CATEGORY 1

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50-369 William B. McGuire Nuclear Station, Unit 1, Duke Powe 05000369
50-370 William B. McGuire Nuclear Station, Unit 2, Duke Powe 05000370
50-413 Catawba Nuclear Station, Unit 1, Duke Power Co. 05000413
50-414 Catawba Nuclear Station, Unit 2, Duke Power Co. 05000414
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SUBJECT: Forwards detailed description & justification for revised request for relief 98-GO-0005 from requirements of ASME Boiler & Pressure Vessel Code Secion XI.

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April 26 1999

U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

ATTENTION: Document Control Desk

SUBJECT: Duke Energy Corporation

Oconee Nuclear Station - Units 1, 2, & 3
Docket Nos. 50-269, 50-270, and 50-287

McGuire Nuclear Station - Units 1 & 2
Docket Nos. 50-369 and 50-370

Catawba Nuclear Station - Units 1 & 2
Docket Nos. 50-413 and 50-414

Request for Relief from the Requirements of the ASME Boiler and Pressure Vessel Code, Section XI

Duke Energy Corporation Serial Number 98-GO-0005, Revision 1

By letter dated September 29, 1998 Duke Energy Corporation submitted Request for Relief 98-GO-0005 to the NRC. This request for relief was initially submitted pursuant to 10 CFR 50.55a(a)(3)(ii). Based on subsequent information received from NRC officials, Duke Energy Corporation has decided to re-submit this request for relief pursuant to 10CFR50.55a(a)(3)(iii). Request for Relief 98-GO-98-0005, Revision 1 addresses certain requirements of the ASME Boiler and Pressure Vessel Code, for Oconee Units 1, 2 and 3; McGuire Units 1 and 2; and Catawba Units 1 and 2. Relief is being requested from the ultrasonic examination requirements of Section XI, 1989 Edition, Appendix III, Supplement 4(b)(1) III-4410 Beam Angle.

A detailed description and justification for the revised Request for Relief 98-GO-0005 is included as the attachment to this letter. The revision pursues this request for

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relief on the basis of impracticality instead of hardship as originally proposed.

Questions regarding this matter should be directed to J. S. Warren at (704) 382-4986.

Very truly yours,

M. S. Tuckman

MST/JSW

Attachment

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DUKE ENERGY CORPORATION
Oconee Units 1, 2, and 3
McGuire Units 1 and 2
Catawba Units 1 and 2

10-YEAR INTERVAL REQUEST FOR RELIEF NO. 98-GO-0005, Revision 1

Pursuant to 10CFR50.55a (a) (3) (iii), Duke Energy Corporation has determined that compliance with the specified requirements of ASME Section XI is not practical. Accordingly, information is being submitted is support of our determination and relief is being sought from the applicable ASME Section XI requirements.

I. **System/Components for Which Relief is Requested:** All Category B-F Pressure Retaining Dissimilar Metal Welds.

Item Numbers:
B5.10
B5.40
B5.70
B5.100
B5.130

Category B-J Welds in Piping (All austenitic stainless steel welds with single sided access).

Item Numbers:

B9.11
B9.31

Category C-F-1 Pressure Retaining Welds in Austenitic Stainless Steel or High Alloy Piping (All welds with single sided access).

Item Numbers:

C5.11
C5.21

II. Code Requirement: ASME Section XI, 1989 Edition, Appendix III, Supplement 4 (b) (1) III-4410 Beam Angle - The actual beam angle in the examination part shall be 40 deg. or greater for shear wave at the I.D. surface, and 35 deg. or greater for refracted longitudinal wave at the I.D. surface. The beam angle in the examination part shall be determined for each pipe size, schedule, and material to be examined for each plant. The beam angle measurements shall be used to assure coverage of the required examination volume by extending the calibration and examination distance as required.

III. Code Requirement from Which Relief is Requested: Relief is requested from the requirement to measure the actual beam angle in the examination part when refracted longitudinal waves are used to examine dissimilar metal welds and similar metal austenitic stainless steel welds having single sided access.

IV. Basis for Relief: In 1990 Duke Energy Corporation received NRC Information Notice 90-30, "Ultrasonic Inspection Techniques for Dissimilar Metal Welds." In response to this information notice Duke Energy Corporation began investigating the use of refracted longitudinal wave search units. With the use of mock-ups containing thermal fatigue cracks Duke Energy Corporation determined that refracted longitudinal wave search units provide enhanced flaw detection capability for the examination of dissimilar metal welds. Additional evaluation and qualification through the "Performance Demonstration Initiative" (PDI), shows that refracted longitudinal waves also provide the same improvement for similar metal austenitic stainless steel welds.

The refracted longitudinal wave search unit's qualities are based on the following:

1. The longitudinal wave shows minimal attenuation and beam angle distortion when passing through the weld metal, thereby improving penetration.

2 Improved signal-to-noise ratio caused by a quasi-focusing effect at the beam intersection as shown in Figure 1.

There are, however, three restrictive factors in using these search units:

1. They have a limited range of sensitivity, which is as a rule ½ to 2 times the focal distance. For piping examination the designed focal distance is usually 3/4t, where "t" is the nominal pipe thickness.

2. The beam angle varies with the sound path distance and the designed beam angle is only valid at the focal point of the search unit. See Figure 2 as an example.

3. Mode conversion occurs when a longitudinal wave strikes the inside surface of a component at any angle other than a right angle to the surface. As shown in Figure 3, part of the longitudinal wave energy mode converts into a shear wave at the inside surface. The mode conversion process creates two sound beams of differing intensities reflecting off of the inside surface. [1] At incident angles greater than 30° the shear wave will be the dominant wave mode.

Beam angle measurements in the examination part using shear waves are conducted as shown in Figure 4. This technique requires reflecting the sound beam off the inside surface of the pipe and is the only practical method by which a search unit beam angle can be measured in piping installed in a nuclear power plant. This technique is valid for shear wave angles greater than 33.5 degrees. The beam angle variations resulting from the design of the refracted longitudinal wave search unit creates uncertainty as to the actual incident angle at the pipe I.D. The effects of mode conversion resulting in two beams of differing

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[1] Firestone, F. A. : Tricks with the Supersonic Reflectoscope, *J. Soc. Nondestructive Testing*, vol. 7, no. 2 Fall 1948.

intensities and different angles make the reflection technique impractical.

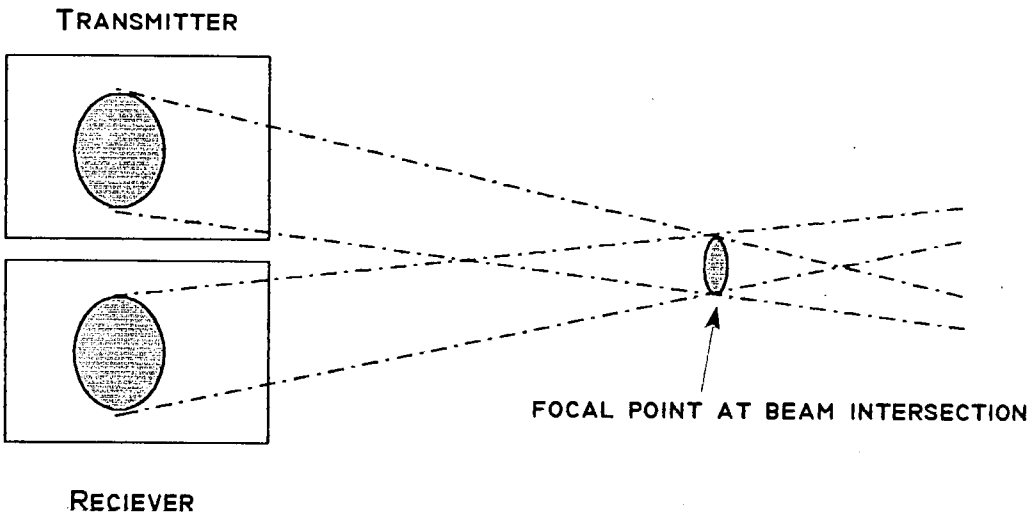
V. Alternative Method for Measuring Beam Angle: Duke Energy Corporation proposes measuring the beam angle of refracted longitudinal wave search units using a reference block of similar chemical analysis, heat treatment and tensile properties as the material on the side of the joint from which the examination will be performed.

The reference block will contain 1/8 inch (3mm) diameter side drilled holes covering as a minimum the sound path range from ½ to 2 times the focal distance as shown in Figure 5. These holes will be used to establish data points along the sound beam axis. The beam angle deviation along the sound path shall be plotted on a chart similar to the chart in Figure 2. The beam angle at a sound path distance equal to the pipe inside surface shall be 35 deg. or greater.

VI. Justification for the Granting of Relief: The use of refracted longitudinal wave search units provides enhanced flaw detection capability, improved penetration and higher signal-to-noise ratio when examining dissimilar metal welds and similar metal welds with single sided access. The proposed alternative will improve the quality of the examinations by providing a practical method for measuring the beam angle of these search units.

Evaluated by: James J. McAdlew Date 4/22/99

Reviewed by: R. Kevin Rhyne Date 4/22/99

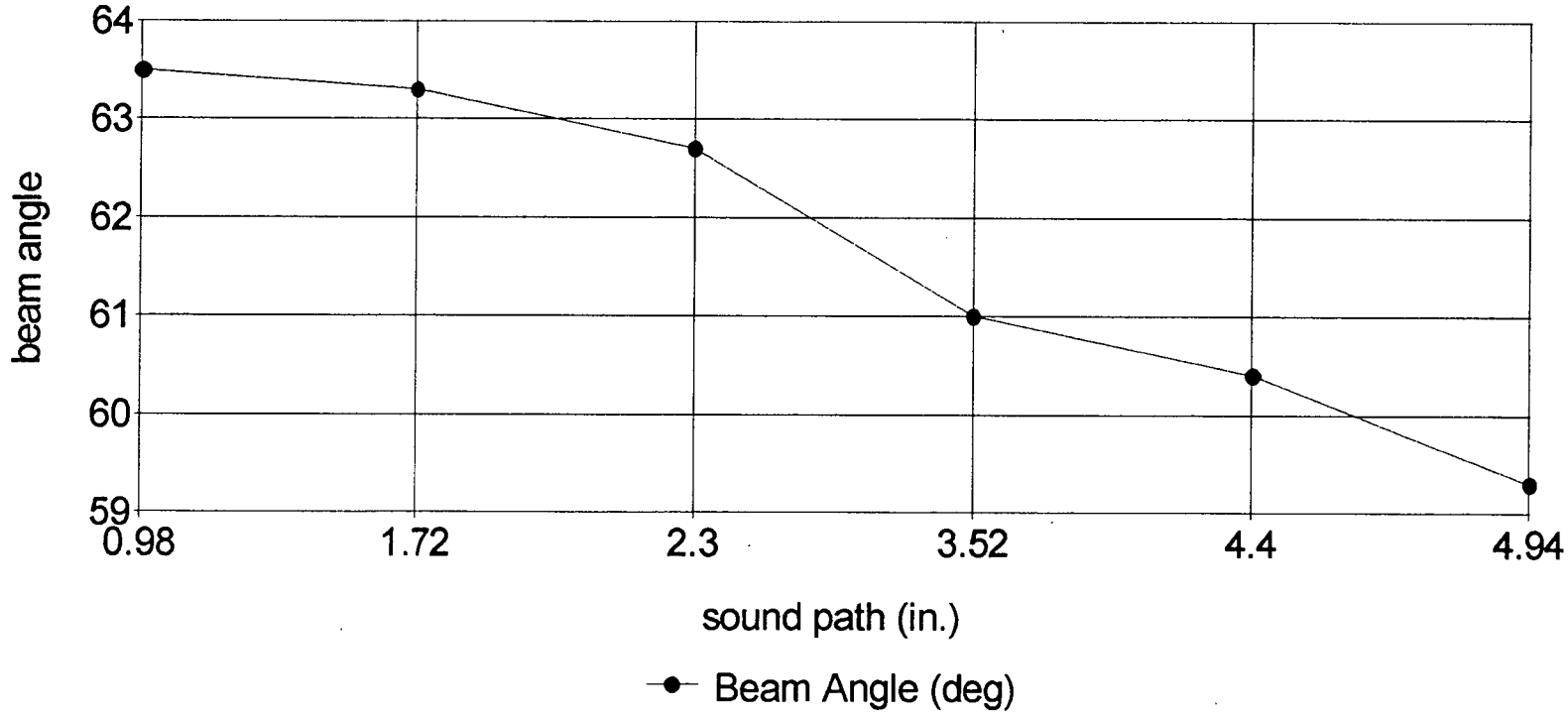


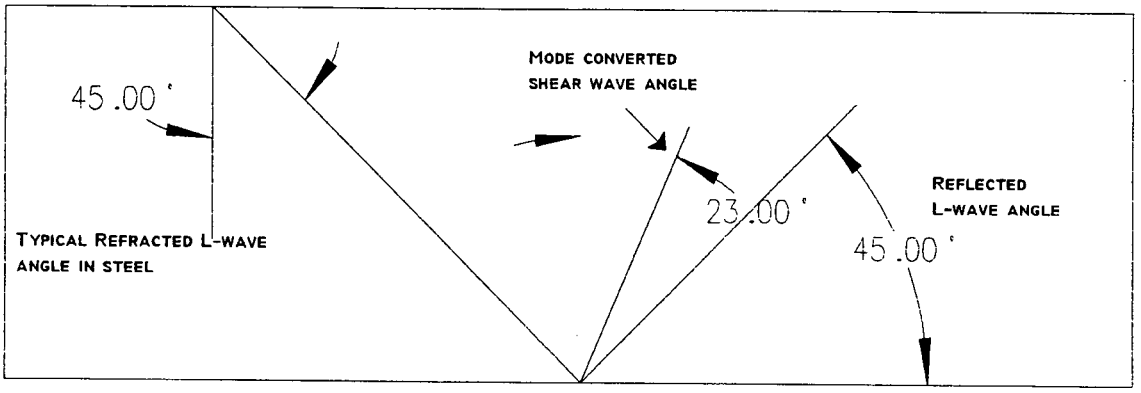
TYPICAL RL SEARCH UNIT CONSTRUCTION
SIMPLIFIED VIEW

FIGURE 1

Angle vs Sound Path for 60° RL Probe

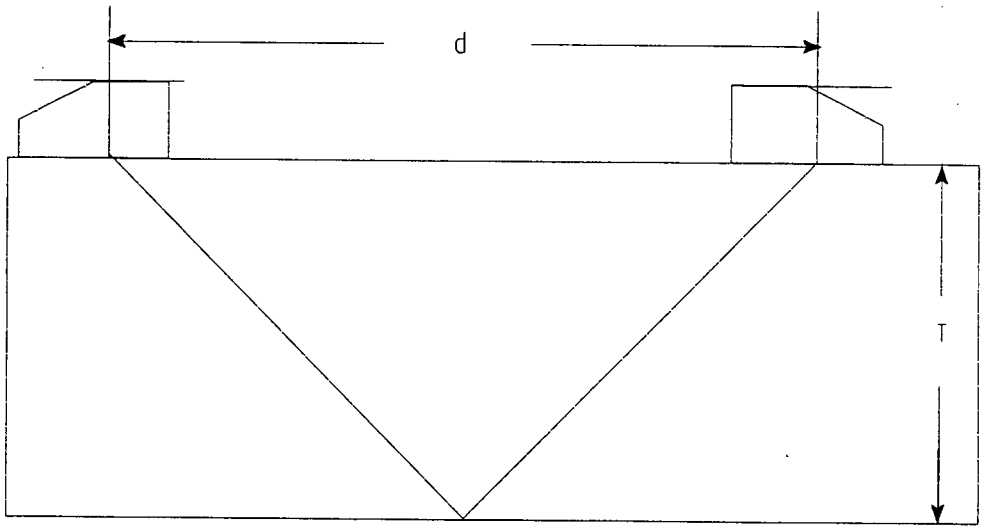
Figure 2





LONGITUDINAL-TO-SHEAR WAVE MODE CONVERSION

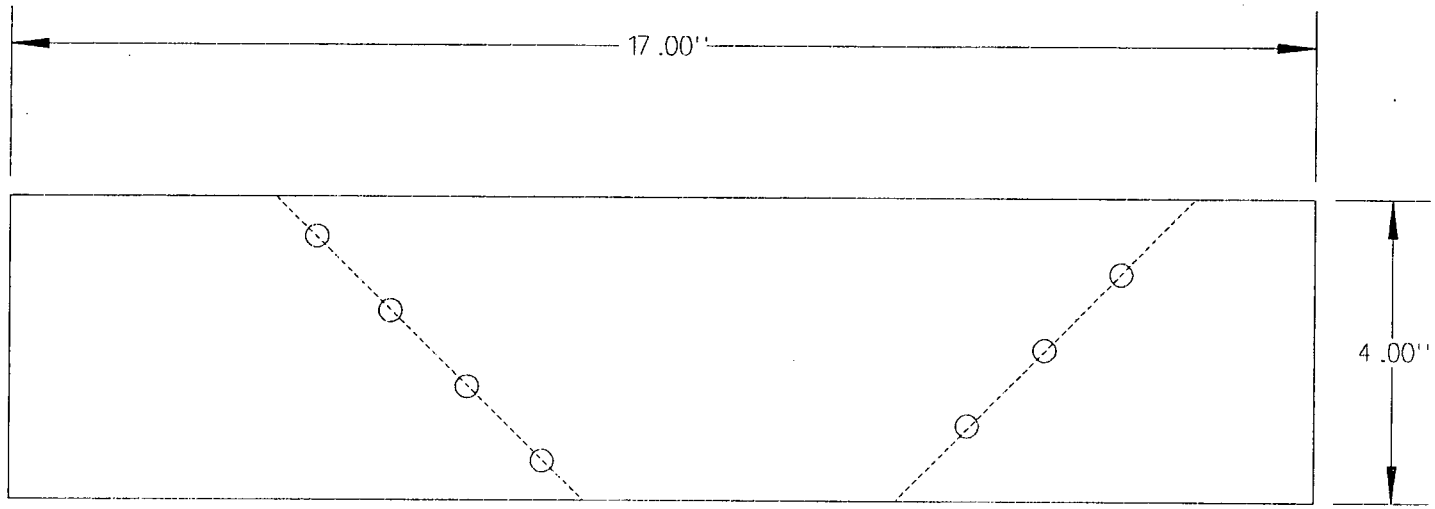
FIGURE 3



BEAM ANGLE MEASUREMENT METHOD

TWO SEARCH UNITS ARE USED IN A PITCH-CATCH MODE.
THE RECEIVER SEARCH UNIT IS MANIPULATED TO OBTAIN A PEAK AMPLITUDE SIGNAL.
THE DISTANCE BETWEEN THE SEARCH UNIT INDEX POINTS IS MEASURED AND KNOWING THE THICKNESS OF THE PIPE, THE BEAM ANGLE CAN BE DETERMINED.

FIGURE 4



TYPICAL REFERENCE BLOCK LAYOUT FOR MEASURING RL PROBE ANGLE

FIGURE 5