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2CAN050301

May 8, 2003

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

SUBJECT: Arkansas Nuclear One, Unit 2
Docket No. 50-368
Request for Relaxation from Section IV.C(1)(a) of the Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads

REFERENCES:

1. NRC letter dated February 11, 2003, *Issuance of Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors* (0CNA020302)
2. Entergy letter dated February 28, 2003, *Answer to Issuance of Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors* (2CAN020304)
3. Entergy letter dated June 3, 2002, *30 Day Post Outage Response to NRC Bulletins 2001-01 and 2002-01 for ANO-2 and Follow-up Response to Bulletin 2002-01 for ANO-1 and ANO-2* (0CAN060203)
4. Entergy letter dated September 4, 2001, *30 Day Response to NRC Bulletin 2001-01 for ANO-2; Circumferential Cracking of VHP Nozzles* (2CAN090102)
5. Entergy letter dated November 15, 2001, *Supplemental Response to NRC Bulletin 2001-01 Regarding ANO-2 Vessel Head Penetration Inspection Scope* (2CAN110102)
6. Entergy letter dated June 17, 2002, *Submittal of Demonstration Report for Volumetric Examination of Vessel Head Penetration Nozzles* (0CAN060201)
7. Entergy letter dated May 14, 2002, *60 Day Response to NRC Bulletin 2002-01, Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity* (0CAN050201)

Dear Sir or Madam:

On February 11, 2003, the Nuclear Regulatory Commission (NRC) issued an Order addressing interim inspection requirements for reactor pressure vessel (RPV) heads at pressurized water reactors (Reference 1). The NRC stated that the actions in the Order are interim measures, necessary to ensure that licensees implement and maintain appropriate measures to inspect and, as necessary, repair RPV heads and associated penetration nozzles. The Order required that licensees begin implementation of the requirements of the Order immediately and respond to specific actions within twenty (20) days of the date of the Order. Entergy Operations Inc. (Entergy) submitted the Arkansas Nuclear One, Unit 2 (ANO-2) Order response by letter dated February 28, 2003 (Reference 2) and indicated that we would be seeking relaxation of requirements contained in Section IV.C(1)(a) of the Order. Accordingly, as provided for by Section IV.F of the Order, this letter requests a relaxation from Section IV.C(1)(a) of the Order, which requires a bare metal visual (BMV) examination of 100 percent of the RPV head surface.

Entergy's request for relaxation of the bare metal visual inspection requirements for the ANO-2 RPV head is contained in Attachment 1. Entergy believes that the benefit derived from a bare metal visual inspection of the ANO-2 RPV head as required by the Order is not commensurate with the potential risk and the excessive difficulty in removal and replacement of insulation components. The actions, required by the Order, to perform volumetric examinations of the reactor head penetrations and visual inspections of the reactor vessel head cooling shroud/head flange provide the primary assurance for reactor vessel head integrity. Entergy inspected the ANO-2 reactor vessel head penetrations during the Spring 2002 refueling outage (2R15) using ultrasonic testing (UT) examinations from the inside diameter of the nozzle surface. The results of this inspection were provided to the NRC in Reference 3. All 90 head penetrations were confirmed to retain their pressure boundary integrity and there were no indications of primary water stress corrosion cracking.

Additionally, Entergy will perform supplemental inspections as discussed in Attachment 1 and as committed to in Attachment 2 of this letter. These additional commitments include a visual inspection of RPV head periphery inside the cooling shroud and the examination of the portion of the J-groove weld adjoining the nozzle including the triple point of the weld, nozzle and annulus interface. Entergy believes that examinations and inspections derived from the remainder of the actions of the Order and the supplemental examinations, committed to herein; provide an acceptable level of quality and safety. Therefore, sufficient basis exists for the NRC to grant relaxation of the requirements contained in Section IV.C(1)(a) of the Order until replacement of the ANO-2 RPV head.

The proposed relaxation request involves new commitments as summarized in Attachment 2. Entergy requests expedited review and approval of this request by July 1, 2003, to support planning for the Fall 2003 refueling outage.

If you have any questions or require additional information, please contact Steve Bennett at 479-858-4626.

Sincerely,

CGA/sab

Attachments
1. Relaxation Request for ANO-2 Regarding Performance of Bare Metal Visual Inspection of the Reactor Vessel Head
2. List of Regulatory Commitments

cc: Mr. Ellis W. Merschoff
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Attachment 1

2CAN050301

Relaxation Request for ANO-2 Regarding Performance of Bare Metal Visual Inspection of the Reactor Vessel Head

**Relaxation Request for ANO-2 Regarding
Performance of Bare Metal Visual Inspection of the Reactor Vessel Head**

1.0 BACKGROUND

On February 11, 2003, the U.S. Nuclear Regulatory Commission (NRC) issued an Order (Reference 1) regarding interim requirements to ensure that licensees implement and maintain appropriate measures to inspect and, as necessary, repair reactor pressure vessel (RPV) heads and associated penetration nozzles at pressurized water reactors. The Order was effective immediately and modified the license for Arkansas Nuclear One, Unit 2 (ANO-2). Based upon criteria in section IV.B of the Order, the ANO-2 RPV head will be entering the high susceptibility ranking for primary water stress corrosion cracking (PWSCC) in the outage beginning in the fall of 2003. The category of high susceptibility is based upon having of greater than 12 effective degradation years (EDY) or previous indications of PWSCC induced cracking in the RPV head penetration nozzles or nozzle J-groove welds. The ANO-2 RPV head has not experienced PWSCC induced cracking in RPV penetration nozzles or J-groove welds but is expected to be at approximately 12.4 EDY by the end of cycle 16.

2.0 ANO-2 REACTOR PRESSURE VESSEL HEAD DESIGN

The ANO-2 RPV head was fabricated by Combustion Engineering and has 81 Control Element Drive Mechanism (CEDM) penetrations, eight incore instrument (ICI) penetrations and one head vent penetration (Figure 1). The CEDM nozzles consist of a 4.05 inch outside diameter (OD) tube with a guide cone threaded into the inside of the bottom of the tube. In addition, a CEDM motor housing adaptor, attached at the top of the tube, tapers out to a larger diameter to mate with the 7 3/16 inch OD CEDM motor housing using an omega seal weld. The cone connections and the motor housing adaptors both closely follow the contour of the head. The ICI nozzles have an internal diameter (ID) of 4.75 inches and do not have guide cones attached. The vent line is a three-quarter inch ID NPS Schedule 80 pipe made from ASME SB-167 Alloy 600 material. The ANO- 2 reactor vessel was built to the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section III, Nuclear Vessels, 1968 edition with addenda through Summer 1970.

3.0 APPLICABLE REQUIREMENTS

The Order establishes a minimum set of RPV head inspection requirements, as a supplement to existing inspection and other requirements in the ASME Code and NRC regulations. The requirement addressed by this request involves Section IV.C(1)(a) of the Order. Section IV.C(1)(a) requires plants with RPV heads having a high PWSCC susceptibility classification to perform a bare metal visual (BMV) examination of 100 percent of the RPV head surface each refueling outage. The Order further provides that the NRC may relax any of the conditions of the Order upon demonstration by the licensee given good cause. Entergy believes the inspections and examinations as discussed herein provide an equivalent level of quality and safety for identifying RPV head PWSCC and potential for boric acid corrosion. Accordingly, and as provided for by Section IV.F, Entergy requests relaxation from Section IV.C(1)(a) of the Order.

4.0 REASON FOR RELAXATION

4.1 ANO-2 Cooling Shroud, CEDM Housing and RPV Head Insulation Description –

Entergy has reviewed the configuration of the ANO-2 RPV head assembly and concluded that due to its unique design, it would involve significant hardship to disassemble and reassemble the cooling shroud and insulation package to perform a bare metal visual inspection. The risk of damaging vital CEDM components during removal and installation of the cooling shroud and potential damage to the insulation package has prevented BMV inspections from being an reasonable option to Entergy. A description of the configuration of the ANO-2 head, insulation and cooling shroud is provided in the following paragraphs.

The insulation on the ANO-2 RPV head is comprised of metal reflective panels and pliable insulation collars covered with fiberglass cloth (Figures 2 and 3). The RPV head insulation in the nozzle area is designed to conform to the curvature of the head, and is located underneath the CEDM cooling shroud orifice plate, which is also designed to conform to the curvature of the RPV head. A plenum is provided at the outside of the cooling shroud orifice plate which forces cooled air from the CEDM cooling system across the RPV head insulation and through holes in the orifice plate where the CEDM assemblies penetrate the cooling shroud. Removable insulation is provided only in the head flange and stud region, which does not interface with the CEDM or incore instrumentation nozzles.

<u>Nozzle Insulation Collars</u> - The 81 CEDM nozzles and 8 incore instrument nozzles are insulated with a prefabricated, pliable insulation collar which fits snugly around the base of each nozzle on the top of the RPV head. The head vent is surrounded by the metal reflective insulation and does not have a collar. The bottom of each collar is custom fit to follow the contour of the RPV head. The collar is comprised of Pittsburgh Corning TempMat insulation covered with fiberglass cloth lagging and is held in place by stainless steel (SS) wire. The inside diameter of the insulation collar is comprised of a continuous cylinder of 24 gauge SS. The nozzle insulation collars terminate approximately 3/4 of an inch below each CEDM nozzle omega seal weld lip. The height of the insulation collars range from 1-7/16 to 11-7/16 inches depending on the location of the nozzle on the RPV head dome region.

<u>Head Dome Insulation</u> - The insulation collars described above are enclosed by prefabricated SS reflective insulation panels, which are in direct contact with the RPV head. The openings in the panels are sized to closely fit around the CEDM nozzle insulation collars. The panels are provided with lap joints to form a seal over the head region. There is a single panel at the top of the dome that is approximately 56 inches in diameter and interfaces with 21 CEDM nozzles. Two additional tiers of panels are provided on the dome region of the head, with the upper tier consisting of 8 panels (outside diameter of 98.5 inches), and the lower tier consisting of 8 panels (outside diameter of 129.5 inches). A total of 17 insulation panels make up the dome insulation.

<u>Insulation/Cooling Shroud Interface</u> - The CEDM cooling shroud is made of steel plates which are typically 3/8 or 1/2 inch thick depending on the location. The top center portion of the orifice plate is 1/8 of an inch thick. They are installed on top of the RPV head above the insulation components and provide an engineered cooling path around each of the CEDM nozzles and housings that is critical to CEDM reliability. The center section of the cooling shroud (orifice plate) conforms to the head curvature through a series of stair-step plate

sections which have specifically sized orifices through which the CEDM nozzles pass. The annulus gap between the CEDM and each orifice is sized to control the air flow through that orifice. The CEDM cooling shroud orifice plate openings around the 81 CEDM nozzles range from 9.41 to 9.86 inches in diameter, while the outside diameter of the CEDM assembly at the orifice elevation is 7 3/16 inches (Figure 3). The tops of the nozzle insulation collars are approximately 9 inches below the bottom of the orifice plate. However, because the head is a radius shape and the cooling shroud is stair-stepped, the distance from the top of the insulation to the bottom of the cooling shroud may be 4 inches or less. A coil stack is installed external to the CEDM motor housing. The coil stack rests on the CEDM housing with no mechanical attachment. The outside diameter of the CEDM coil stacks are 10 1/4 inches (which is larger than the orifice holes through the cooling shroud), and the bottom of each coil stack assembly is 1 3/4 inches above the orifice plate. The coil stack and attached CEDM shroud are in excess of 18 feet long. The Reed Switch Position Transmitter (RSPT) consists of a group of reed switches and a voltage divider network mounted within a stainless steel tube. Two reed switch stacks are mounted on each CEDM outside the RCS pressure boundary along the upper CEDM housing and have to be removed to remove the coil stacks.

The cooling shroud is connected to the head through trunnions attached to the top of the cooling shroud plenum via three vertical support legs on the lift rig (Figures 1 and 5). Keyways are provided at the bottom of the cooling shroud for proper alignment and to ensure that dynamic conditions do not impact safety related components. The lifting rig remains connected to the head assembly during cycle operation. Eight personnel doors located around the RPV cooling shroud provide access to the ICI nozzles including several of the outer periphery CEDM nozzles. At these locations visual inspection of insulation panels and limited viewing of the CEDM collars can be performed. Boric acid deposits that would be present from above the head or that would occur from a leaking nozzle in these areas should be visible.

Access to the nozzle insulation collars from above the orifice plate is restricted due to the size and location of the orifice plate openings. Below the orifice plate the vertical gap between the insulation and the cooling shroud is as little as 4 inches and the horizontal gap between the nozzle insulation collars is approximately 2.5 inches wide. Due to the relationship between the dome shape of the head and the stair step shape of the cooling shroud, there is not a direct line of sight from the personnel doors in the cooling shroud to the space between the top of the reflective insulation and the bottom of the cooling shroud orifice plate.

<u>CEDM Nozzle Spacing</u> –The CEDM nozzles are in a symmetrical grid with the nozzles spaced 11 9/16 inches on center. The outside diameter of the CEDM motor housing is approximately 7 inches from the nozzle up to a point about five feet above the top of the head. This leaves only about 4 1/2 inches between the CEDM motor housings for the first five feet above the head surface, and only slightly more space for the next upper 15 feet. Assuming the RSPTs, CEDM coil stacks, cooling shroud, reflective insulation panels, and insulation collars are removed, the congestion of the CEDM motor housings still limit access to reinstall the insulation collars. If damage of the CEDM housings or insulation collars occur during disassembly or reassembly, the hardship for making repairs would be significant.

4.2 Limitations to Conducting RPV Head BMV Inspection –

In order to provide access to the RPV head for BMV inspections, several physical limitations exist to gain access to the RPV head insulation and lifting the cooling shroud. The concerns that these limitations create for gaining access to the RPV head have been determined to create a substantial hardship. Figure 5 provides a full view of the head, cooling shroud, lifting rig, drives, etc. The following discussions summarize Entergy's concerns with these conditions:

4.2.1: Typical Industry Practice - Performing a Bare Metal Visual without Removal of the Cooling Shroud – Typically the other pressurized water reactors have gained access to the insulation under the cooling shroud without removal of the shroud based on clearances and accessibility. However, for ANO-2 the cooling shroud fits closely over the insulation panels and only limited access can be provided to reach the insulation panels and insulation collars. The ANO-2 cooling shroud and insulation package were not designed and constructed to be able to perform BMV inspections of the head and were not designed to be removed from the top of the head. The ANO-2 head insulation collars were installed while the remainder of the CEDM assemblies was being welded in place. Because of the close spacing of the nozzles, the original construction was completed by installing each insulation collar immediately after its motor housing was welded in place, and before the adjacent CEDM motor housings were installed. The motor housings and insulation collars were installed sequentially in this manner working from the inner nozzle locations toward the periphery.

The insulation collars around the nozzles were custom fit to follow the contour of the head surface and the nozzle surface below the omega seal welds. The insulation collars were installed first, then the reflective metal insulation panels were lowered into place to fit around the collars. If a means could be developed to lift the metal reflective insulation enough to insert a boroscope or fiber-optic inspection tool between the metal reflective insulation and the head surface, the collars would still prevent access to perform the visual inspection of the head surface around the nozzles. The insulation collars cannot be lifted off of the head due to the rigid 24 gauge stainless steel inner cylinder with radial spokes on top and bottom, and the close fit of the collar below the taper transition of the nozzle.

Assuming that tooling could be developed to access the insulation collars, cutting a gap in the insulation collars would invalidate the CEDM thermal analysis since the nozzle insulation collar would not be able to be restored to their original design condition. CEDM cooling would be impacted by introducing convection paths from the RPV head to the cooling shroud envelope via gaps between the nozzles and insulation. The CEDM thermal analysis would have to be evaluated to assess the effects on the CEDM components.

The ability to safely remove insulation from under the cooling shroud as typically performed at other facilities cannot be performed at ANO-2. Therefore, to perform a BMV inspection, the cooling shroud and insulation package including collars would have to be removed.

4.2.2 First Alternative to Industry Practice - Removing the Cooling Shroud and Associated Insulation Panels - The removal of the cooling shroud creates substantial risks since this evolution has not been previously attempted. Lifting the steel cooling shroud has a high risk of damaging the CEDM housings. Entergy is not aware of a facility that has removed the cooling shroud to perform a BMV inspection. The weight and close tolerances of the cooling shroud and lift rig once released from the head have the potential to shift and damage the CEDM housings while lifting.

As viewed in Figure 5 the head lift rig is made up of three legs that are pinned to the reactor head lifting lugs at the bottom of the legs, and are structurally connected near the top by the work platform and the stud handling hoist monorail system. The legs are also structurally connected to each other by a lead shielding support structure just above the cooling shroud. The cooling shroud is attached to the legs at the top of the shroud by trunnions. The top of the legs provide a pin connection to which the lifting tripod attaches. The tripod provides a single point of attachment at the top center of the tripod that the polar crane connects to when lifting the head. The height of the lift rig from its connection to the RPV head to the eye at the top of the tripod is approximately 33 feet. A pendulum type lift of this structure with the polar crane could experience unanticipated damage to the CEDM motor housings due to the lift rig tilting, swinging, or rotating. The cooling shroud which is made of up to 1/2 inch plate steel has the potential of undergoing spring deformation from cycles of heatups and cooldowns. This potential deformation could further hamper removal and reinstallation.

Prior to lifting the cooling shroud, 81 coil stacks and 162 RSPTs have to be removed from the CEDM drive housings. In addition, the 17 interconnected insulation panels would have to be removed by unbuckling the interconnections and lifting each panel over the top of the CEDM motor housings. These panels are designed to fit into place with specific configurations around CEDM nozzles. Based on the experience with similar panels, Entergy believes that, if removed, the insulation panels would likely have to be replaced with new panels to restore the required fit between the panels.

The head lift rig, coil stacks and RSPTs that have to be removed require special storage racks to be designed and constructed. Adequate planning is necessary to address the ALARA considerations, storage racks for the RSPTs and coil stacks, along with floor loadings and available space for placing the cooling shroud and lift rig.

The dose for the removal/reinstallation of the cooling shroud (including the RSPTs and coil stack removal) and insulation components is estimated to be 23 man-rem. This estimate only includes the actual projected work and does not include contingencies that may arise as previously mentioned.

4.2.3 Second Alternative to Typical Industry Practice - Redesign of the Shroud and Insulation Package - The optimum approach would be to redesign the cooling shroud and insulation, such that, the insulation could easily be removed during future outages without requiring removal of the shroud and CEDM coil stacks. The scope of work required to redesign the cooling shroud and perform the heat transfer analysis for the design change is substantial. Therefore, the near-term redesign and installation of a complete insulation package and cooling shroud is not realistic and its feasibility for future outages will have to be assessed. Entergy believes that this effort is best performed as part of RPV head replacement initiative.

Given the present ANO-2 RPV head cooling shroud and insulation design, the bare metal surface inspection cannot be performed without the benefit of effective planning and risk management. Based upon this, Entergy has concluded that a BMV inspection of the surface of the RPV head would not yield a commensurate safety benefit relative to the potential for damage of equipment and given that the volumetric examination of the nozzles and welds assure that no pressure boundary leaks are present. For this reason, relaxation from the requirement for a 100 percent BMV examination of the RPV head surface is considered appropriate.

5.0 PROPOSED ALTERNATIVE

Fall 2003 Refueling Outage RPV Head Inspection Plans - The majority of the RPV head is not accessible for visual inspection, however, there are doors that are located in the cooling shroud (8 ICI nozzle and 6 alignment key doors) which provide limited viewing of the ICI nozzles and peripheral CEDM nozzles. Therefore, to help assure a comparable level of quality, Entergy will perform a visual inspection of the ICI nozzles and accessible CEDM nozzles through the cooling shroud access doors during the Fall 2003 and for future outages until head replacement. This inspection will look for boric acid deposits that would be indicative of a penetration leak or that could potentially cause wastage of the RPV head. If boric acid accumulation is identified during this inspection, further inspection and evaluation will be performed to ensure that no degradation of the RPV head has occurred. In addition, as part of ANO's GL 88-05 inspections, the head flange around the studs is inspected 360 degrees around the outside of the cooling shroud.

Prior to issuance of the Order, Entergy was following the guidance of MRP-75 and our commitments for compliance to NRC Bulletins 2001-01 and 2002-01. The ANO-2 outage inspection plan included volumetric examinations but did not include bare metal visual inspections of the RPV head. Entergy has previously been in the moderate susceptibility category and the difficulty in performing a BMV inspection had been established in response to NRC Bulletin 2001-01 (Reference 4). Until issuance of the Order, Entergy had concluded that volumetric examinations of the RPV head penetrations were sufficient to ensure RPV head integrity. The NRC acceptance for Entergy to only perform volumetric examinations of the ANO-2 RPV head penetrations was documented in Reference 5. The redesign of the shroud and insulation package is a significant task that would best be served as part of a larger initiative for replacing the RPV head. Entergy is evaluating reactor vessel head replacement as part of ongoing efforts to remove Alloy 600 materials from the RCS pressure boundary. Entergy will provide further plans during the following cycle that will clarify our intention for head replacement or will provide our plans for gaining access to the top of the head for performing a BMV inspection.

Entergy will perform volumetric examination of 100% of the reactor pressure vessel head penetrations during the next scheduled refueling outage and future cycles until RPV head replacement. The volumetric examinations will use Westinghouse demonstrated UT probes similar to that used in the last 2R15 refueling outage. This examination will be performed using EPRI demonstrated UT examination techniques for examination of the nozzle tube wall and J-groove weld interface.

The Westinghouse open housing UT probe has been previously demonstrated to be able to see flaws at least 0.060 of an inch into the J-groove weld. This capability was provided in an NDE demonstration report submitted to the NRC in Reference 6. Based on this testing, PWSCC flaws at the J-groove weld to tube interface of 0.060 of an inch into the J-groove weld will be detected. During the previous refueling outage the open housing probe was able to scan each of the penetrations and was able to confirm the integrity of the J-groove weld next to the nozzle. The UT examination of ANO-2 CEDM and ICI nozzles was performed during refueling outage

2R15 using the Westinghouse open housing UT probe. Having the capability to examine a minimum of 0.060 of an inch into the weld also provides the ability to look at the triple point where the penetration nozzle, J-groove weld and nozzle to head annulus join.

The Time of Flight Diffraction (TOFD) technique will be used to examine each CEDM and ICI penetration tube, including 0.060 of an inch of the adjacent J-groove attachment weld, looking for planar-type defects within this examination volume. This 2002 Materials Reliability Program (MRP) Inspection Technology Demonstrations has demonstrated the TOFD to be capable of detecting flaws in the entire proposed examination volume, including the “triple point” region of the attachment weld. The TOFD ultrasonic inspection approach utilizes two pairs of 0.250” diameter, 55° refracted-longitudinal wave transducers facing each other. These transducers are separated from each other at a distance of 24mm PCS (probe center spacing). One transducer sends sound into the inspection volume, and the other transducer receives the reflected and diffracted signals, as they interact with the material. This technique is accurately calibrated on a calibration standard of known dimensions, which allows for accurate depth and length dimensioning and positioning of any reflectors that are recorded within the examination volume. One TOFD transducer pair detects in the axial direction of the penetration tube, and one TOFD transducer pair detects in the circumferential direction of the penetration tube. The triple point examination provides additional assurance and confidence that there are no flaws that provide a leak path to the annulus and surface of the head. Therefore, Entergy commits to assess the triple point of the nozzle examinations to further ensure pressure boundary integrity.

<u>ANO Comprehensive Management of Alloy 600</u> - Entergy has ongoing efforts underway to address Alloy 600 nozzles and welds in Entergy’s nuclear facilities. The ANO-1 reactor vessel head, which is a B&W design, is being replaced in the Fall 2005 refueling outage. Even though the ANO-2 head has not experienced PWSCC to date, Entergy recognizes the need to monitor and maintain the long term integrity of the head and other reactor coolant pressure boundary components. Studies have begun to evaluate the replacement of the ANO-2 RPV head. Entergy replaced the ANO-2 steam generators, which had Alloy 600 tubes, in the Fall 2000 refueling outage. Studies are also underway for performing permanent repairs or replacement of the ANO-2 Pressurizer. Coordination of these repairs and replacements are part of the overall planning strategy for maintenance of the ANO-2 reactor coolant pressure boundary integrity. As discussed in Reference 7, ANO also has an Alloy 600 program and a boric acid control program which ensure that Alloy 600 nozzles are regularly monitored and that potential boric acid corrosion is addressed.

In addition, Entergy is actively involved in industry initiatives and evaluation of findings regarding PWSCC degradation. The ANO Alloy 600 and boric acid control programs have further matured from experiences gained at Entergy facilities and from other nuclear facilities. Entergy continues to incorporate lessons learned from new insights from PWSCC-related industry events. Lessons learned training from the Davis Besse event through Significant Operating Event Report 02-4 has been provided to ANO supervision and above. This training reinforces management awareness and expectations to prevent similar concerns from occurring.

6.0 BASIS FOR RELAXATION ACCEPTIBILITY

Previous Volumetric Examination - Entergy performed a 100% UT examination of the ANO-2 RPV head penetrations during the most recent refueling outage in the Spring of 2002. The scope consisted of an examination of all of the RPV head penetrations 360 degrees around the nozzle. The nondestructive examination (NDE) from under the head was performed by Westinghouse using their procedures with the oversight of Entergy Engineering and Quality Control specialists. The inspection plan for the 81 CEDMs included the use of the EPRI demonstrated UT probe from above the J-groove weld to the inspectible extent of the nozzle below the weld. The eight ICI nozzles were similarly inspected using a comparable UT probe but modified for the larger ICI nozzle diameter. The single vent nozzle was inspected by a smaller UT probe that utilized axial and circumferential shooting ultrasonic shear-waves. All 90 head penetrations were confirmed to have good pressure boundary integrity with no indications of PWSCC cracking and reactor coolant system leaks that could cause head wastage. The outage results were reported in Reference 3.

The Fall 2003 examinations will scan 2 inches above the J-groove weld on the CEDM and ICI nozzles and into the interference fit region between the RPV head and nozzle to provide an assessment of a potential leak path in the interference fit region. In the event that there is not an interference fit between the nozzle and the RPV head low alloy material, the examination of the triple point will further confirm the existence or absence of flaws. Cracking that would result in leakage through the J-groove weld would pass through the triple point at a location around the circumference. This examination of the triple point also provides an assessment to determine if a leak path exists into the interference fit region as required by the Order. For this reason, precursors to PWSCC initiated leakage will be identified, evaluated, and repaired as required.

Visual Inspections - Visual inspections of the RPV cooling shroud and the periphery of the head at the flange are performed in accordance with Generic Letter (GL) 88-05. There has been no indication of boric acid leakage from above the head that could cause RPV head wastage. Entergy has no reason to believe that reactor pressure vessel head degradation has occurred at ANO-2. Prior to the recent refueling outage (spring of 2002), the GL 88-05 inspections along with other routine inspections of the ANO-2 reactor pressure vessel head has not identified boric acid leakage on the head. Boric acid visual inspections were performed while cooling down during 2R15 and again after the reactor head was placed on the head stand. Typical views of the top of the cooling shroud between the CEDM housings from inspections performed during 2R15 are provided in Figure 4. Only trace amounts of boric acid staining was observed at a few locations (likely from historical control element drive mechanisms venting). The 2R15 results of the inspection for ANO-2 reactor vessel head were provided to the NRC in Reference 3.

The ANO CEDM motor housings are attached to the CEDM penetration nozzles by a welded connection. Therefore, ANO-2 is not susceptible to leakage through a flanged gasket connection above the head that has been experienced at other sites.

ANO-2 performed 100% volumetric examination of the CEDM and ICI nozzles at the last refueling outage and no PWSCC indications were found. It is unlikely that a crack has initiated and propagated through the pressure boundary in one cycle. Nevertheless, Entergy's proposed inspection method will be able to determine if there is a throughwall or throughweld crack by interrogating the full thickness of the nozzle and at least 0.060 of an inch into the weld. If there is a leak path through the weld, it would be detected with the UT inspection technique at the triple point of the annulus, nozzle, and weld interface.

The Fall 2003 UT examination will also be capable of detecting the "river bed" affect associated with leakage through the annulus region. This technique determines whether telltale signs of washout exist from lack of contact between the carbon steel of the head and the OD of the nozzle wall in the annulus region. Entergy's supplemental visual inspection will ensure that there is no evidence of leakage from above that could cause head degradation. Visual inspections from above and volumetric examinations of the RPV head penetrations provide reasonable assurance that there is no degradation to the carbon steel vessel. The triple point examination and the supplementary visual examination of the peripheral ICI and CEDM penetrations offer a complimentary approach to a bare metal visual inspection. Therefore, Entergy does not believe that the BMV inspection provides a commensurate level of benefit given the difficulty and possible damage of the insulation and CEDM components in removal and restoration of the cooling shroud and insulation.

Other CE Head Designs - The Combustion Engineering (CE) facilities have been inspecting the RPV head penetrations for several years. The inspections have involved a combination of bare metal visual inspections, UT examinations and J-groove weld eddy current testing. A couple of CE units have experienced some PWSCC degradation; however, no CE unit has had a throughwall or throughweld flaw in an RPV head penetration, to date. For those CE units that have been able to perform bare metal visual examinations, there has been no boric acid degradation to the top of the RPV heads. This experience reinforces that examinations of the RPV penetration nozzle walls and the J-groove weld interface provide the primary means to ensure the integrity of the RPV head.

7.0 COMPLIANCE WITH THE ORDER RELAXATION REQUIREMENTS

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 [NRC] 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.*

Acceptable Level of Safety and Quality - The performance of a volumetric examination of the integrity of the RPV head nozzles along with a leakage path assessment provides the primary means to determine the integrity of the reactor coolant pressure boundary. Entergy is performing this inspection in the Fall 2003 refueling outage as required by section IV.C(1)(b)(i) of the Order. In addition, based on the demonstrations performed as reported in Reference 6, the volumetric examination of the nozzle can also interrogate the integrity of the J-groove weld to nozzle interface for PWSCC flaws. The ANO boric acid walkdown inspections in accordance with the Generic Letter 88-05 will also identify boric acid that may precipitate down from above the RPV head onto the cooling shroud. If boric acid accumulation is identified on the cooling shroud or around the flange, further actions will be taken to determine its source and that the integrity of the head has not been compromised. Actions that would be considered if boric acid were detected have been previously discussed in Reference 3. It is recognized that boric acid leakage locations from above the head has the potential to cause wastage (Information Notice 2003-02). However; no significant wastage has been experienced to the RPV head from this type of boric acid deposits within the industry. Entergy has no basis to believe that boric acid precipitation from above the ANO-2 RPV head has occurred that could cause wastage. Therefore, the proposed action for examination of the ANO-2 reactor vessel head per section IV.C(1)(b)(i) and IV.D of the Order will provide an acceptable level of quality and safety to ensure the integrity of the ANO-2 RPV head.

Hardship or Unusual Difficulty - The ANO-2 cooling shroud and insulation package were not designed to be removed and reinstalled from the top of the head to permit BMV inspections. The ANO-2 head insulation package was constructed as the CEDM assemblies were being welded in place. To remove the cooling shroud and insulation would potentially damage CEDM housings and the insulation with no means of effective repair. Therefore, compliance with the Order would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Entergy will provide our long term plans during the next cycle of operation, which will address RPV head integrity.

8.0 DURATION OF RELAXATION

The proposed relaxation from the requirements in Section IV.C(1)(a) of the Order that requires a 100 percent visual examination of the bare RPV head surface is requested until RPV head replacement.

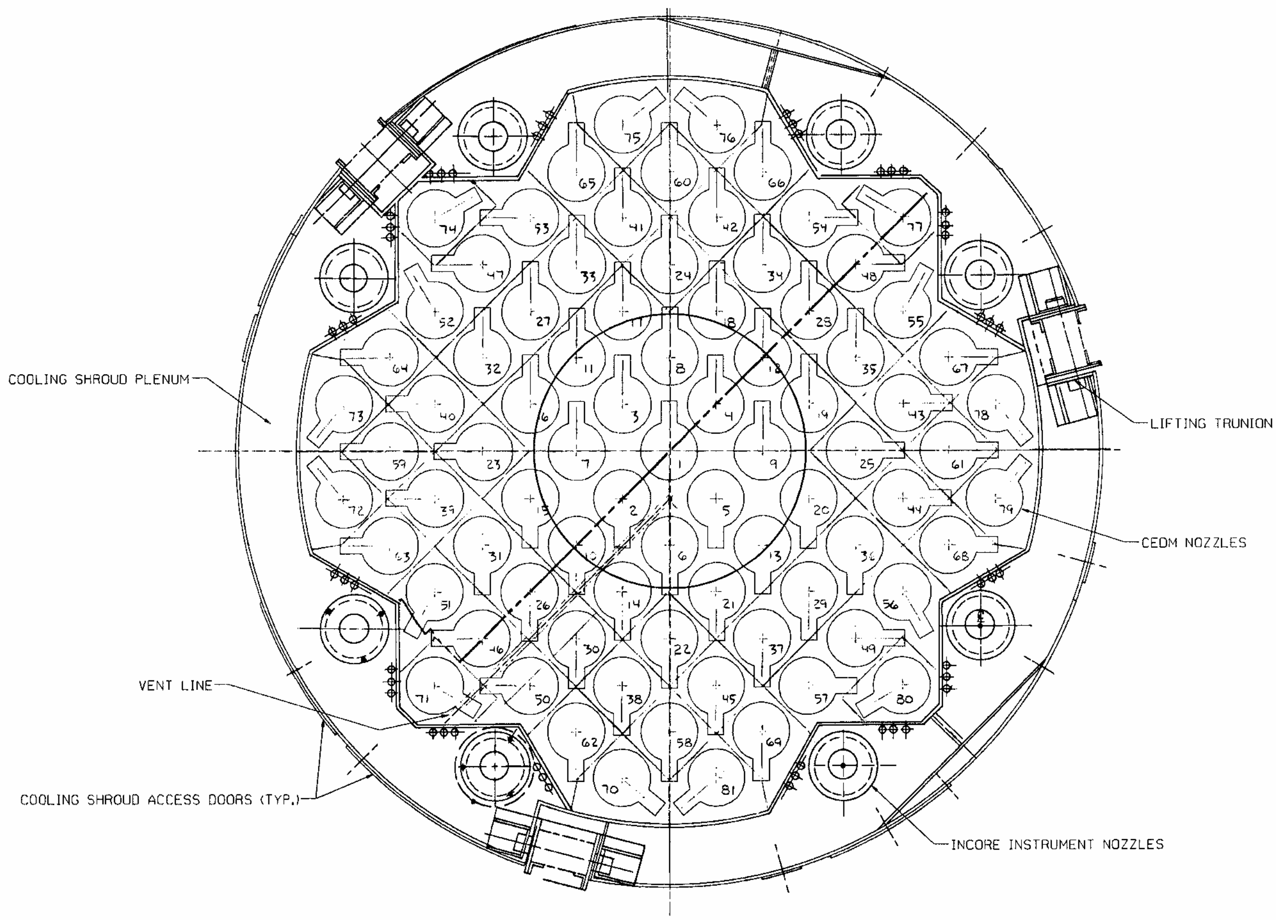

COOLING SHROUD PLENUM
LIFTING TRUNION
CEDM NOZZLES
VENT LINE
COOLING SHROUD ACCESS DOORS (TYP.)
INCORE INSTRUMENT NOZZLES

Figure 1

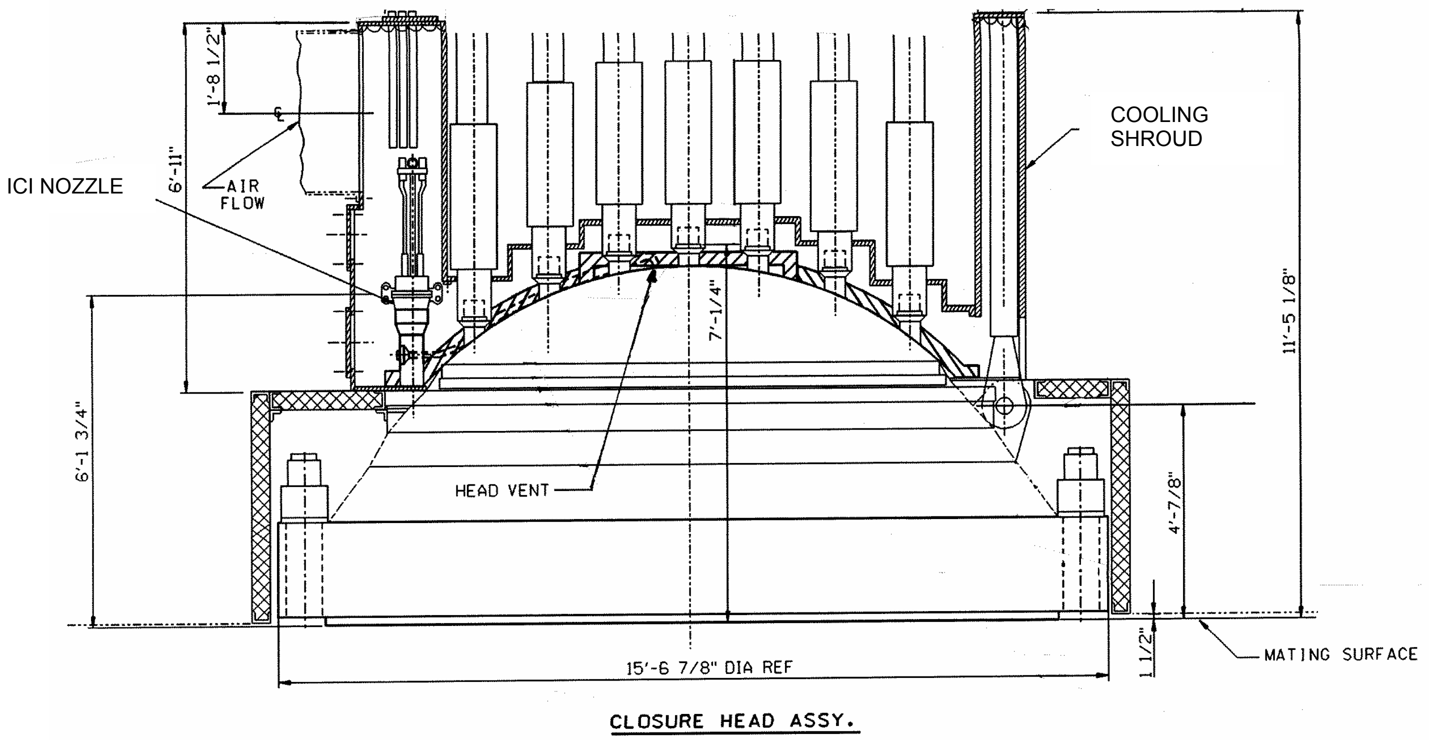
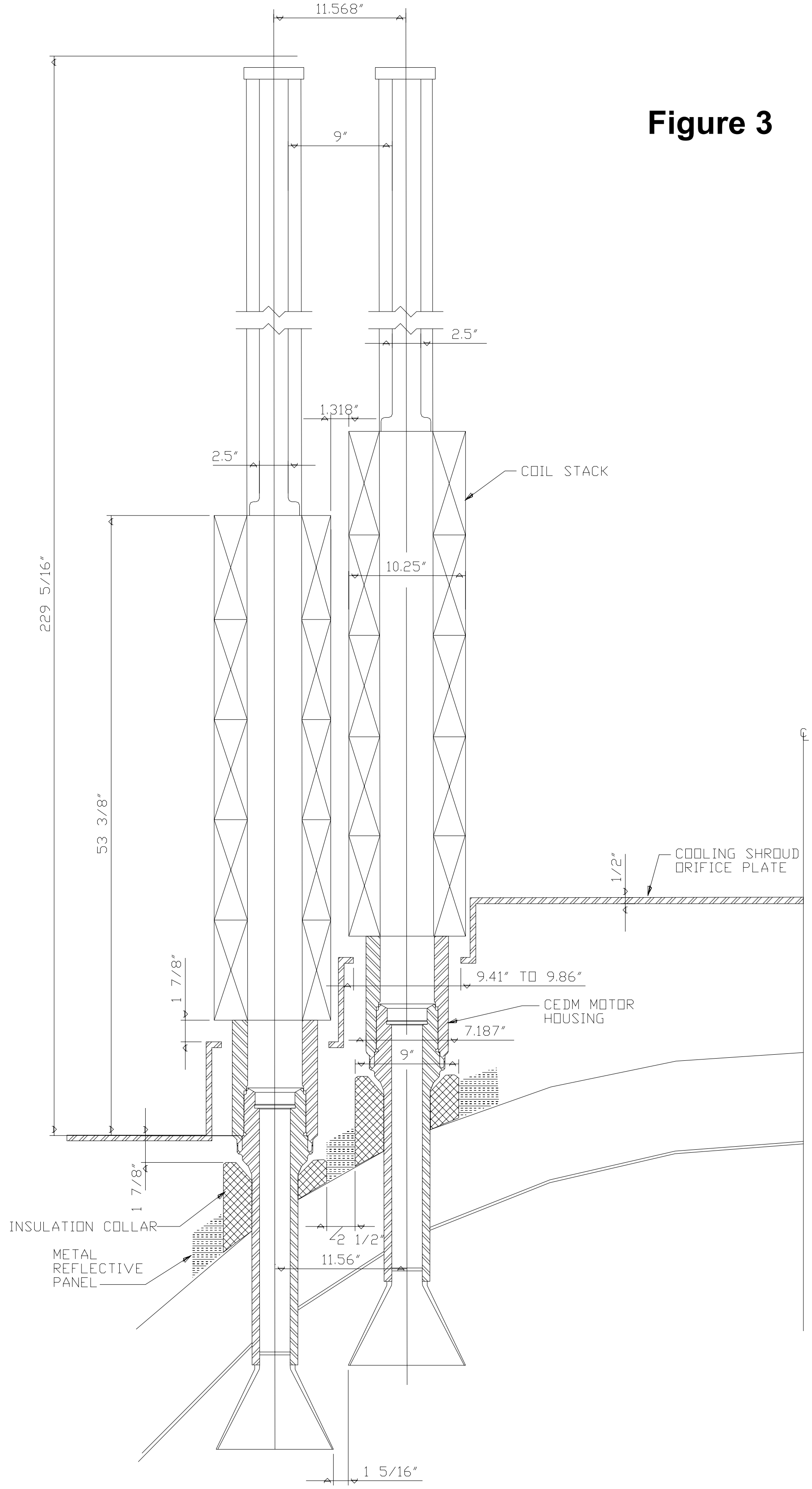
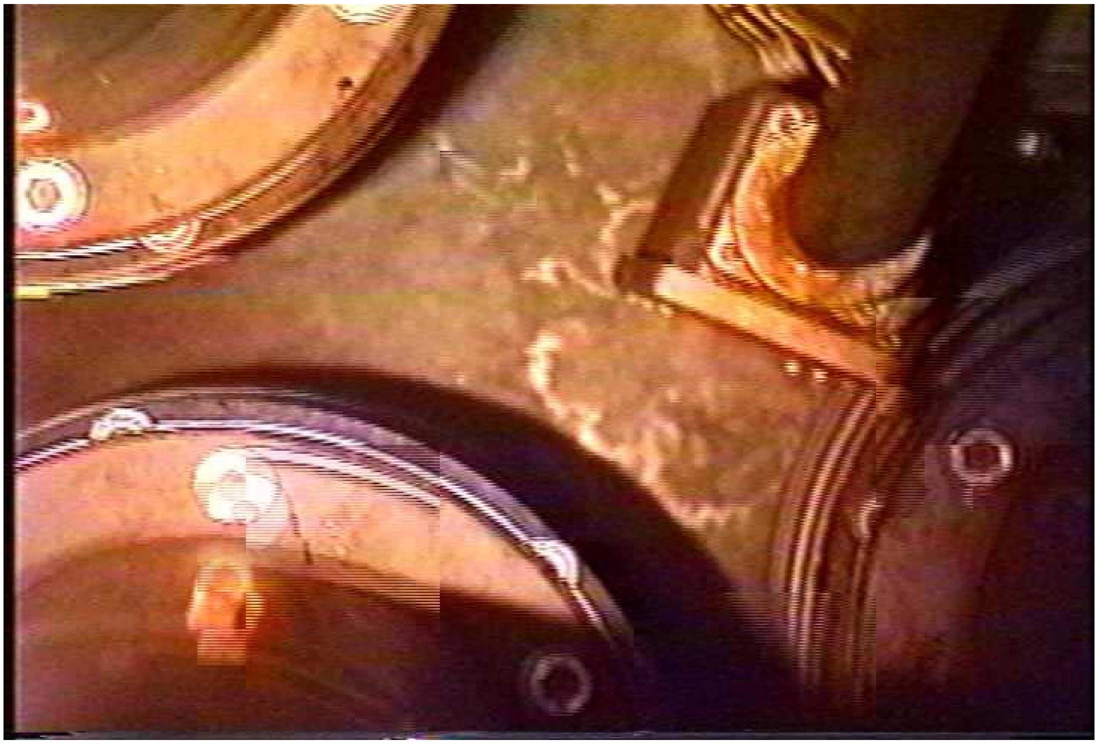

1'-8 1/2"
6'-11"
AIR FLOW
ICI NOZZLE
COOLING SHROUD
7'-1/4"
11'-5 1/8"
6'-1 3/4"
HEAD VENT
4'-7/8"
1 1/2"
MATING SURFACE
15'-6 7/8" DIA REF
CLOSURE HEAD ASSY.

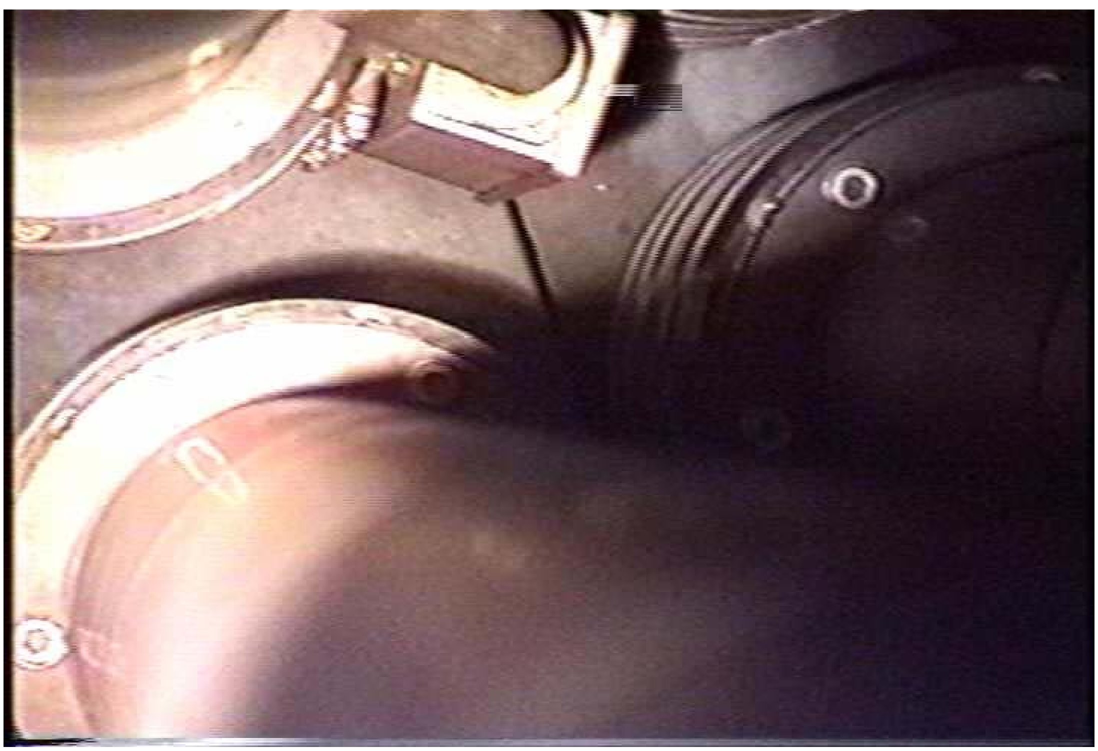
Figure 2

Figure 3


11.568"
9"
2.5"
1.318"
2.5"
COIL STACK
10.25"
229 5/16"
53 3/8"
COOLING SHROUD
ORIFICE PLATE
1/2"
1 7/8"
9.41" TO 9.86"
CEDM MOTOR
HOUSING
7.187"
9"
1 7/8"
INSULATION COLLAR
METAL
REFLECTIVE
PANEL
2 1/2"
11.56"
1 5/16"



Typical of Boric Acid Staining on Cooling Shroud as Found from 2R15 Inspections



Typical of Most Cooling Shroud Conditions from 2R15 Inspections

Figure 4

Figure 5

Attachment 2

2CAN050301

List of Regulatory Commitments

List of Regulatory Commitments

The following table identifies those actions committed to by Entergy in this document. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments.

COMMITMENT	TYPE (Check one)		SCHED COMP DATE
	ONE-TIME ACTION	CONT. COMP	
Entergy will perform a visual inspection of the ICI nozzles and accessible CEDM nozzles through the cooling shroud access doors during the Fall 2003 and for future outages until head replacement. This inspection will look for boric acid deposits that would be indicative of a penetration leak or that could potentially cause wastage of the RPV head. If boric acid accumulation is identified during this inspection, further inspection and evaluation will be performed to ensure that no degradation of the RPV head has occurred		**X**	**Fall 2003**
Entergy is evaluating reactor vessel head replacement as part of ongoing efforts to remove Alloy 600 materials from the RCS pressure boundary. Entergy will provide further plans during the following cycle that will clarify our intention for head replacement or will provide the plans for gaining access to the top of the head for performing a BMV inspection.	**X**		**Summer 2004**
The triple point examination provides additional assurance and confidence that there are no flaws that provide a leak path to the annulus and surface of the head. Therefore, Entergy commits to assess the triple point of the nozzle examinations to further ensure pressure boundary integrity		**X**	**Fall 2003**
The ANO boric acid walkdown inspections in accordance with the Generic Letter 88-05 will also identify boric acid that may precipitate down from above the RPV head onto the cooling shroud. If boric acid accumulation is identified on the cooling shroud or around the flange, further actions will be taken to determine its source and that the integrity of the head has not been compromised		**X**	**Conditional**