SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELAXATION REQUEST FROM ORDER EA-03-009 REGARDING THE

EXAMINATION COVERAGE FOR REACTOR PRESSURE VESSEL HEAD

INCORE INSTRUMENTATION PENETRATION NOZZLES

FACILITY OPERATING LICENSE NO. NPF-6

ENTERGY OPERATIONS, INC.

ARKANSAS NUCLEAR ONE, UNIT 2

DOCKET NO. 50-368

1.0 INTRODUCTION

Order EA-03-009, issued on February 11, 2003, requires specific examinations of the reactor pressure vessel (RPV) head and vessel head penetration (VHP) nozzles of all pressurized water reactor plants. Section IV, Paragraph F, of the Order states that the Director, Office of Nuclear Reactor Regulation, may, in writing, relax or rescind any of the conditions set forth in Section IV.C of the Order upon demonstration by the licensee of good cause. Section IV, Paragraph F of the Order states that a request for relaxation regarding inspection of specific nozzles shall 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. In addition, Section IV, Paragraph F of the Order states that requests for relaxation of the Order associated with specific penetration nozzles will be evaluated by the Nuclear Regulatory Commission (NRC) staff using the procedure for evaluating proposed alternatives to the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(a)(3).

For Arkansas Nuclear One, Unit 2 (ANO-2) and similar plants determined to have a high susceptibility to primary water stress corrosion cracking (PWSCC), in accordance with Section IV, Paragraphs A and B of the Order, the following inspections are required to be performed at every refueling outage in accordance with Section IV, Paragraph C.(1) of the Order:

(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.

Footnote 3 of the Order provides specific criteria for examination of repaired VHP nozzles.

By letter dated September 24, 2003, as supplemented by letters dated September 26, and October 2 and 8, 2003, Entergy Operations, Inc. (Entergy, the licensee) requested relaxation to implement an alternative to the requirements of Section IV, Paragraph C.(1)(b), of the Order for all Incore Instrumentation (ICI) nozzles at ANO-2. The licensee's letter submitted on September 24, 2003, supersedes a request made on September 3, 2003, and supplemented by letter dated September 12, 2003.

2.0 RELAXATION REQUEST FROM EXAMINATION COVERAGE FOR RPV HEAD ICI PENETRATION NOZZLES, ORDER EA-03-009

2.1 Order Requirements for Which Relaxation is Requested

Section IV.C.(1) of Order EA-03-009 requires, in part, that the following inspections be performed every refueling outage for high susceptibility plants similar to ANO-2:

(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.

The licensee has requested relaxation from Section IV.C.(1)(b)(i) of the Order to perform ultrasonic testing of the RPV head penetration inside the tube from 2 inches above the J-groove weld to the bottom of the penetration on all eight ICI nozzles. Specifically, the relaxation is related to UT examination of the bottom portion of the nozzles, as well as a portion of the counterbore region above the J-groove weld.

By supplement dated October 8, 2003, Entergy requested the relaxation for one operating cycle (operating cycle 17) commencing with the startup from Fall 2003 refueling outage at ANO-2.

2.2 Licensee's Proposed Alternative Method

The licensee stated that it will perform a UT examination from the inside diameter (ID) of each ICI nozzle (i.e., nozzle base material) in accordance with Section IV.C(1)(b)(i) of the Order, with the exception of the blind zone at the bottom of each ICI nozzle, and the blind zone in the counterbore region above the J-groove weld of each ICI nozzle. For illustration purposes, Figure 1 shows the ICI nozzle configuration, and Figure 2 shows the location of the blind zones. Figure 1 was taken from the licensee's September 24, 2003, letter, and Figure 2 was taken from the licensee's presentation that it gave at NRC headquarters on August 14, 2003.

The licensee states that because meaningful UT data cannot be collected at the bottom of the ICI nozzle, Entergy will augment the UT inspection with a surface examination of the nozzle ID surface, outside diameter (OD) surface, and J-groove weld that falls within the blind zone at the end of all eight of the ICI nozzles. The licensee also states that the nozzle end blind zone varies in length from 0.2 inch to 0.5 inch depending on probe location.

The licensee states that for the counterbore blind zone, an analysis has been performed to ensure that a postulated unidentified surface crack in the counterbore blind zone will extend along the length and into an inspectable region, at least one operating cycle prior to growing through-wall.

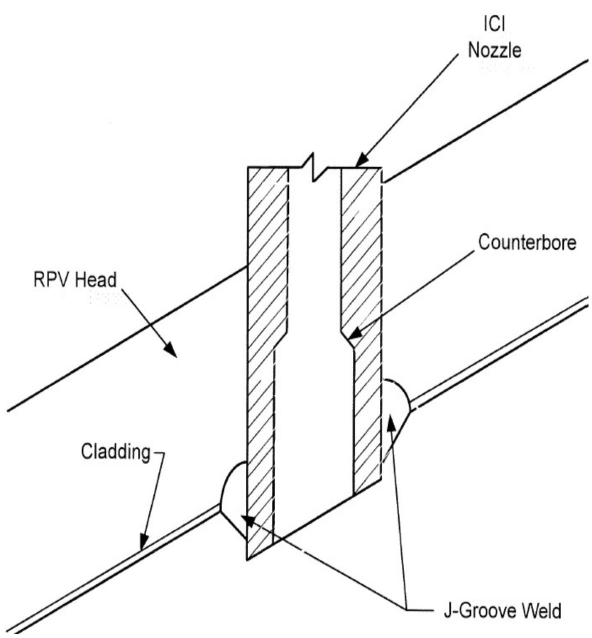

Figure 1

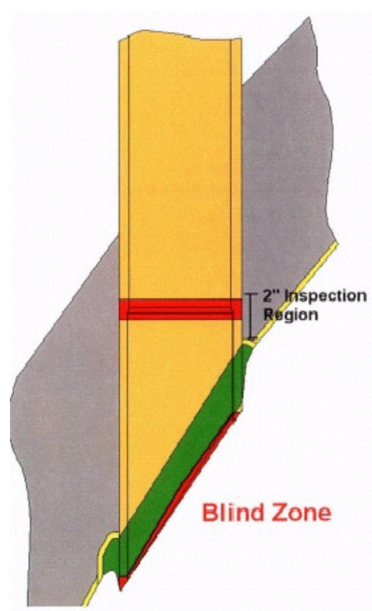

Figure 2

2.3 Licensee's Basis for Relaxation

Counterbore Blind Zone

The licensee states that the ICI nozzles are manufactured with a counterbore above the J-groove weld (Figure 1). According to the licensee, because of UT transducer liftoff of at the counterbore, a UT blind zone exists at the upper hillside location (180° azimuth) of each ICI nozzle. The licensee describes the dimensions of the blind zone as measuring approximately 0.88 inch in axial length, with the bottom of the blind zone located 1.080 inches above the top of the J-groove weld. The licensee states that the portion of the counterbore blind zone that lies within the required inspection zone of 2-inches above the J-groove weld is centered at the upper hillside location of each nozzle, and has a circumferential extent of 82°. According to the licensee, the blind zone associated with the counterbore does not exist at any other azimuthal location along the circumference of the ICI nozzle within the required 2 inch inspection area above the J-groove weld. The licensee states that the counterbore is significantly closer to the J-groove weld on the upper hillside of the nozzle than on the lower hillside, due to the RPV head angle at the ICI locations. The licensee also states that no volumetric inspection equipment is available to inspect the counterbore region, and resolving the UT limitations due to the counterbore would require eliminating the counterbore region through a physical modification of the nozzle itself. Entergy further states that it does not have the equipment necessary to perform such a modification.

Entergy states that it 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 also stated that it found that these techniques pose hardships, as discussed below.

The licensee states that performing a PT examination of the counterbore blind zone region would result in a significant increase in personnel radiation exposure of approximately 10 man-rem. The licensee also states that it has concerns related to ensuring that a valid PT examination is performed because of inherent geometrical constraints encountered when performing an examination inside a small diameter tube, such as the ICI nozzle. The licensee further states that 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, and this asymmetrical geometry presents certain challenges for personnel performing the manual PT. The licensee explains the process involved to perform a PT examination of the ICI nozzles as follows:

(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 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.

The licensee states that performing an ECT examination on the counterbore region would encounter the same limitations as those encountered with UT. Entergy also states that it 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. According to Entergy, the time and resources required to develop this equipment is unknown. Entergy states that it believes that the hardships associated with inspection activities required by the Order, as discussed in its relaxation request, are not commensurate with the level of increased safety or quality that would be obtained by complying with the Order.

Counterbore Crack Growth Analysis

The licensee states that 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. According to the licensee, the analysis, Engineering Report M-EP-2003-003, Revision 0 (Enclosure 2 of the licensee's September 3, 2003, letter), is based on design information and actual UT data obtained during the previous refueling outage. The licensee further states that, based on the aforementioned analysis, no examination of the counterbore region is necessary.

Blind Zone at Nozzle Bottom End

Entergy states that a blind zone exists along the bottom of each ICI nozzle and varies from approximately 0.20 inch to 0.50 inch. According to the licensee, the blind zone at the end of the nozzle occurs due to loss of coupling as the transducers traverse across the bottom end of the nozzle. The licensee states that 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. The licensee states that it is not aware of any equipment currently available that will resolve the configuration limitation and that new UT equipment would have to be developed and appropriately qualified. According to the licensee, the time and resources required to develop and qualify this equipment is unknown.

Inspection Probe Design Limitation

The licensee states that the inspection probe to be used to inspect the ANO-2 ICI nozzles consists of seven (7) individual transducers. The licensee further states that 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, and this recess must be filled with water to provide coupling between the transducer and the nozzle wall. The licensee contends that because of this design, the complete diameter of the transducer must fully contact the inspection surface before ultrasonic information can be collected, and since these 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, the licensee states that this theory does not hold true based on it's prior UT inspection experience. According to the licensee, a review of UT data from previous inspections shows that the circumferential-scanning TOFD transducer pair only collects meaningful data down to a point 0.200 inch above the bottom of the nozzle. The licensee states that below this point, UT data cannot be collected. Entergy further states that it 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.

The licensee stated that because of the blind zone at the end of the ICI nozzles, UT examinations will be augmented by performing a PT examination of the nozzle ID and OD surfaces, and the weld area that falls within the blind zone at the nozzle bottom end. The licensee states that augmented inspections will be performed on the bottom ends of the ICI nozzles using the manual PT examination method as the primary technique. The licensee also states that because the PT examination method cannot distinguish acceptable fabrication discontinuities from PWSCC, PT indications are conservatively assumed to be PWSCC. The licensee further states that PT indications will be investigated by either supplemental inspection using the ECT examination method or grinding followed by additional PT or ECT examinations.

Entergy states that it believes that the hardships associated with inspection activities required by the Order, as discussed in its submittal, are not commensurate with the increased level of safety or quality that would be obtained by complying with the Order.

3.0 EVALUATION

Counterbore Blind Zone

The NRC staff's review of the portion of this request regarding the counterbore blind zone region was based on Criterion (2) of Paragraph F of Section IV of the Order, which states:

> 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.

Within the context of the licensee's proposed alternative examination of the RPV penetration nozzles, the licensee has demonstrated the hardship that would result from implementing examinations to the counterbore region of the ICI nozzles. The hardship identified by the licensee includes the need for physical modification of the components due to nozzle configuration, limitation of the currently available UT probe used for nozzle examination, and radiation exposure to perform a PT examination in accordance with the Order. This evaluation focuses on the issue of whether there is a compensating increase in the level of quality and safety such that these nozzles should be inspected despite this hardship

The licensee's stress analysis and fracture mechanics analysis in support of the relaxation request for the ICI nozzles are very similar to those performed for control element drive mechanism (CEDM) nozzles. However, due to the difference in design for these two types of nozzles, the blind zone for the ICI nozzles, where UT data cannot be collected, is defined differently and is caused by different reasons. The NRC staff's evaluation will focus on these differences and assess the impact of them on the stress analysis and fracture mechanics analysis results to ensure that all technical elements have been considered properly to support continued operation of ANO-2 for one fuel cycle in the absence of inspection data in the blind zone for the ICI nozzles.

Although Section XI of the ASME Code does not provide guidelines for characterizing postulated flaws for this type of application, it is reasonable to assume existence of the largest flaw that could exist in the blind zone consistent with engineering principles. Once the initial flaw size is determined, the applied stress intensity factor (applied K) for the flaw is calculated to evaluate the crack growth according to an appropriate crack growth rate (CGR) for the Alloy 600 material. The objective is to determine whether the postulated initial flaw will grow lengthwise into an inspectable area prior to growing through-wall on the nozzle, and whether through-wall growth will occur in less than one cycle. The stresses required for the applied K calculation are from a stress analysis using finite element method (FEM) modeling of the ICI nozzle assembly. Evaluation of the technical elements mentioned above is discussed below.

The NRC staff has evaluated information regarding the FEM modeling. The licensee's FEM model considers welding processes by simulating melting and solidification of individual welding passes through a combination of thermal and structural models. Heat treatment history has also been considered. This method of calculating residual stresses is consistent with the industry practice and is acceptable to the staff. In addition, the licensee considers test and operating loads. The basic stress-strain properties for Alloy 600 nozzle material and the Alloy 182 J-groove weld filler materials used in the stress analysis are generic in shape, which are modified based on certain basic material property from ANO-2's certified material test report (CMTR). Considering the lack of plant-specific data, this engineering approach in modifying the generic stress-strain curve is appropriate. Further, the CMTR material property affects the maximum stress of the nozzle more than the generic stress-strain shape does to the stress, providing additional support for the licensee's approach. The use of the stress-strain law for an elastic-perfectly plastic model for the Alloy 182 filler metal may not be a good representation of the material's real behavior. However, it was used to overcome a modeling limitation of the FEM code so that more realistic stresses could result.

The ICI nozzles differ from CEDM nozzles by having a counterbore with an axial length of 0.25 inch and a taper of 1 to 4 (radial depth to length), located at 1.080 inch from the top of the J-groove weld. The blind zone is caused by the lift-off of the UT transducer sled over the counterbore during scanning. Since the licensee did not model the counterbore region with a mesh size that could account for stress increases, the staff requested the licensee to provide an error assessment. In response to the NRC staff's concern, the licensee provided additional information in its letter of September 26, 2003, which is based on additional FEM analyses on nozzles with and without a counterbore, where an adequate mesh was used for the counterbore region. The results indicate that the maximum axial stresses increase by 25% to 30%, while the hoop stresses stay approximately the same. The NRC staff considers this finding reasonable because geometric discontinuity is only seen in the axial direction of the ICI nozzle with a counterbore, not the circumferential direction. The NRC staff addresses the significance of the higher axial stresses in its evaluation of the licensee's fracture mechanics analysis, as described below. With the stress issue specific to ICI nozzles addressed appropriately by the licensee, the staff finds that the FEM modeling for the ICI nozzles is adequate, and the resulting stresses can be used as input to the licensee's fracture mechanics evaluation.

Assuming that the UT examination confirms there is no crack on the nozzle that creates a leak path and the triple point examination confirms there is no leak path through the weld, the licensee evaluated only ID surface flaws in the fracture mechanics analysis to assess the consequences of having flaws in the blind zone. Among the four assumed initial flaw geometries, the elliptical ID flaw of 0.88 inch in length and 0.147 inch in depth associated with Case 4 is the most limiting. Therefore, the staff focused its evaluation on the analysis and results related to this flaw. The NRC staff considers the assumed flaw length appropriate because it is the longest axial flaw that could possibly exist in the blind zone of 0.88 inch length. The assumed depth of more than one third of the nozzle wall thickness is also adequate, as supported by industry service data. This is still true even when stresses at the blind zone and the UT-accessible zone are considered. The NRC staff found that although the axial stresses at the counterbore region inside the blind zone are 25% to 30% higher than what was reported in the original submittal, they are still lower than those at the UT accessible region close to the J-groove weld. Therefore, based on service data and stresses, the NRC staff determines that the licensee's assumption on the flaw size is conservative.

For applied K calculations for ID axial flaws, the licensee used an influence-function approach, based on extensive FEM analyses for thick cylinders with ID and OD surface flaws by S. R. Mettu et. al. (1992). Using these formulas for thick cylinders is appropriate because, for this application, the radius to thickness ratio (R/t) for the ICI nozzle is 6.9.

The licensee calculated the applied K at the crack depth using the stress analysis results, which fully considers the variation of stress distribution along the depth direction. For the upper crack front, the licensee calculated the applied K using an average stress from the stress analysis results. Since the contribution of high stresses at the moving crack front region to the applied K has not been fully reflected by the licensee's "moving average scheme," the staff requested the licensee to perform a quantitative error analysis. The NRC staff did not ask for an error analysis in its CEDM relief request review because ID surface flaws are not limiting in the CEDM application, except for one case where the upper crack tip of the ID flaw is assumed to exceed the blind zone by 0.16 inch. The conservatism associated with this assumption made the error analysis unnecessary for this single CEDM case. The licensee provided additional information in its letter dated September 26, 2003, to address the error analysis for the ICI case. The licensee estimates this error by finding the ratio between the applied K for a crack with a concentrated opening force acting close to the crack tip and that using the moving average scheme. The concentrated force represents the stresses in the moving segments adjusted by the average stresses. The results indicate the error in applied K is 2.97% for the sample calculation. Considering the geometry and location differences of the ICI nozzles, the licensee estimated that an error of 10% should bound all ICI nozzles. The staff determines that the available propagation length of only 0.16 inch would limit this error among the ICI nozzles, making a 10% error bound acceptable. Using the proposed CGR equation, the staff further estimates that the crack growth, due to the increase of the applied K by 10%, is less than 15%. Based on this review of the licensee's analysis approach, the NRC staff finds that the licensee has adequately supported its conclusion that axial cracks in the counterbore blind zone will grow lengthwise into an inspectable area prior to growing through-wall, and through-wall growth will not occur in less than one cycle.

For ID circumferential flaws, the licensee's stress analysis results show compressive axial stresses for the upper, middle, and bottom locations of the blind zone. Since compressive stresses will not cause crack growth and the stress concentration factor in the range of 1.25 - 1.30 associated with the counterbore will not change the compressive stresses to tensile stresses, the NRC staff finds that the growth of postulated ID circumferential flaws in the blind zone is not credible.

The licensee used the results from the FEM stress analysis, the initial flaw sizes, and the fracture mechanics methodology discussed above to perform the crack growth analysis. The results of the available propagation length and the crack growth time to reach the propagation length are listed in Table 3 of Engineering Report M-EP-2003-003 for four assumed crack geometries within the blind zone of ICI nozzles. These results indicate that a postulated crack in the blind zone would not be expected to go through-wall in less than 6 years, and this same flaw would be expected to grow into an inspectable area within 4 years. Since the Table 3 results are calculated using an acceptable fracture mechanics methodology (including the determination of the maximum flaw size in the blind zone), and the available propagation lengths are based on acceptable UT uncertainties, the NRC staff accepts the results summarized in Table 3.

The aforementioned crack growth analysis used the approach described in Footnote 1 of the Order, with the exception of the CGR, as the criteria to set the necessary height of the surface examination. Therefore, the coverage addressed by this request provides reasonable assurance of structural integrity of the component. However, this analysis incorporates a crack growth formula different from that described in Footnote 1 of the Order, as provided in the Electric Power Research Institute Report, "Material Reliability Program (MRP) Crack Growth Rates for Evaluating Primary Water Stress Corrosion Cracking (PWSCC) of Thick Wall Alloy 600 Material (MRP-55), Revision 1." The NRC staff has completed a preliminary review of the crack growth formula, but has not yet made a final assessment regarding the acceptability of the report. If the NRC staff finds that the crack growth formula in industry report MRP-55 is unacceptable, the licensee shall revise its analysis that justifies relaxation of the Order within 30 days after the NRC informs the licensee of an NRC-approved crack growth formula. If the licensee's revised analysis shows that the crack growth acceptance criteria are exceeded prior to the end of the current operating cycle, this relaxation is rescinded and the licensee shall, 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, the licensee 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 the current operating cycle or the subsequent operating cycle, the licensee shall, within

30 days, submit a letter to the NRC confirming that its analysis has been revised. Any future crack growth analyses performed for this and future cycles for RPV head penetrations must be based on an acceptable CGR formula. By letter dated October 2, 2003, the licensee modified its alternative to include this condition.

The NRC staff finds that the licensee's proposed alternative examination of the ICI RPV head penetration nozzles, including its crack growth analysis to justify not inspecting the blind zone in the counterbore region, provides reasonable assurance of structural integrity of the RPV head, VHP nozzles, and welds. Further inspection of the ICI nozzle counterbore region in accordance with Section IV.C.(1)(b)(i) of Order EA-03-009 would result in hardship without a compensating increase in the level of quality and safety.

Bottom of Nozzle Blind Zone

The NRC staff's review of the portion of this request regarding the blind zone at the end of the ICI nozzles was based on Criterion (1) of Paragraph F of Section IV of the Order, which states:

> The proposed alternative(s) for inspection of specific nozzles will provide an acceptable level of quality and safety.

The staff finds that the geometry and configuration of the end of the ICI nozzles make them very difficult to inspect using a volumetric examination technique. The licensee states that the nozzle end blind zone varies in length from 0.2 inch to 0.5 inch, depending on probe location. The licensee proposes to perform a surface examination of the nozzle ID and OD surfaces, and the J-groove weld surfaces that fall within the blind zone at the end of all 8 of the ICI nozzles.

The staff finds that, by performing a surface examination on the area of material that is not receiving a UT examination in accordance with the requirements of Section IV.C.(1)(b)(i) of the Order, (i.e., blind zone at the end of nozzle), the licensee is performing an examination that is sufficient to detect the PWSCC phenomenon. Therefore, this alternative examination provides reasonable assurance of structural integrity of the ICI nozzles and, thus, provides an acceptable level of quality and safety.

4.0 CONCLUSION

The staff concludes that the licensee's proposed alternative examination of the ICI RPV head penetration nozzles, including its crack growth analysis to justify not inspecting the blind zone in the counterbore, provides reasonable assurance of the structural integrity of the RPV head, VHP nozzles, and welds. Further inspection of the ICI nozzle counterbore region in accordance with Section IV.C.(1)(b)(i) of Order EA-03-009 would result in hardship or unusual difficulty, without a compensating increase in the level of quality and safety.

The staff concludes that the licensee's proposed alternative examination of the ICI RPV head penetration nozzles to perform a surface examination of the blind zone at the bottom of the ICI nozzles, provides an acceptable level of quality and safety consistent with Criterion (1) of Section IV, Paragraph F, of Order EA-03-009.

Therefore, pursuant to Section IV, Paragraph F, of Order EA-03-009, good cause has been shown for relaxation of the Order, and the staff authorizes, for one operating cycle commencing with the startup from the Fall 2003 refueling outage, the proposed alternative inspections for all ICI head penetration nozzles at ANO-2, subject to the following condition:

> 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 the operating cycle which follows the current refueling outage, this relaxation is rescinded and 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 the upcoming operating cycle 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 the upcoming operating cycle and future cycles for RPV head penetrations will be based on an NRC-acceptable crack growth rate formula.

Principal Contributor: R. Davis

Date: October 9, 2003