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CNRO-2003-00046

September 24, 2003

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

SUBJECT: Entergy Operations, Inc.
Relaxation Request to NRC Order EA-03-009 for In-Core Instrumentation Nozzles

Arkansas Nuclear One, Unit 2
Docket No. 50-368
License No. NPF-29

REFERENCE:

1. Entergy Operations, Inc. Letter CNRO-2003-00035 to the NRC, "Response to Request for Additional Information Pertaining to Relaxation Request to NRC Order EA 03-009 for In-Core Instrumentation Nozzles," dated September 3, 2003

2. Entergy Operations, Inc. Letter CNRO-2003-00033 to the NRC, "Relaxation Request to NRC Order EA 03-009," dated August 27, 2003

In Reference #1, Entergy Operations, Inc. (Entergy) requested relaxation from Section IV.C(1)(b) of NRC Order EA-03-009 for Arkansas Nuclear One, Unit 2 (ANO-2). Specifically, Entergy requested via ANO-2 Relaxation Request #3 that a combination of techniques and supplementary analysis be allowed for determining the condition of the In-Core Instrumentation (ICI) nozzles in lieu of the requirements of Section IV.C(1)(b) of the Order.

In telephone calls held on September 16 and September 19, 2003 representatives of the NRC staff and Entergy discussed a similar request for Waterford Steam Electric Station, Unit 3. Based on those discussions, Entergy is withdrawing the previous version of ANO-2 Relaxation Request #3 and submits, as Enclosure 1, a revised ANO-2 Relaxation Request #3.

ANO-2 Relaxation Request #3 is supported by fracture mechanics analysis documented in Engineering Report M-EP-2003-003, Rev. 0. Entergy provided this engineering report to the NRC staff via Reference #1. Engineering Report M-EP-2003-003 remains applicable to the enclosed ANO-2 Relaxation Request #3.

A101

Engineering Report M-EP-2003-003 utilizes information pertaining to material properties and analytical methods provided by Dominion Engineering, Inc. via Dominion letter L-4162-00-01, "Material Properties and Modeling Methods Used in ANO Unit 2 Welding Residual Stress Analysis." Entergy provided this letter to the NRC staff via Reference #2.

This letter contains new commitments as identified in Enclosure 2.

Should you have any questions, please contact Guy Davant at (601) 368-5756.

Sincerely,

M. A. Krupa

MAK/GHD/bal

Enclosure: 1. Arkansas Nuclear One, Unit 2 Relaxation Request #3
2. Licensee-Identified Commitments

cc: Mr. C. G. Anderson (ANO)
Mr. W. A. Eaton (ECH)
Mr. G. A. Williams (ECH)

Mr. T. W. Alexion, NRR Project Manager (ANO-2)
Mr. R. L. Bywater, NRC Senior Resident Inspector (ANO)
Mr. T. P. Gwynn, NRC Region IV Regional Administrator

ENCLOSURE 1

CNRO-2003-00046

ARKANSAS NUCLEAR ONE, UNIT 2
RELAXATION REQUEST #3

ENTERGY OPERATIONS, INC.
ARKANSAS NUCLEAR ONE, UNIT 2

RELAXATION REQUEST #3 TO NRC ORDER EA-03-009

I. ASME COMPONENTS AFFECTED

Arkansas Nuclear One, Unit 2 (ANO-2) has ninety (90) ASME Class 1 reactor pressure vessel (RPV) head penetration nozzles comprised of eighty-one (81) Control Element Drive Mechanism (CEDM) nozzles, eight (8) In-Core Instrument (ICI) nozzles, and one (1) vent line nozzle. This request pertains to the ICI nozzles only. The locations of RPV head penetrations are provided in Figure 1.

II. REQUIREMENTS

The NRC issued Order EA-03-009 (the Order) that modified the current licenses at nuclear facilities utilizing pressurized water reactors (PWRs), which includes ANO-2. The NRC Order establishes inspection requirements for RPV head penetration nozzles. In accordance with Section IV.A of NRC Order EA-03-009, the ANO-2 susceptibility category is "high" based on a calculated value of 12.4 effective degradation years (EDY) at the beginning of the upcoming fall refueling outage.

Section IV.C of the Order states in part:

"All Licensees shall perform inspections of the RPV head using the following techniques and frequencies:

(1) For those plants in the High category, RPV head and head penetration nozzle inspections shall be performed using the following techniques every refueling outage.

(a) Bare metal visual examination of 100% of the RPV head surface (including 360° around each RPV head penetration nozzle), AND

(b) Either:

(i) Ultrasonic testing of each RPV head penetration nozzle (i.e., nozzle base material) from two (2) inches above the J-groove weld to the bottom of the nozzle and an assessment to determine if leakage has occurred into the interference fit zone, OR

(ii) Eddy current testing or dye penetrant testing of the wetted surface of each J-groove weld and RPV head penetration nozzle base material to at least two (2) inches above the J-groove weld."

Entergy is performing a bare metal visual examination of the ICI nozzles in accordance with Section IV.C(1)(a) of the Order.

III. REASON FOR REQUEST

Section IV.F of the Order states:

"Licensees proposing to deviate from the requirements of this Order shall seek relaxation of this Order pursuant to the procedure specified below. The Director, Office of Nuclear Reactor Regulation, may, in writing, relax or rescind any of the above conditions upon demonstration by the Licensee of good cause. A request for relaxation regarding inspection of specific nozzles shall also address the following criteria:

(1) The proposed alternative(s) for inspection of specific nozzles will provide an acceptable level of quality and safety, or

(2) Compliance with this Order for specific nozzles would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

"Requests for relaxation associated with specific penetration nozzles will be evaluated by the NRC staff using its procedure for evaluating proposed alternatives to the ASME Code in accordance with 10 CFR 50.55a(a)(3)."

Pursuant to Section IV.F(2) of the Order, Entergy Operations, Inc. (Entergy) requests relaxation from the requirements of Section IV.C(1)(b). Entergy plans to inspect RPV head ICI penetration nozzles at ANO-2 using the ultrasonic testing (UT) method in accordance with Section IV.C(1)(b)(i) of the Order to the maximum extent possible. However, limitations due to nozzle configuration cause reduced UT inspection coverage of each nozzle. In addition, the design of the UT inspection probe introduces a limitation impacting the amount of coverage that can be obtained. Entergy believes that to resolve these limitations would result in hardships without a compensating increase in the level of quality and safety. These limitations and their associated hardships are discussed below.

A. Counterbore Blind Zone

ICI nozzles are manufactured with a counterbore as shown in Figure 2. Due to lift-off of the UT transducers at the counterbore, a UT blind zone exists at the upper hillside location (180° azimuth) of each ICI nozzle. Measuring approximately 0.88 inch in axial length, the bottom of the blind zone is located 1.080 inches above the top of the J-groove weld. Centered at the upper hillside location of each nozzle, the counterbore blind zone has a circumferential extent of 82°. See Figure 6 for additional details.

It should also be noted that the blind zone associated with the counterbore does not exist at any other azimuthal locations along the circumference of the ICI nozzle within the 2-inch area above the J-groove weld. Due to the RPV head angle at the ICI locations, the counterbore is significantly closer to the J-groove weld on the upper hillside of the nozzle than on the lower hillside. Specifically, the distance from the top of the J-groove weld to the bottom of the counterbore blind zone on the lower hillside of the ICI nozzle is 9.96 inches as shown in Figure 7. At the 90° and 270° azimuthal locations, the counter bore is approximately 4.64 inches above the top of the J-groove weld. See Figure 8 for additional details. No volumetric inspection equipment is available to inspect the counterbore region.

Resolving the UT limitations due to the counterbore would require eliminating the counterbore region through a physical modification of the nozzle itself. Entergy does not have the equipment necessary to perform such a modification.

B. Blind Zone at Nozzle Bottom End

A blind zone exists along the bottom of each ICI nozzle and varies from approximately 0.20 inch to 0.70 inch. This blind zone occurs due to loss of couplant as the transducers traverse across the bottom end of the nozzle. This problem is further compounded by the configuration of the ICI nozzle bottom end which is cut to match the contour of the RPV head. See Figures 3, 4, and 5 for additional information.

Entergy knows of no UT equipment currently available that resolves this configuration limitation; therefore, new UT equipment would have to be developed and appropriately qualified. The time and resources required to develop and qualify this equipment is unknown.

C. Inspection Probe Design Limitation

The inspection probe to be used to inspect Waterford 3 CEDM nozzles consists of seven (7) individual transducers. Various probe configurations will be utilized to perform the UT inspections [e.g., UT time-of-flight diffraction (TOFD) and standard 0° scans.]

The inspection probe is designed so that the ultrasonic transducers are slightly recessed into the probe holder. This recess must be filled with water to provide coupling between the transducer and the nozzle wall. Because of this design, the complete diameter of the transducer must fully contact the inspection surface before ultrasonic information can be collected. Because UT probes have a diameter of 0.250 inch, these transducers should, in theory, be able to collect meaningful UT data down to a point approximately 0.125 inch (1/2 diameter) above the area to be inspected. However, based on prior UT inspection experience and a review of UT data from previous inspections, the circumferential-shooting TOFD transducer pair only collects meaningful data down to a point 0.200 inch above inspectable area. Below this point, UT data cannot be collected.

Entergy knows of no UT equipment currently available that resolves this probe limitation; therefore, new UT equipment would have to be developed and appropriately qualified. The time and resources required to develop and qualify this equipment is unknown.

Entergy also evaluated the feasibility of inspecting the counterbore blind zone of each ICI nozzle using either the liquid penetrant testing (PT) method or the eddy current testing (ECT) method as specified in Section IV.C(1)(b)(ii) of the Order. Entergy found that these techniques pose hardships, as discussed below.

D. Hardships of Performing Alternative Surface Examinations in the Counterbore Region

1. PT Examination

To perform a PT inspection of the counterbore blind zone region would result in a significant increase in personnel radiation exposure. Entergy estimates that the radiation exposure associated with performing a manual PT inspection of the counterbore region of each ICI nozzle would result in a total exposure of approximately 10 man-REM.

In addition to the radiation exposure, there are concerns related to ensuring a valid PT examination is performed. There are inherent geometrical constraints encountered when performing an examination inside a small diameter tube, such as the ICI nozzle. These constraints limit the ability of personnel to control certain aspects of the PT examination. Specific to the ICI nozzles, the counterbore is situated in a position measured from the bottom of the nozzle that ranges from approximately 5 inches on the upper hillside to approximately 12.5 inches on the lower hillside. This asymmetrical geometry presents certain challenges for personnel performing the manual PT.

The PT process involves the following steps:

(1) Pre-cleaning and inspecting for cleanliness and suitability of the surface for examination;

(2) Applying penetrant to the required coverage area;

(3) Removing excess penetrant after the required dwell time, such that there would be no irrelevant indications caused by insufficient cleaning;

(4) Applying an appropriate amount of developer, which would be adequate to draw out any PWSCC-type indication from the examination surface without being excessive to the point that an indication might be masked;

(5) Interpreting the examination area, with sufficient visual access (distance to the area and the visual angle) and lighting to assure that the examination can be properly interpreted.

(6) Post-cleaning after interpreting the area to remove residual PT materials.

Each of these steps must be carefully controlled and performed properly in order to provide a valid examination. In the case of inspecting for PWSCC-type indications, following these steps is critical due to the tight, intergranular nature of this crack mechanism. Maintaining sufficient visual contact with the examination surface during these inspection steps to assure proper controls over the process would be difficult. While special equipment (e.g., mirrors, cameras, and lights) can be used to aid in visually accessing this area, they do not be provide the optimum approach for detecting cracks.

Another major obstacle would be in the developing stage of the PT process. It is crucial when applying the spray developer that an adequate and consistent distance be maintained between the spray nozzle and the surface under examination. This is necessary since an insufficient coating of developer may not draw out a fine indication, while an excessive coating of developer can mask that same indication. After the developer is applied, any mirrors, special lighting sources, or gloved hands coming in contact with any part of the surface under inspection would disturb the developer coating and invalidate the examination of that area. Any area that is disturbed would have to be cleaned and re-examined utilizing the entire PT process.

2. ECT Examination

Using ECT would encounter the same limitations as those encountered with UT. Entergy knows of no ECT equipment currently available that resolves the counterbore and nozzle end blind zone limitations; therefore, new UT equipment would have to be developed and appropriately qualified. The time and resources required to develop this equipment is unknown.

In conclusion, Entergy believes that the hardships associated with inspection activities required by the Order as discussed above are not commensurate with the level of increased safety or reduction in probability of leakage that would be obtained by complying with the Order.

IV. PROPOSED ALTERNATIVE AND BASIS FOR USE

Paragraph IV.C(1)(b)(i) of the Order requires that the UT inspection of each RPV head penetration nozzle encompass "from two (2) inches above the J-groove weld to the bottom of the nozzle." Due to the reasons stated above, Entergy requests relaxation from this requirement for ANO-2 ICI nozzles and proposes a three-step alternative, which involves the use of analysis, UT examination, and surface examination techniques, as described below.

A. Proposed Alternative

1. Analysis

An analysis has been performed to ensure that an unidentified surface crack in the counterbore blind zone will extend along the length into an inspectable region at least one operating cycle prior to growing through-wall. The analysis, based on design information and actual UT data obtained during the previous refueling outage, is discussed in further detail in Section IV.B.1 below and is fully documented in Engineering Report M-EP-2003-003, Rev. 0. Based on this analysis, no examination of the counterbore region is required.

2. UT Examination

The ID of each ICI nozzle (i.e., nozzle base material) shall be ultrasonically examined in accordance with Section IV.C(1)(b)(i) of the Order except as follows:

a) For the area of the counterbore blind zone that falls within two (2) inches above the J-groove weld on the upper hillside; and

b) For the area of the nozzle end blind zone.

In addition to the UT examination, an assessment to determine if leakage has occurred into the interference fit zone will be performed, as currently specified in Section IV.C(1)(b)(i) of the Order.

3. Augmented Inspection Plan for ICI Nozzle Bottom End

Because meaningful UT data cannot be collected at the bottom end of the ICI nozzle, Entergy will augment the UT inspection with a surface examination of the nozzle ID, OD, and weld area that falls within the blind zone at the nozzle bottom end. As previously mentioned, the nozzle end blind zone varies in length from approximately 0.20 inch to 0.70 inch depending on probe location (see Figures 3, 4 and 5).

The augmented inspections will be performed on the bottom ends of the ICI nozzles using the manual PT examination method as the primary technique. Because the PT examination method cannot distinguish acceptable fabrication discontinuities from primary water stress corrosion cracking (PWSCC), PT indications are conservatively assumed to be PWSCC. Under these conditions, PT indications will be investigated by either:

a) Supplemental inspection using the ECT examination method; or

b) Grinding followed by additional PT or ECT examinations.

Entergy will include the following information in the 60-day report submitted to the NRC in accordance with Section IV.E of the Order:

- Results of the UT inspections
- Results of any required reanalysis
- Results of any required augmented inspections

B. Basis for Use

1. Analysis

The extent of the proposed alternative is established by an engineering evaluation comprised of a finite element stress analysis and fracture mechanics model of the ICI nozzle counterbore blind zone. The purpose of this engineering evaluation is to ensure that an unidentified surface crack in the counterbore blind zone will extend along the length, into an inspectable region, at least one operating cycle prior to growing through the thickness.

Only an ID fracture mechanics analysis is required for this justification. This is due to the fact that the OD surface of the nozzle is not in a reactor coolant environment which promotes PWSCC. The UT exam discussed in Section IV.A.1 confirms there is no OD crack on the nozzle creating a leak path, and the triple point examination confirms there is no leak path though the weld. Additionally, the leak assessment examination above the weld confirms there is no leak through the weld butter. Hence, PWSCC can only be initiated on the ID surface of the counterbore blind zone. Both circumferential and axial cracks were evaluated; however, detailed fracture mechanics of the circumferential crack was not required because the ID and ¼ thickness axial stress is very low tensile (< 10 ksi) or predominately compressive in the 82° arc being evaluated. Therefore, no potential exists to initiate a crack in this area.

The finite element-based stress analysis and the fracture mechanics evaluation are described below. For additional details pertaining to the engineering evaluation and its conclusions, see Engineering Report M-EP-2003-003, Rev. 0.

a) Stress Analysis

A finite element-based stress analysis representing the eight (8) ANO-2 ICI nozzle penetrations was performed by Dominion Engineering, Inc. (Dominion) using best estimates of as-built geometries based on previous UT and available design information, and the material yield strength of the eight nozzles from the same heat number. General dimensions for reactor head and ICI nozzles were obtained from Westinghouse/Combustion Engineering (CE) design drawings and documents. To accommodate a potentially longer downhill side fillet weld as shown in the UT data, the fillet weld dimension in the model was increased from 3/16 inch to 7/16 inch. The counterbore was not explicitly modeled; rather, the elements were angled and tapered to transition from the 4.750-inch ID below the counterbore to the 4.625-inch ID above the counterbore. The actual counterbore is 0.25 inch high with a 1-to-4 (depth-to-length) taper; this transition precludes the need to evaluate stress concentrations such as required per ASME Section III, Subsection NB-3680 for transitions with less than a 1-to-3 transition.

Consideration of a Circumferential Crack in the Counterbore Blind Zone

Entergy considered a circumferential crack located on the ID surface, spanning the full 82° circumferential extent of the blind zone (see Figure 6). A circumferential crack, if propagated through-wall, could potentially lead to ejection of the associated nozzle. For this circumferential crack growth to occur, both the PWSCC environment and a conducive tensile axial stress field must exist. The Dominion axial stress finite element analysis data were reviewed for locations at the upper hillside and those angles spanning 45° on either side of the 180° azimuth (135° and 157.5°) that would encompass the circumferential extent of the counterbore blind zone.

From previous fracture mechanics evaluations for the CEDM nozzles, it was shown that no crack growth will occur for an applied hoop stress of 10 ksi; that is, the resulting applied stress intensity factor is below the threshold value of 8.19 ksi $\sqrt{in}$ needed for crack growth.

The stresses at the ID and at the 25% through-wall location, covering a 90° circumferential span around the ICI nozzle, are predominantly compressive. Hence, the initiation of a circumferential crack in the counterbore blind zone is precluded and presents no safety significance by not inspecting this region.

b) Fracture Mechanics Evaluation

Safety analyses performed by the EPRI Materials Reliability Program (MRP) have demonstrated that axial cracks in the nozzle tube material do not pose a challenge to the structural integrity of the nozzle. Axial cracks, if allowed to exist undetected for sufficient periods of time can produce a primary boundary leak that can cause damage to the reactor vessel head (carbon steel) and create a conducive environment for initiating and propagating OD circumferential cracks. These conditions challenge the pressure boundary; hence, critical importance is paid to proper periodic inspection and to the disposition of cracks that may be discovered. Therefore, proper analyses are essential to ascertain the nature of axial crack growth such that appropriate determination can be accomplished.

Several crack sizes were evaluated in the counterbore blind zone on the upper hillside. Crack aspect ratios typical of ASME Section XI (6-to-1 and 10-to-1 length-to-depth) and another aspect ratio emphasizing deep flaws (4-to-1) were evaluated to maximize through-wall growth while accommodating growth along the length of the ICI nozzle. These evaluations also considered a case in which the half-length of the crack was less than the remaining length needed to grow to the end of the blind zone. Summaries of crack depths and lengths used to evaluate the counterbore blind zone are presented in the table below.

Crack Case ID	Description	Crack Depth. (inch)	Crack Length (inch)
1	Aspect ratio of 6-to-1 with depth initially 25% through-wall	0.1	0.6
2	Aspect ratio of 10-to-1 with an initial length of 0.4 inch	0.04	0.4
3	Aspect ratio of 4-to-1 with depth initially 25% through-wall	0.1	0.4
4	Aspect ratio of 6-to-1 with the crack spanning the length of the blind zone	0.147	0.88

In the PWSCC crack growth evaluation, the acceptability of the crack is determined by its extension outside the counterbore blind zone to a detectable length in greater than one operating cycle prior to growing through-wall. The minimum detectable crack was 0.08 inch with cracks between 0.08 inch and 0.16 inch detected based on EPRI demonstrations. For conservatism, the detectability threshold was set at 0.16 inch. That is, a crack contained within the counterbore blind zone must propagate along the length of the nozzle a distance measured from the tip of the crack to the edge of the blind zone plus an axial distance of 0.16 inch to ensure proper detection. The results of the crack growth evaluations are presented in the table below.

Crack Case ID	Propagation Length (inch)	Time to Reach Propagation Length (years)	Time to Grow Through-Wall (years)
1	0.3	10.94	13.74
2	0.4	> 40	> 40
3	0.4	20.98	23.34
4	0.16	3.83	6.99

A review of the stress output shows the through thickness and axial distribution of hoop stresses on the lower hillside (0° azimuth) of the nozzle to be higher than that of the upper hillside for the same relative distance above the J-groove weld. That is, for the length of the nozzle 1.08 inches above the top of the weld on the lower hillside, plus a region 0.88 inch beyond that (equivalent to the span of the counterbore blind zone on the upper hillside), the stress distribution was generally higher. However, the bottom of the counterbore blind zone on the lower hillside is 9.96 inches above the top of the J-groove weld and is, therefore, not subject to the requirements of the Order. Because of the higher stress field, it is reasonable to presume that under equivalent conditions, a crack could initiate in this equivalent lower hillside area more readily than on the upper hillside. However, this region is inspectable via UT; thus, the most susceptible location based on stresses is addressed by the current inspection coverage.

c) Analysis Conclusions

The engineering evaluation supports the following conclusions:

(i) The upper hillside (180° azimuth) of the ICI nozzle above the top of the J-groove weld possesses the highest hoop stresses in the vicinity of the counterbore for which a UT blind zone exists.

(ii) The conservatisms used in the analysis (pressure applied to crack faces and high crack length-to-depth aspect ratio) provide assurance that an undetected crack in the counterbore blind zone on the upper hillside will extend along the length of the nozzle into an inspectable region at least one operating cycle prior to growing through-wall.

(iii) The area above the J-groove weld on the lower hillside of the ICI nozzle is in a higher stress field than the area on the upper hillside. Because of this, the lower hillside area is more susceptible to crack initiation than the upper hillside. However, this area is inspected by UT.

(iv) The ID surface crack on the upper hillside either did not show any potential for crack growth, or the growth in the axial direction reached a detectable area of the nozzle in at least one operating cycle prior to the crack growing through-wall. Hence, an ID surface crack in a region above the J-groove weld on the upper hillside is not significant in that it does not affect nozzle integrity.

(v) No potential exists for an ID circumferential crack to be located in the counterbore blind zone due to low tensile stress (< 10 ksi) and the predominant compressive axial stress field spanning 45° on either side of the upper hillside of the ICI nozzle.

This analysis incorporates a crack-growth formula different from that described in Footnote 1 of the Order, as provided in EPRI Report MRP-55. Entergy is aware that the NRC staff has not yet completed a final assessment regarding the acceptability of the EPRI report. If the NRC staff finds that the crack-growth formula in MRP-55 is unacceptable, Entergy shall revise its analysis that justifies relaxation of the Order within 30 days after the NRC informs Entergy of an NRC-approved crack-growth formula. If Entergy's revised analysis shows that the crack growth acceptance criteria are exceeded prior to the end of Operating Cycle 17 (following the upcoming refueling outage), Entergy will, within 72 hours, submit to the NRC written justification for continued operation. If the revised analysis shows that the crack growth acceptance criteria are exceeded during the subsequent operating cycle, Entergy shall, within 30 days, submit the revised analysis for NRC review. If the revised analysis shows that the crack growth acceptance criteria are not exceeded during either Operating Cycle 17 or the subsequent operating cycle, Entergy shall, within 30 days, submit a letter to the NRC confirming that its analysis has been revised. Any future crack-growth analyses performed for Operating Cycle 17 and future cycles for RPV head penetrations will be based on an NRC-acceptable crack growth rate formula.

2. UT Examination

The UT inspection probe to be used to inspect the ANO-2 ICI nozzles consists of seven (7) individual transducers. The configuration of the probe has been optimized for maximum coverage. UT inspection of ICI nozzles will be performed using a combination of TOFD and standard 0° pulse-echo techniques. The TOFD approach utilizes two pairs of 0.250-inch diameter, 55° refracted-longitudinal wave transducers aimed at each other. One of the transducers transmits sound into the inspection volume while the other receives the reflected and diffracted signals as they interact with the material. There will be one TOFD pair scanning in the axial direction of the penetration nozzle tube and one TOFD pair scanning in the circumferential direction of the tube. The TOFD technique is primarily used to detect and characterize planar-type defects within the full volume of the tube.

The standard 0° pulse-echo ultrasonic approach utilizes one 0.250-inch diameter straight beam transducer. The 0° technique is used to:

- Plot the penetration nozzle OD location and J-groove weld location,
- Locate and size any laminar-type defects that may be encountered, and
- Monitor the back-wall signal response to detect leakage that may occur in the interference regions of the RPV head penetration.

The UT inspection procedures and techniques to be utilized at ANO-2 have been satisfactorily demonstrated under the EPRI Materials Reliability Program (MRP) Inspection Demonstration Program.

3. Augmented Inspection Plan of the ICI Nozzle End

Augmenting UT examination of the nozzle base material with surface examination ensures the ICI nozzle is adequately examined to determine its condition. The augmented inspection plan will only be used for those portions of the nozzles that could not be inspected by UT or excluded by analysis.

The augmented inspections will be performed using the PT examination method as the primary technique. Entergy believes the use of PT to augment UT is acceptable for ensuring that the required areas not excluded by analysis are inspected. The Order recognizes and allows the use of PT as acceptable for evaluating the condition of nozzle surfaces. Augmenting the UT examination of the nozzle base material with PT ensures the nozzle is adequately examined to determine its condition.

As discussed in Section IV.A.3, above, Entergy may use ECT to investigate indications identified by PT. ECT is also an acceptable technique for evaluating such indications. As with PT, the Order recognizes and allows the use of ECT as acceptable for evaluating the condition of nozzles and associated J-groove welds.

V. CONCLUSION

Section IV.F of NRC Order EA-03-009 states:

"Licensees proposing to deviate from the requirements of this Order shall seek relaxation of this Order pursuant to the procedure specified below. The Director, Office of Nuclear Reactor Regulation, may, in writing, relax or rescind any of the above conditions upon demonstration by the Licensee of good cause. A request for relaxation regarding inspection of specific nozzles shall also address the following criteria:

(1) The proposed alternative(s) for inspection of specific nozzles will provide an acceptable level of quality and safety, or

(2) Compliance with this Order for specific nozzles would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety."

Section IV.C(1)(b) of the Order establishes a minimum set of RPV head penetration nozzle inspection requirements to identify the presence of cracks in penetration nozzles that could lead to leakage of reactor coolant and wastage of RPV head material.

While the industry has identified PWSCC in CEDM nozzles, there is no industry history of PWSCC found in ICI nozzles.

Entergy believes the proposed alternative, described in Section IV above, provides an acceptable approach to determine the condition of the ANO-2 ICI nozzles by utilizing inspections and supplemental analysis. The technical basis for the supplemental analysis of the proposed alternative is documented in Engineering Report M-EP-2003-003, Rev. 0.

Entergy believes that compliance with the UT inspection provisions of Section IV.C(1)(b)(i) of the Order as described in Section II above would result in hardships and unusual difficulties, as discussed in Section III above, without a compensating increase in the level of quality and safety. Therefore, Entergy requests that this relaxation request be authorized pursuant to Section IV.F(2) of the Order.

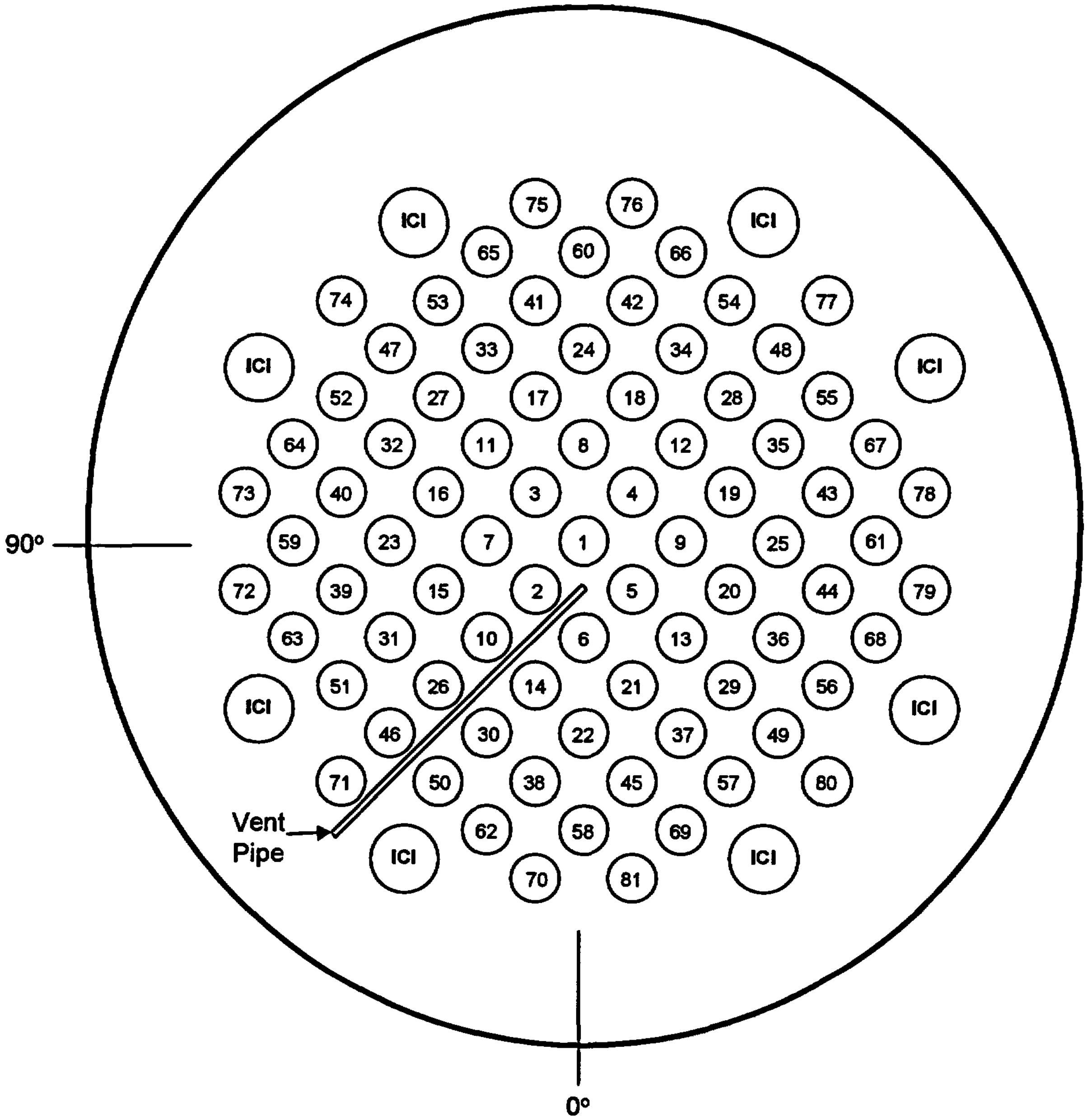

FIGURE 1
PENETRATION LOCATIONS IN THE ANO-2 RPV HEAD

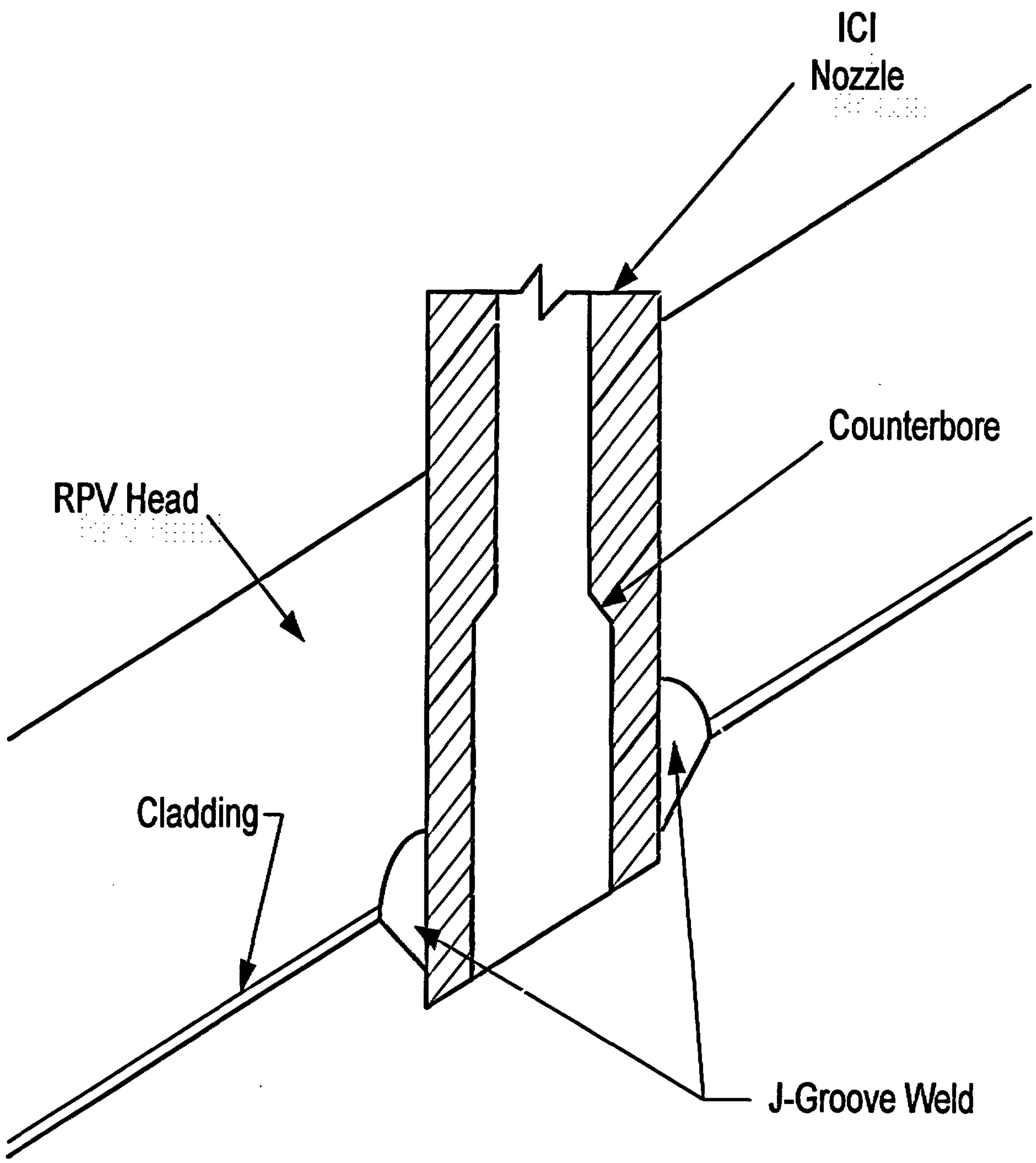

FIGURE 2
ICI NOZZLE CONFIGURATION

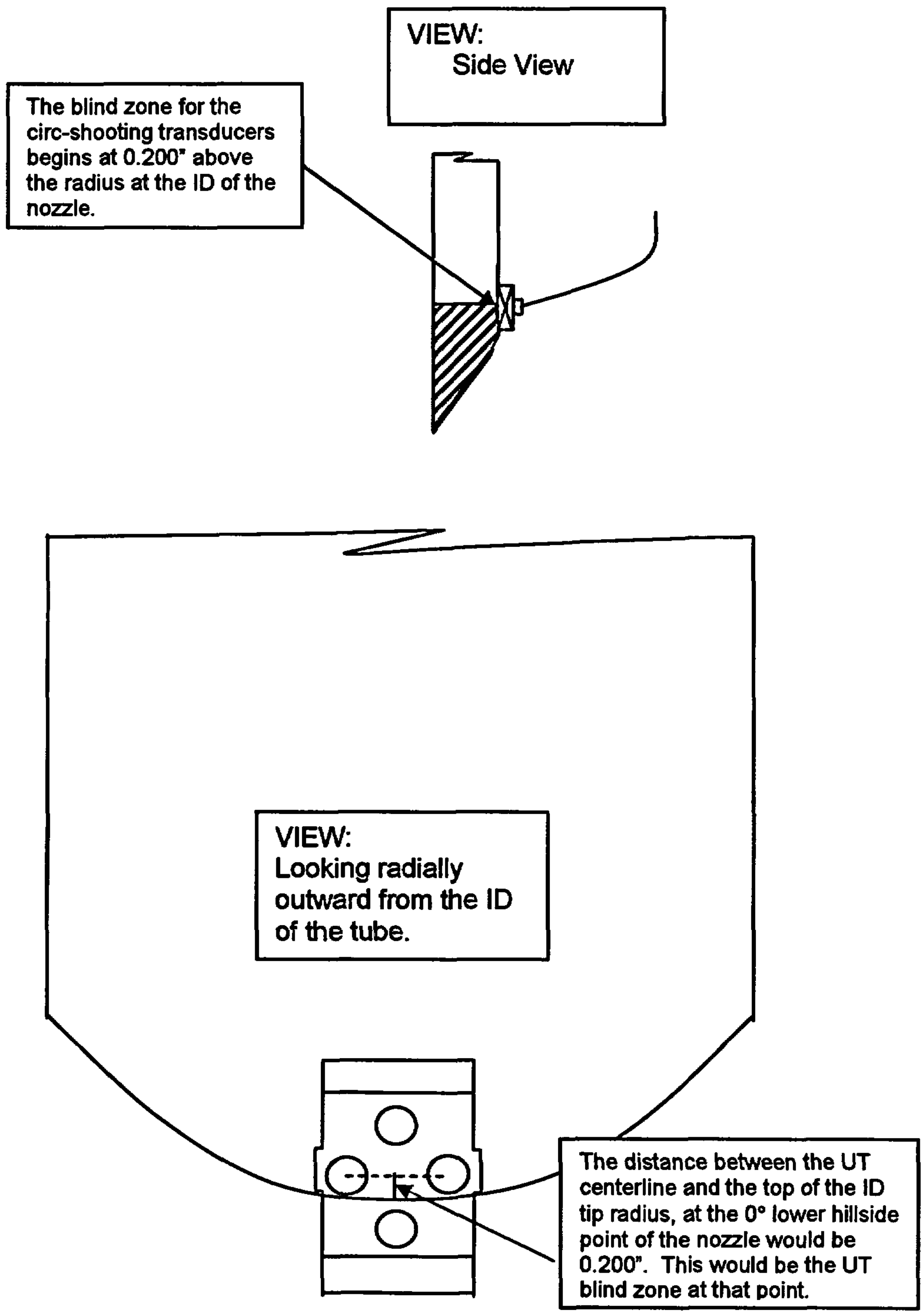

FIGURE 3
UT INSPECTION PROBE
END OF NOZZLE – LOWER HILLSIDE POSITION

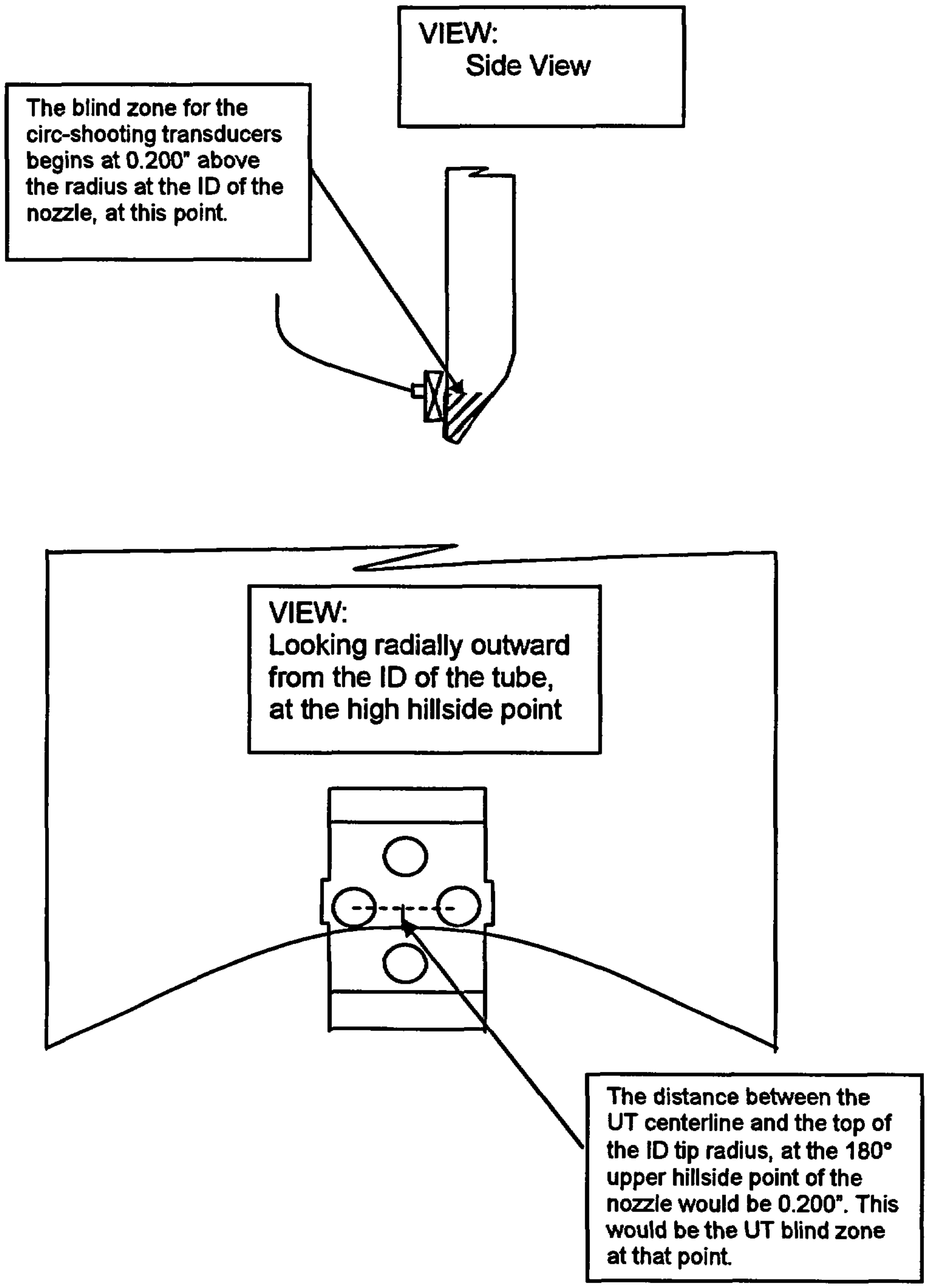

FIGURE 4
UT INSPECTION PROBE
END OF NOZZLE- UPPER HILLSIDE POSITION

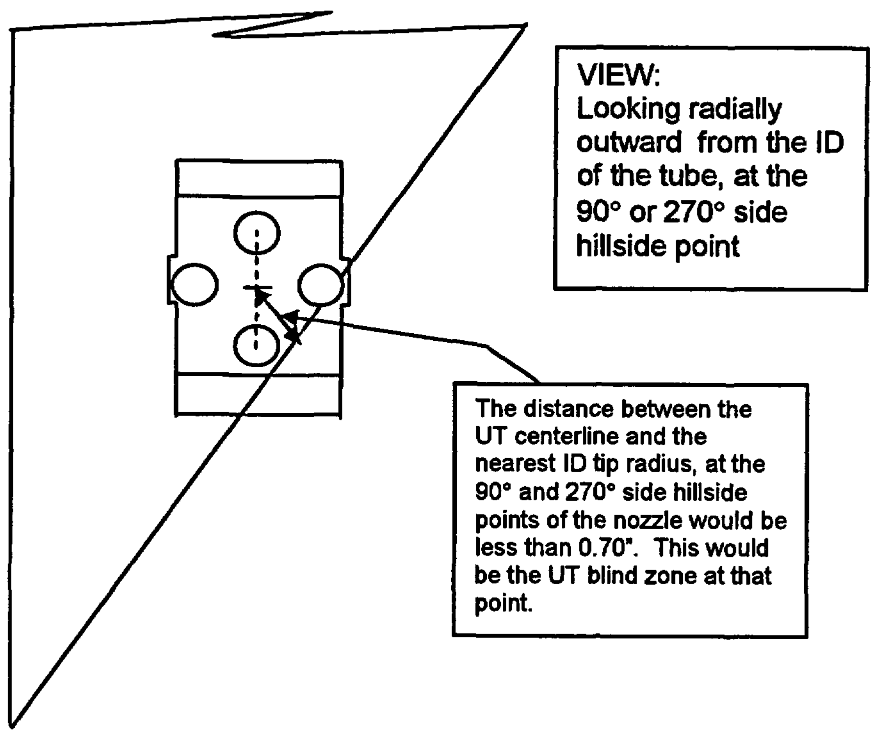

FIGURE 5
UT INSPECTION PROBE
END OF NOZZLE – SIDE VIEW @ 90° and 270°

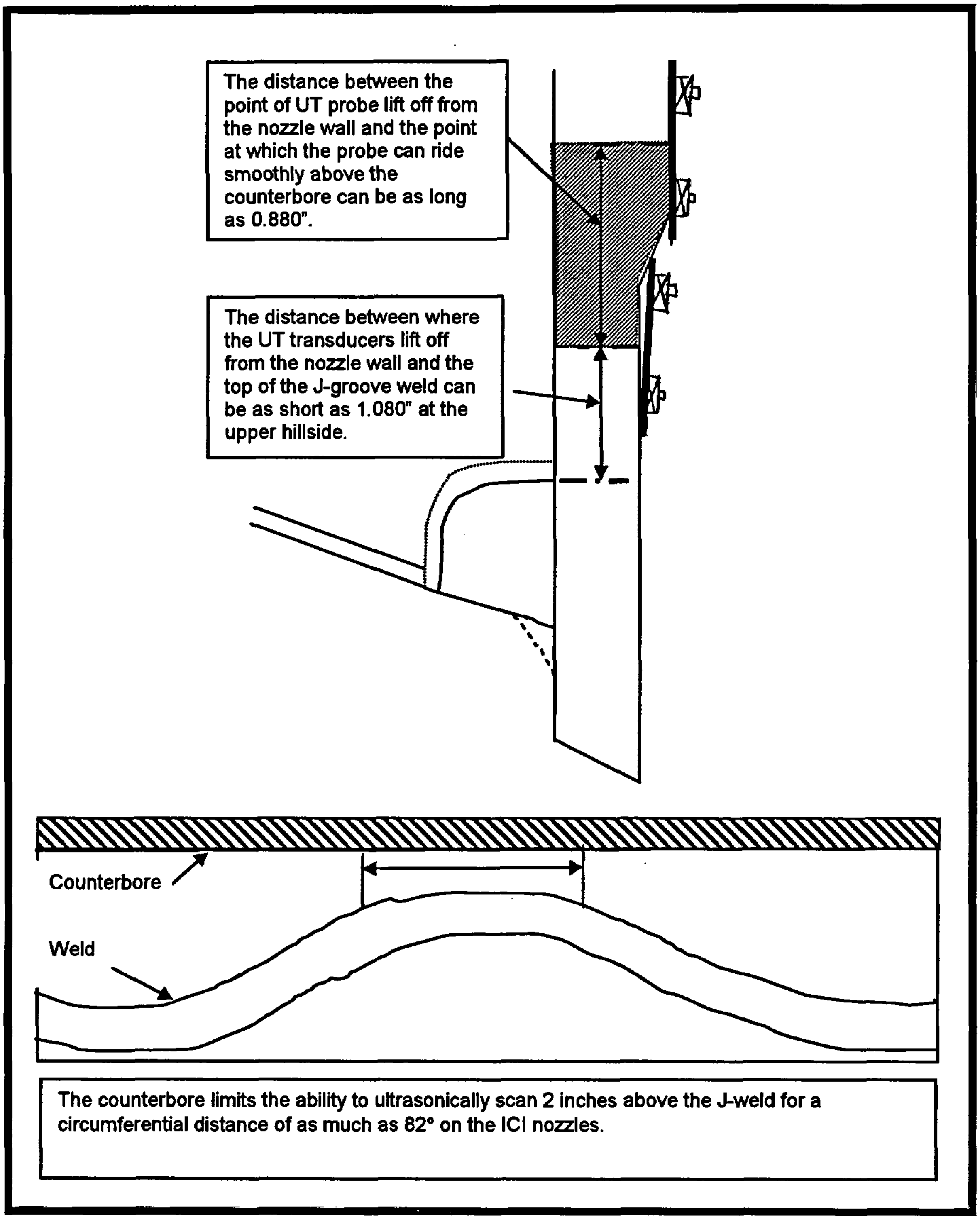

FIGURE 6
COUNTERBORE – UPPER HILLSIDE POSITION

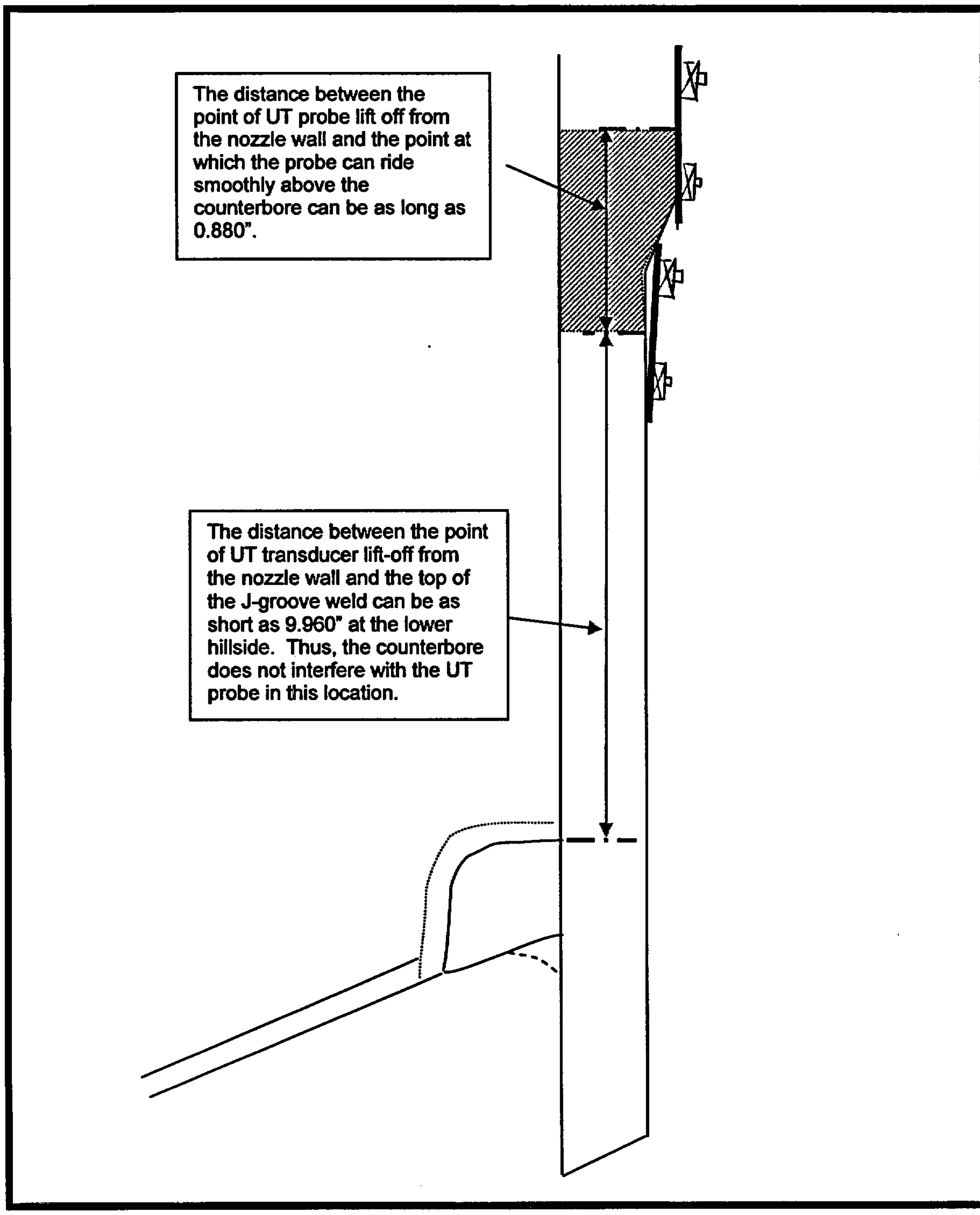

FIGURE 7
COUNTERBORE – LOWER HILLSIDE POSITION

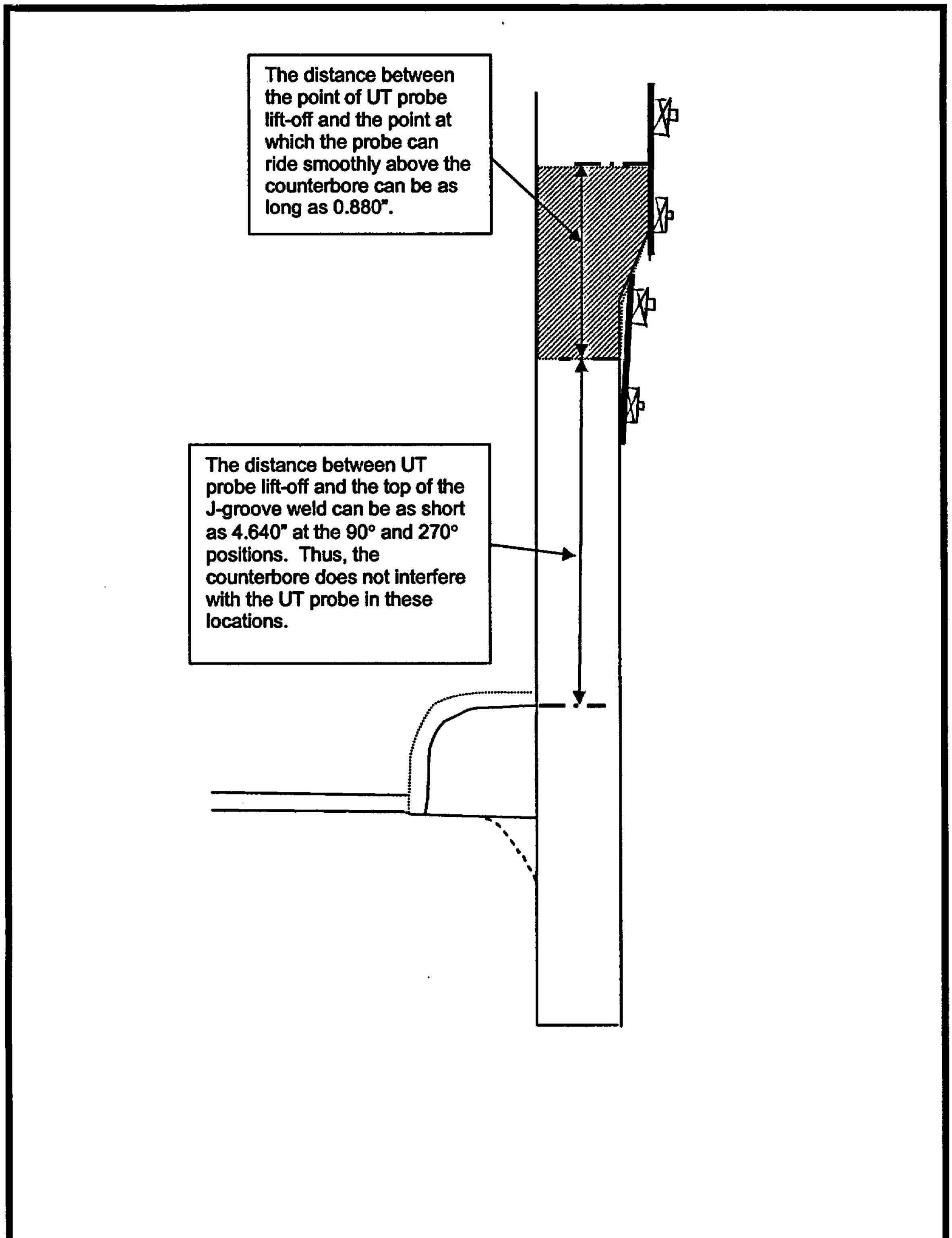

FIGURE 8
COUNTERBORE @ 90° AND 270° POSITIONS

ENCLOSURE 2

CNRO-2003-00046

LICENSEE-IDENTIFIED COMMITMENTS

LICENSEE-IDENTIFIED COMMITMENTS

COMMITMENT	TYPE (Check one)		SCHEDULED COMPLETION DATE
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
1. Entergy will provide in the 60-day report for ANO-2, as required by the Order, specific inspection information; i.e., extent of inspections and results of those inspections.	✓		60 days after startup from the next refueling outage
2. If the NRC staff finds that the crack-growth formula in MRP-55 is unacceptable, Entergy shall revise its analysis that justifies relaxation of the Order within 30 days after the NRC informs Entergy of an NRC-approved crack-growth formula.	✓		Within 30 days after the NRC informs Entergy of an NRC-approved crack-growth formula.
3. If Entergy's revised analysis (#2, above) shows that the crack growth acceptance criteria are exceeded prior to the end of Operating Cycle 17 (following the upcoming refueling outage), Entergy will, within 72 hours, submit to the NRC written justification for continued operation.	✓		Within 72 hours from completing the revised analysis in #2, above.
4. If the revised analysis (#2, above) shows that the crack growth acceptance criteria are exceeded during the subsequent operating cycle, Entergy shall, within 30 days, submit the revised analysis for NRC review.	✓		Within 30 days from completing the revised analysis in #2, above.
5. If the revised analysis (#2, above) shows that the crack growth acceptance criteria are not exceeded during either Operating Cycle 17 or the subsequent operating cycle, Entergy shall, within 30 days, submit a letter to the NRC confirming that its analysis has been revised.	✓		Within 30 days from completing the revised analysis in #2, above.
6. Any future crack-growth analyses performed for Operating Cycle 17 and future cycles for RPV head penetrations will be based on an acceptable crack growth rate formula.		✓	N/A