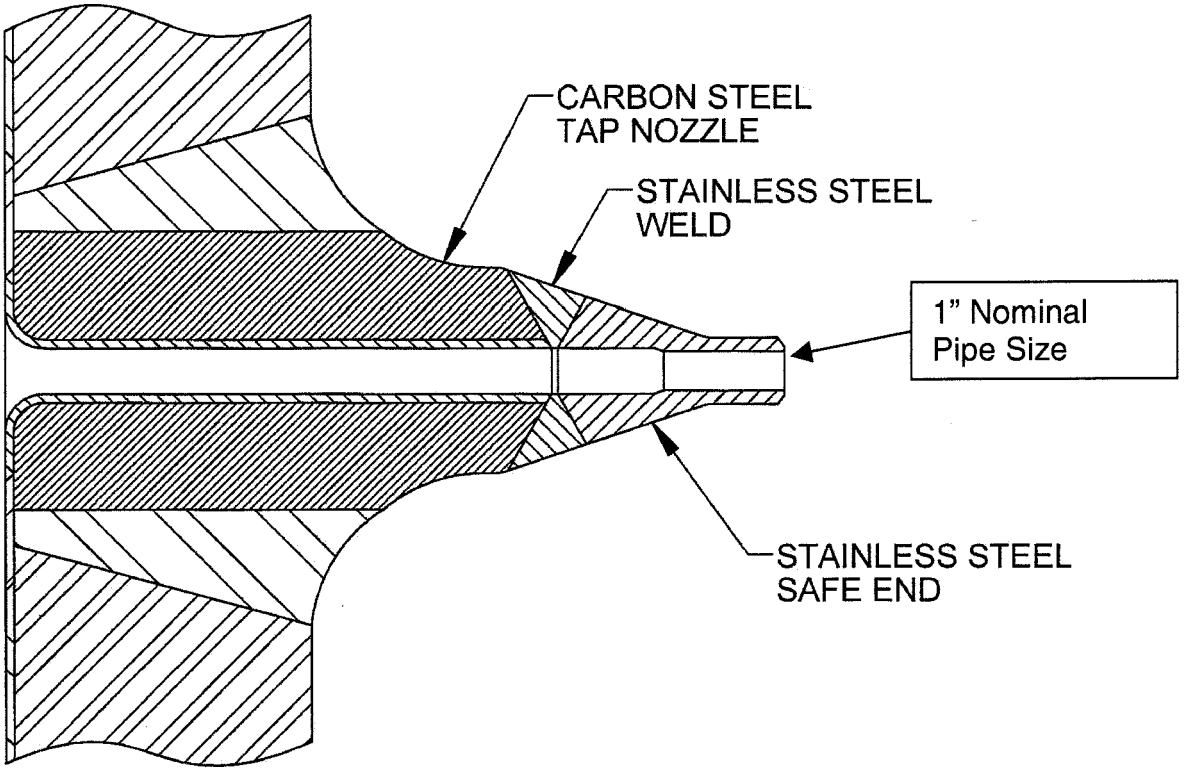
AmerGen currently plans to implement this relief request during the next scheduled refueling outage (Fall 2007) for modification of the three (3) PZR upper level sensing tap nozzles in the steam space. AmerGen currently plans to implement this relief during the steam generator replacement outage (Fall 2009) for modification of the three lower level sensing and one sample tap nozzle in the water space. Should these schedules be required to be changed this relief request will remain in effect until these seven (7) welds and safe ends are replaced.

VIII. Precedents

This proposed alternative is similar, but not identical, to a relief request submitted by Union Electric Company's Callaway Plant in a letter dated November 18, 2004, as approved by NRC letter dated May 19, 2005.

This proposed alternative is similar, but not identical, to a relief request submitted by Duke Energy Corporation's Oconee Nuclear Station Units 1, 2 and 3 in a letter dated March 15, 2006, as approved by NRC letter dated June 20, 2006.

**FIGURE 1**

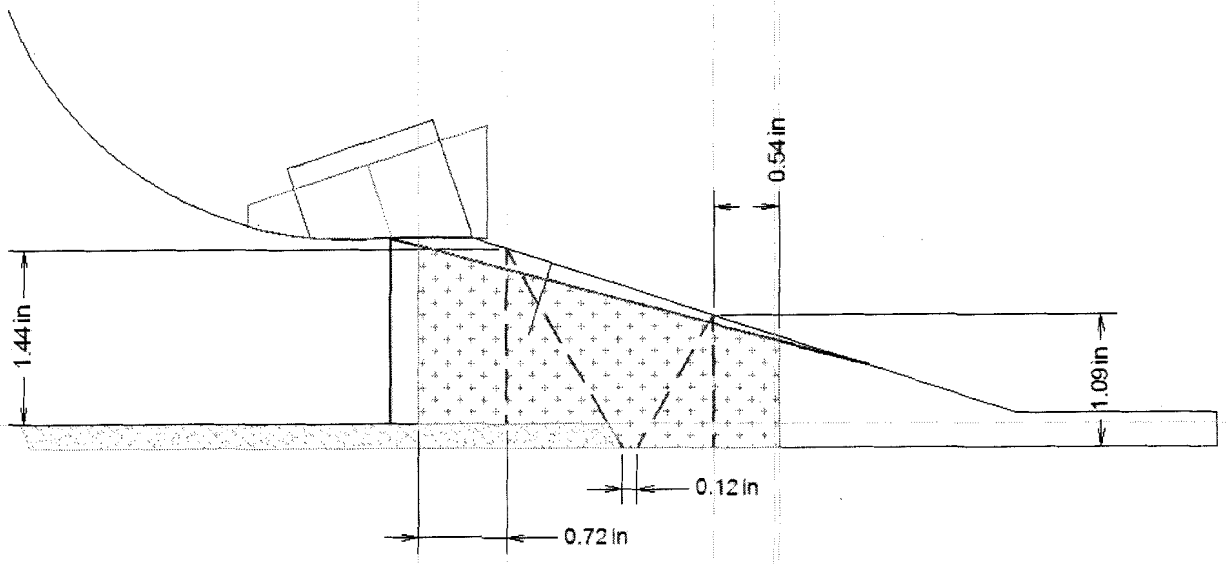



# PRESSURIZER LEVEL SENSING AND SAMPLE TAP NOZZLE MODIFICATION

## Figure 2

## Preliminary Examination Coverage

## Axial Scan from Nozzle Side



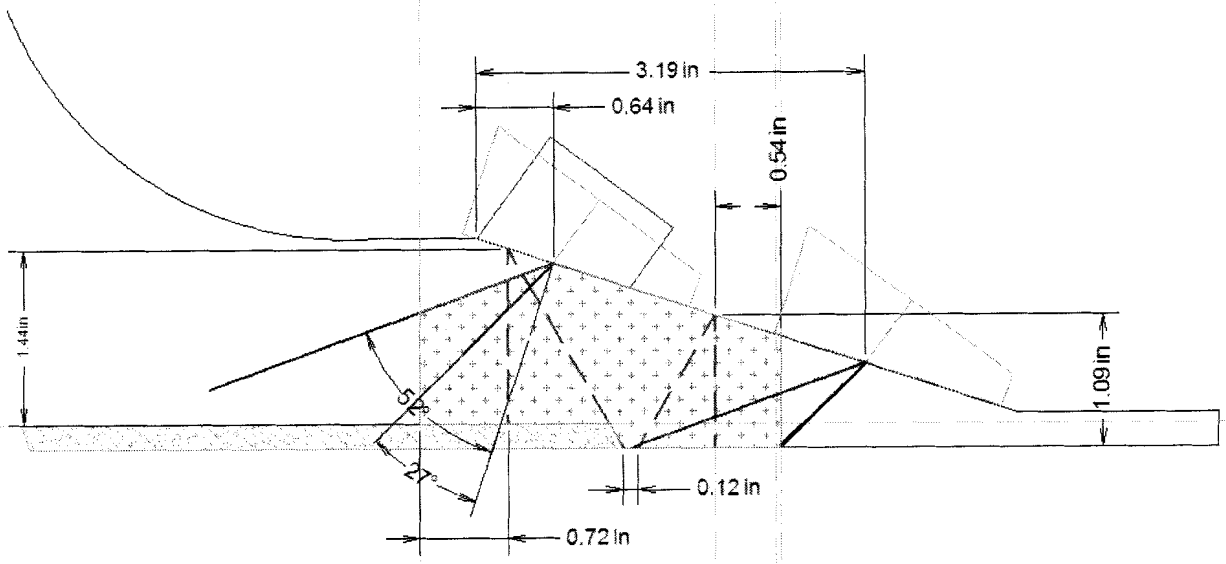

TOTAL INSPECTION AREA = 3.78 sq. inches
TOTAL WELD AREA = 2.14 sq. inches
TOTAL MISSED INSPECTION AREA = 0.35 sq. inches
TOTAL MISSED WELD AREA = 0.19 sq. inches

PERCENTAGE INSPECTION AREA COVERAGE (green) = 90.7%
PERCENTAGE WELD AREA COVERAGE = 91.1%

## Figure 3

## Preliminary Examination Coverage

## Axial Scan from Safe End Side




TOTAL INSPECTION AREA = 3.78 sq. inches
TOTAL WELD AREA = 2.14 sq. inches
TOTAL MISSED INSPECTION AREA = 0.38 sq. inches
TOTAL MISSED WELD AREA = 0.05 sq. inches

PERCENTAGE INSPECTION AREA COVERAGE (green) = 90%
PERCENTAGE WELD AREA COVERAGE = 98.7%