Progress Energy

Crystal River Nuclear Plant
Docket No. 50-302
Operating License No. DPR-72

Ref: 10CFR50.55a

November 13, 2009
3F1109-07

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

Subject: Crystal River Unit 3 – Relief Request (RR) 09-004-II, Revision 0

Dear Sir:

Pursuant to 10 CFR 55a(a)(3)(ii), Florida Power Corporation (FPC), doing business as Progress Energy Florida, Inc., is hereby submitting Relief Request (RR) #09-004-II, Revision 0. This relief request is associated with the "bare-metal" inspection criteria specified in 10 CFR 50.55a(g)(6)(ii)(E)(1) and ASME Code Case N-722, Note (3.a), for the inspection of the Reactor Pressure Vessel (RPV) bottom-mounted nozzles.

During a recent review of the October 1, 2009, visual inspection performed on the Crystal River Unit 3 (CR-3) Reactor Pressure Vessel (RPV) bottom-mounted instrument penetrations, residual coating remnants on the under vessel area, including around the bottom-mounted instrument penetration welds, were noted by an NRC Inservice Inspection Inspector. This coating was viewed as an "obstruction" to acceptable performance of the bare-metal visual inspection required by ASME Code Case N-722, Note (3.a), and 10CFR50.55a(g)(6)(ii)(E)(1). CR-3 believes that the presence of the residual coating remnants did not impede the ability to detect small amounts of Reactor Coolant System (RCS) leakage.

This condition was discussed with NRC NRR and Regional personnel during a telephone conference call on October 26, 2009. At that time, CR-3 communicated the intent to submit this relief request on an expedited basis since CR-3 is currently in a Refueling Outage that is scheduled to end in late December 2009. On October 29, 2009, two (2) copies of the October 1, 2009, visual inspection DVD were received by the CR-3 NRC Project Manager.

FPC requests approval of Relief Request 09-004-II, Revision 0, by December 10, 2009.

This correspondence contains no new regulatory commitments.

If you have any questions regarding this submittal, please contact Mr. Dan Westcott, Superintendent, Licensing and Regulatory Programs at (352) 563-4796.

Sincerely,

Stephen J. Cahill

Stephen J. Cahill
Engineering Manager
Crystal River Nuclear Plant

SJC/dwh

Enclosure: Relief Request 09-004-II, Revision 0

xc: NRR Project Manager
Regional Administrator, Region II
Senior Resident Inspector

A047
NRR

PROGRESS ENERGY FLORIDA, INC.

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

ENCLOSURE

RELIEF REQUEST 09-004-II, REVISION 0

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

--Hardship or Unusual Difficulty Without a Compensating Increase in Level of Quality or Safety--

1. ASME Code Component(s) Affected

The affected component is the Reactor Pressure Vessel (RPV) which has a unique equipment identification number RCRE-1. The Class 1 vessel has fifty two (52) NiCrFe Alloy 600 Bottom-Mounted Nozzles (BMNs) with summary numbers B15.5.2.00 (rollup designation) through B15.5.2.52.

2. Applicable Code Edition and Addenda

Crystal River Unit 3 (CR-3) is currently in the Fourth Ten-Year Inservice Inspection (ISI) Interval. The American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code of record for the Fourth Ten-Year ISI Interval is Section XI, 2001 Edition, up to and including the 2003 Addenda.

3. Applicable Code Requirement

10CFR50.55a(g)(6)(ii)(E)(1): "All licensees of pressurized water reactors shall augment their inservice inspection program by implementing ASME Code Case N-722 subject to the conditions specified in paragraphs (g)(6)(ii)(E)(2) through (4) of this section. The inspection requirements of ASME Code Case N-722 do not apply to components with pressure retaining welds fabricated with Alloy 600/82/182 materials that have been mitigated by weld overlay or stress improvement."

10CFR50.55a(g)(6)(ii)(E), "Reactor coolant pressure boundary visual inspections," Footnote 1: "For inspections to be conducted every refueling outage and inspections conducted every other refueling outage, the initial inspection shall be performed at the next refueling outage after January 1, 2009. For inspections to be conducted once per interval, the inspections shall begin in the interval in effect on January 1, 2009, and shall be prorated over the remaining periods and refueling outages in this interval."

ASME Code Case N-722-1, Table 1, "Examination Categories," Item No. B15.80, RPV Bottom-Mounted Instrument Penetrations.

ASME Code Case N-722-1, Note (3): "The Visual Examination (VE) performed on Alloy 600/82/182 components for evidence of pressure boundary leakage and corrosion on adjacent ferritic steel components shall consist of the following:

(a) A direct VE of the bare-metal surface performed with the insulation removed. Alternately, the VE may be performed with the insulation in place using remote visual inspection equipment that provides resolution of the component metal surface equivalent to a bare-metal direct VE."

4. Reason for Request

During a recent review of the October 1, 2009, visual inspection performed on the CR-3 RPV bottom-mounted instrument penetrations, an NRC Inservice Inspection Inspector noted residual coating remnants on the under vessel area, including around the bottom-mounted instrument penetration welds. This coating was viewed as an "obstruction" to acceptable performance of the bare-metal visual inspection required by ASME Code Case N-722, Note (3.a), and 10CFR50.55a(g)(6)(ii)(E)(1). Failure to perform an acceptable bare-metal visual inspection required by ASME Code Case N-722, Note (3.a), prior to restart from the current Refueling Outage (R16), would be considered a violation of 10CFR50.55a(g)(6)(ii)(E)(1).

No definition of "bare-metal" could be located in the ASME code regarding VEs. Within the context of bottom-mounted nozzles with Alloy 600 dissimilar metal welds, the term "bare-metal visual inspection" was originally used in NRC Bulletin 2003-02, "Leakage from Reactor Pressure Vessel Lower Head Penetrations and Reactor Coolant Pressure Boundary Integrity," to distinguish between visual inspections performed with insulation removed versus insulation in place. In other situations, the ASME code allows visual inspections used in a pressure test to identify pressure boundary leakage with insulation in place (Section XI, IWA-5241).

CR-3 considers the intent of the ASME code to be a direct visual inspection of the intersection of the bottom nozzle outside diameter (OD) surface and the reactor vessel bore, such that there is reasonable assurance that evidence of small amounts of Reactor Coolant System (RCS) leakage emanating from the nozzle in the area of the J-groove weld to the inside diameter (ID) of the bottom reactor vessel eventually will be detectable at the intersection of the nozzle and reactor vessel OD surface.

At CR-3, the inspection was performed during the current refueling outage (R16) to meet the requirements of 10CFR50.55a(g)(6)(ii)(E)(1) and Footnote 1. During the inspection, residual paint was present on a number of the bottom-mounted nozzles and the reactor vessel in the area of the nozzle bore. The Level II inspectors considered that the presence of the residual paint did not impede the ability to detect small amounts of RCS leakage. CR-3 believes that the inspection performed on October 1, 2009, meets the intent and requirements of the ASME code, but recognizes the value in eliminating any ambiguity, which is to be accomplished through this relief request.

Additional effort in an attempt to remove all of the residual paint to produce a 100 percent bare-metal surface on the nozzles and the reactor vessel is considered a hardship. An estimated dose of 10 Rem would be involved in an attempt to remove the residual paint in the region of the intersections without assurance that it would provide a compensating increase in the level of quality or safety.

5. Proposed Alternative and Basis for Use

CR-3 proposes to accept the existing condition of the nozzle-reactor vessel region as providing reasonable assurance that small amounts of RCS leakage will be detectable.

Component Description

The BMNs were originally installed as a single piece Alloy 600 nozzle fabricated from ¾-inch Schedule 160 pipe in accordance with ASME B&PV, Section II SB-167, with an approximately 1.025 inch OD and 0.60 inch ID. The nozzles were ground to fit specific holes in order to keep the 0.005 to 0.010 inch diametrical clearance. Each BMN was attached to the inside surface of the Reactor Vessel Lower Head (RVLH). The BMNs were not shrink-fit during installation as were the Control Rod Drive Mechanism (CRDM) nozzles in the closure head. The specified diametric clearance between the original nozzle and RVLH was 0.005 to 0.010 inch. These were welded to the reactor vessel using a J-groove weld on the ID. The J-groove weld preparation did not include buttering before J-groove welding. The original nozzle and J-groove weld at each unit received a post-weld stress relief heat treatment at 1100-1150 degrees Fahrenheit (°F).

After fabrication, paint was applied to the reactor vessel for shipping protection. One coat of high heat paint was applied. The CR-3 reactor vessel bottom head paint is not considered a pressure boundary, and was applied by original design as a protective coating and has performed its design function. After 30 plus years of operation, at about 555°F, the vast majority of the residual paint became brittle, flaked off and was removed in 2003.

Following failures of several tubes inside the reactor vessel at Oconee-1, during initial start-up hot functional testing, the nozzles at CR-3 were modified. The BMN design was modified (see Figure 1) to strengthen the nozzle portion inside the reactor vessel. The portion of the original nozzles inside the reactor vessel were cut off above the J-groove weld, and replaced by a two (2)-inch OD Alloy 600 nozzle that was attached by a full penetration butt weld for all plants. The modification was performed in the field without post-weld heat treatment (PWHT). The modification to the Babcock & Wilcox (B&W)-designed BMNs results in two nozzles joined end to end with two slightly different diameters, and potentially, a slight diametrical offset resulting from the welding.

CR-3 BMN Inspection History

Before the leakage from BMNs was detected at South Texas Project (STP) in 2003, inspections for evidence of leakage involved visual examination for evidence of leakage from the insulation below the reactor vessel bottom head.

Following the STP leakage, the NRC issued Bulletin 2003-02. In response to Bulletin 2003-02, CR-3 committed to perform a direct, bare-metal visual examination.

The first such inspection was conducted at CR-3 in the fall of 2003. Following the inspection, CR-3 cleaned the reactor vessel bottom to remove loose scale and flaking residual paint. Information was provided to the NRC by letter dated December 17, 2003, (Accession No. ML033570294), stating that the inspection was complete with no detection of leakage or wastage. This inspection was witnessed by the NRC and documented in "Crystal River Unit 3 – NRC Integrated Inspection Report 05000302/2003006 and Exercise of Enforcement Discretion," dated January 26, 2004, (Accession No. ML0402700080) in which Section 4OA5, Subpart 1.b.4.a states:

> "Verification that the licensee was capable of identifying the pressure boundary leakage as described in the bulletin and/or reactor pressure vessel lower head corrosion:
>
> The inspectors visually observed about 40 percent of the lower vessel head during the licensee's examination; observed the licensee conduct a portion of the examination; discussed the examination with the licensee examiners prior to, during, and following the examination; reviewed a video of the examination, checked examination documentation, and verified the qualification of the licensee examination personnel. The inspectors concluded that the licensee conducted an effective visual inspection to identify potential leakage resulting from lower vessel penetrations. No evidence of boric acid or other reactor coolant system leakage was identified."

The inspection was repeated in 2005 and in 2007 with no change from previous outage(s) in appearance noted and no evidence of leakage detected.

CR-3 BMN 2009 Examination

The inspection performed on October 1, 2009, used Progress Energy Non-Destructive Examination Procedure NDEP-0612, "VT-2 Visual Examination of Nuclear Power Plant

Components," which contains the examination requirements for proximity and lighting, as required by ASME Code Case N-722, Table 1, Note (3.c)., which states: "The direct VE shall be performed at a distance not greater than four (4) ft (1.2 m) from the component and with a demonstrated illumination level sufficient to allow resolution of lower case characters having a height of not greater than 0.105 in (2.7 mm)." Note that the diametrical clearance between the nozzle and reactor vessel bore was 0.005 to 0.010 inches.

The inspection was performed by certified VT-2 inspectors that received the additional training for detection of leakage and boric acid residue as required by Code Case N-722, Table 1, Note (4). This training included a review of the pictures of the STP bottom-mounted nozzle leakage evidence and several other examples of closure head nozzle leakage evidence. The inspection of the 52 BMNs was performed by a team which included the camera handler under-vessel and the inspector at the monitor outside the vessel area in a low-dose area. A Level II inspector made the determination of acceptability based on the high resolution view provided at the monitor, not the lower resolution video-taped recording. The inspection was performed to detect evidence of RCS leakage at the intersection of the reactor vessel and nozzle. No evidence of such leakage was detected.

Following the examination, residual coating remnants on the reactor vessel bottom, including around the bottom-mounted instrument penetration welds, were noted by an NRC Inservice Inspection Inspector during review of the inspection video. This coating was viewed as an "obstruction" to acceptable performance of the bare-metal visual inspection required by ASME Code Case N-722, Note (3.a), and 10CFR50.55a(g)(6)(ii)(E)(1).

CR-3 has performed a detailed review of the video in response to the NRC Inservice Inspection Inspector observations. A description of the nozzle head intersection region examination (Attachment 1), as completed and documented by the Level II inspector that performed the original BMN inspection, provides information from multiple views of each nozzle, including the presence of residual coating on the nozzle tube, the reactor vessel, and covering the intersection, and whether a gap is visible at the intersection.

Attachment 2 shows the description of the views from Attachment 1, re-arranged to tabulate: coating on tube and vessel, coating on tube only, not on vessel, or no coatings, and coating in junction area. The vast majority of tubes have some amount of the residual coating on the tube, but not on the reactor vessel, and an annular gap is visible.

In other cases, there is some amount of coating on the tube, but not on the reactor vessel head, and no annular gap is visible or is visible in less than 100 percent of the circumference. This is likely due to a tight fit in some regions due to distortion from the original shop welding of the J-groove weld and the field welding of the repair butt weld. It also may not be visible via the video since the diametrical clearance is 10 to 20 times smaller than the required resolution of the inspection. Additionally, in some cases, the angle of viewing was not conducive to seeing whether an annular gap was present; the angle of view was adequate to detect evidence of leakage. Lastly, verification of a gap is not a part of the ASME Code Case N-722 requirements.

Out of 52 BMNs, there were eight views with some amount of residual coating at the junction of the tube and reactor vessel, but in no case was residual paint covering the entire nozzle, reactor vessel and intersection areas, as tabulated below.

VIDEO TIME	DESCRIPTION
07:09	Coating on tube only, not on vessel although coatings are present in the junction area. The coating appears white, smooth and two dimensional. No annular gap is visible.
11:53	Coating noted in 10 percent of the junction area. The annular gap is visible.
14:06	Coatings are in the junction area. The annular gap is visible.
14:49	Coatings are in the junction area. No annular gap is visible.
18:02	A small amount of coating is present in the junction area (25 percent covered).
18:14	The vessel surface is clean with a small amount of coating in the junction area. The coating is smooth and two dimensional. No annular gap is visible.
18:35	Coating on tube and junction only, not on vessel. No annular gap noted.
18:56	Coating on tube and junction only, not on vessel. No annular gap noted.

The CR-3 inspection did not reveal evidence of leakage indicated by the presence of boric acid residue, similar to that of STP or on the industry closure heads with leaking CRDM nozzles.

With regard to the ability to detect small amounts of RCS leakage, the condition of the reactor vessel in the regions of the nozzles is better than that of the STP reactor vessel in the region of the nozzles, where leakage was detected. Those areas at STP had, what turned out to be, superficial rusting of the vessel head, yet the evidence of leakage was clearly detectable.

Ultrasonic Testing (UT) has been evaluated as an alternative or complement to the visual examination, as allowed in ASME Code Case N-722, Table 1, Note (5). UT has the potential to detect cracking in nozzle material. This inspection could be performed in the region of the original J-groove weld and the repair full penetration weld. The Materials Reliability Program (MRP) and the Electric Power Research Institute (EPRI) Non-destructive Examination (NDE) center have manufactured mockups of the repaired reactor vessel nozzle configuration. As described in EPRI Report 1011618, "BMI Inspection Issues:"

> "After welding was completed, the inside diameter of the tube was machined out. This removed drop-through of weld material at the root of the repair weld and allowed unrestricted passage of instruments through the inside of the tube. This machining, however, created a small step on the inside of the nozzle tube. The presence of a step in the nozzle bore creates problems for inspection of the tube. Ultrasonic and eddy current probes cannot contact the surface as well as they can on a smooth bore."

The modification to the B&W-designed BMNs results in two nozzles joined end to end with two slightly different diameters, and potentially a slight diametrical offset. This resulted in a slight "step" on the nozzle ID which causes UT probe lift-off and signal loss when performing the UT technique. Demonstrations conducted at the EPRI NDE center have shown this "step" in the nozzle to be problematic for obtaining 100 percent UT coverage and promotes false-positive indications in the B&W BMNs. Therefore, even if UT procedures were demonstrated as meeting the intent of Section XI, Appendix VIII (there is currently no Appendix VIII-specific supplement for BMI nozzle bare-metal examination), it is highly unlikely that acceptable coverage of the examination volume would be achievable, which renders UT as not a viable alternative for CR-3.

Industry Inspection Efforts and Results

Following the STP leaks, the industry performed numerous examinations of bottom nozzles. Through 2008, over 1000 NDE examinations of Westinghouse BMNs have been performed.

While the majority of these NDE examinations were performed ultrasonically, some were examined with eddy current. Over 2700 visual examinations have been performed on all Nuclear Steam Supply Systems (NSSS) designed BMNs. No additional flaws have been detected; no additional indications of leakage from BMNs have been detected.

Detectability of Small Amounts of Leakage into the Annulus Between the Nozzle and the Lower Head Bore Below the J-groove Weld

Leakage into the annulus will be forced downward towards the OD of the bottom head. While the pressure inside the annulus will not approach RCS pressure, it will be greater than atmospheric pressure. Should the leakage be obstructed, such as where the tube contacts the head as a result of weld distortion at the original J-groove weld and the field repair butt weld, it will re-route to a less obstructed area and continue downward. As noted above, the bottom nozzles were not shrink-fit in the head before welding. As a result, there is no physical restriction around 100 percent of the nozzle in the region of the original J-groove weld and: therefore, no restriction to leakage similar to that found in the reactor vessel to CRDM nozzle interface. Additionally, the differential pressure across the bottom nozzle, when compared with the differential pressure across steam generator hard-rolled and hydraulically expanded tubes and hard-rolled tube plugs and sleeves, is significantly larger by approximately 900 pounds per square inch (psi). Small amounts of primary-to-secondary leakage, on the order of gallons per day, are not unusual in steam generators. Therefore, it is expected that small amounts of leakage into an open annulus would freely follow the opening to the point of being detectable when it reaches the OD of the head, similar to the situation at STP.

Impact of Paint on Detectability of Small Amounts of Leakage/Deposits

The industry has analyzed the impact of paint from original plant construction at the intersection between the BMN OD and the outer surface of the bottom head and within the annulus itself. The conclusion was that the presence of such coatings at the nozzle to reactor vessel intersection, or within the annulus, does not have any significant negative effect on the wastage process or its detection:

> The first potential concern is with regard to the effect on the wastage rate. In fact, to the extent that the presence of such coatings may act to decrease the leak rate, the effect on the wastage process would be expected to reduce the corrosion rate of the low-alloy steel material. This is because the leak rate is the key controlling parameter for the extent of local cooling (which controls the size of the wetted region) as well as the magnitude of flow velocities (which is a main driver for any erosion or flow accelerated corrosion mechanisms). The results of the stagnant and low flow crevice testing sponsored by the industry confirms very low corrosion rates (order of 0.005 in/yr or less) for the low-alloy steel material under such conditions.
>
> The second potential concern is with regard to the detectability of deposits, given the presence of a coating. However, except for the especially small volumes of deposits that can be contained within the annulus itself (order of 0.10 in^3), the presence of a coating at the nozzle head intersection or within the annulus cannot act to hide the presence of a given volume of boric acid deposits released through the pressure boundary. Significant wastage cannot occur without increases in the leak rate, which would necessarily also release significantly greater volumes of deposits than can be hidden within the annulus. Furthermore, any significant wastage of the low alloy steel must necessarily produce corrosion products having roughly twice the specific volume as the corroded steel material, again resulting in the release of deposits from the annulus.

Unidentified Leakage Detection and Monitoring – Additional Basis for Capability to Identify BMN Leakage

The entire RCS is located within the secondary shielding and is inaccessible during reactor operation. All RCS leakage drains to the Reactor Building (RB) sump. All RCS leakage to the RB atmosphere will be in the form of fluid and vapor. The fluid will drain to the RB sump while the vapor will be condensed in the RB coolers and drain to the RB sump via a drain line from the RB cooler. There are numerous methods for detecting leakage from the CR-3 RCS. Some of these methods are: monitoring of the RB air sample (particulate and gaseous), RB sump level instrumentation, Makeup Tank (MUT) level, containment cooling fan condensate flow, RB pressure, and RCS inventory balance.

The primary RCS leakage detection method is the monitoring of the RB air sample line radiation monitor. The RB air sample line radiation monitor (RM-A6) consists of a particulate measuring channel with a range of 1 x 10^{-11} to 1 x 10^{-7} μCi/cc (Cesium-137) and a gaseous measuring channel with a range of 1 x 10^{-6} to 1 x 10^{-2} μCi/cc (Krypton-85). RM-A6 contains two parallel connected particulate/iodine prefilters, an isokinetic sampler and two pump assemblies. The two pumps are powered from alternate power sources such that a loss of power to the running pump will automatically start the standby pump. The filter activity is alarmed, counted, and displayed in the control room on the radiation monitor panel module.

The particulate monitoring channel is capable of detecting a change in the RCS leak rate of 1 gallon per minute (gpm) within 1 hour, based on 0.1 percent failed fuel. The predominant nuclide of detection for the particulate channel is Rubidium-88. The gaseous channel requires significantly more time to detect the same change in RCS leak rate (approximately fourteen (14) hours). This is due to the relatively long half-life of its predominant nuclide of detection, Xenon-133.

This ability to detect a change in RCS leak rate of one (1) gpm within one (1) hour meets the intent of Regulatory Guide 1.45, "Guidance on Monitoring and Responding to Reactor Coolant System Leakage." The operability of these monitors is addressed in the CR-3 Improved Technical Specifications (ITS), Section 3.4.14, "RCS Leakage Detection Instrumentation." The Limiting Condition for Operation requires that during Modes 1, 2, 3, and 4, one containment sump monitor and one containment atmosphere radioactivity monitor shall be operable.

In the event that reactor coolant activity is low, there are other methods that are more adequate than RM-A6 at determining if reactor coolant is leaking from the RCS into the RB. The other methods include monitoring of the RB sump level and MUT level.

The RB sump level instrumentation (WD-222-LT), located in the Main Control Room, includes a level transmitter, a level indicator, and a level recorder with a range of zero to twenty (0-20) inches. A RB sump level rate change of zero to six (0 - 6) inches/hour corresponds to an RB sump collection rate of approximately zero to one hundred forty two (0 - 142) gallons/hour.

The MUT level (MU-14-LT) is recorded in the Main Control Room. Any leakage from the RCS under steady state conditions will be reflected as a decrease in MUT level. An RCS leak rate of one (1) gpm corresponds to a MUT level decrease of approximately 1.9 inches/hour.

Alternative monitoring means are incorporated in the RCS Leakage Detecting System, in addition to the above three methods, to provide further detection capability for an RCS leak inside containment. The first alternative method of detecting a one (1) gpm RCS leak is by providing an alarm on high condensate flow from the RB cooling units. This would also be detected as an increase in the rate of rise of the RB sump level. Other methods include monitoring the RB pressure, temperature, and local radiation monitors for any changes.

The CR-3 RCS inventory balance is conducted in accordance with Surveillance Procedure SP-317, "RC System Water Inventory Balance." This CR-3 ITS surveillance is only required every seventy two (72) hours. As a best practice, CR-3 performs this surveillance every twenty four (24) hours. Within this surveillance, a detailed review is made of the MUT level, Reactor Coolant Drain Tank, Pressurizer level and temperature effects on RCS inventory. All surveillance information is inserted into an RCS leakage calculation that produces identified and unidentified RCS leakage. Identified and unidentified RCS leakage is kept in a statistical spreadsheet to calculate the mean (μ) and standard deviation (σ) daily in order to maintain a 60 day average baseline each quarter. If a change is seen in the mean, standard deviation or actual values of unidentified RCS leakage, Action Levels are implemented. There are three Action Levels for RCS leakage. Action Level 1 is implemented if one seven day rolling average of unidentified leakage is greater than 0.1 gpm <u>OR</u> nine consecutive unidentified RCS leakage values are greater than the baseline mean (μ). Action Level 2 is implemented if two of three consecutive unidentified RCS leakage values are greater than [μ+2σ], <u>OR</u> two consecutive unidentified RCS leakage values are greater than 0.15 gpm. Action Level 3 is implemented if one unidentified RCS leakage value is greater than [μ+3σ] <u>OR</u> one (u) unidentified RCS leakage value is greater than 0.3 gpm.

These Action Levels provide for increasingly more aggressive actions to find and identify the source of the leakage as indicated by leak rate and/or the statistical confidence in the leak increment rises.

Other leakage detection systems in the plant, by their character and location, can only detect leakage in a general area. Indication of a general area of leakage will guide Operations and Maintenance personnel in looking for the leak and in identifying, repairing, or isolating the source as quickly as possible.

Simulator training emphasizes abnormal and emergency condition responses. Use of in-house and industry operating experience enhances realism in simulator training. Operators practice plant transient, and emergency response, in the simulator using abnormal operating procedures (APs) and emergency operating procedures (EOPs) to attain knowledge and skills to demonstrate competent job performance. This includes Loss of Coolant Accidents (LOCAs), at various sizes and at various locations, which are diagnosed utilizing the RCS leakage detection systems described above.

To ensure a low threshold for identifying RCS leakage, Operations personnel monitor and Engineering personnel trend for RCS leakage utilizing the Reactor Coolant leakage detection methods. SP-317 specifies which actions need to be taken in the event there is an increase in RCS leakage.

<u>Conclusion</u>

CR-3 performed direct visual examinations of all fifty two (52) bottom-mounted nozzles to meet the requirements of ASME Code Case N-722. There were no physical obstructions blocking access in order to obtain a 100 percent view of each nozzle and the surrounding reactor vessel bottom head area. There were some nozzles with residual paint remnants on a portion of the reactor vessel and the nozzles, and some with paint in the junction area of the reactor vessel and nozzle. There were no indications of leakage as evidenced by a buildup of boric acid residue at any of the junctions, similar to the STP nozzles. CR-3 considers that the residual coating remnants on the reactor vessel, nozzles and junction areas do not impede the ability to fully detect evidence of a small amount of leakage from the nozzle in the region of the original J-groove weld or the repair butt weld.

6. Duration of Proposed Alternative

The duration of the proposed alternative is until the end of CR-3's Fourth Ten-Year Interval, scheduled to end on August 13, 2018, or industry activities and industry operating experience dictate additional actions are required sooner.

7. Precedents

None identified.

8. References

None.

ATTACHMENT 1

CR-3 R16 BMN INSPECTION SUPPLEMENTAL REVIEW AND REPORT

A supplemental review of the reactor vessel and nozzles examination video was performed on Monday, October 26, 2009, by the original Level II inspector for the CR-3 BMNs. The intent of this supplemental review was to determine the possibility of the presence of foreign material (or paint) on the nozzles and reactor vessel surface which would obscure the presence of boric acid. Particular attention was placed on the nozzles and reactor vessel surface at the point of penetration.

Of the fifty two (52) nozzles examined, over ninety (90) percent had some evidence of white foreign material on or near the penetration area in varying degrees

White and brown foreign material was observed over the bottom head including around the nozzle penetration areas. However, only three (3) nozzles had the white material on the head surface and against the nozzle. The areas were small, less than 15 percent of nozzle surface, and were not boric acid. These may be observed on the inspection video at Title 3, Chapter 3 at 11:08, 11:20 and 27:50 time frames.

Nothing observed during the original or supplemental exams produced concerns of hidden boric acid.

The information presented below can be used, in conjunction with the video, to assist in the assessment on the incore nozzle tube to the bottom head of the CR-3 Reactor Pressure Vessel.

Video Time

00:19 Coating on the tube only for one half of the visible surface. There is no coating on the vessel surface. The annular gap is visible; however, the tube is flush against the annular area for ½ of the visible area.
00:31 Coating on the tube and on vessel near the tube, but not at the junction area. The annular gap is visible; however, the tube is flush against the annular area for one half of the visible area.
00:45 Coating on the tube, only for one half of the visible surface with a rusty streak on tube. The annular gap is visible; however, the tube is flush against the annular area for one half of the visible area.
00:54 Coating on tube only, not on vessel. The annular gap is visible.
01:20 Coating on tube only, not on vessel. The annular gap is visible.
01:32 Coating on tube only, not on vessel. The annular gap is visible.
01:56 Coating on tube only, not on vessel. The annular gap is visible.
02:12 Coating on tube only, not on vessel. No annular gap is visible due to the tight fit of the pipe.
02:31 Coating on tube only, not on vessel. No annular gap is visible due to the tight fit of the pipe.
03:16 Coating on tube only, not on vessel. The annular gap is visible on the left side of the tube only.
03:26 Coating on tube only, not on vessel. Rust stream on tube. No annular gap is visible due to the tight fit of the tube.
04:48 Coating on tube only, not on vessel. No annular gap noted.
05:02 Coating on tube only, not on vessel. No annular gap noted.
05:40 Coating on tube only, not on vessel. Ten percent of annular gap is visible.

07:09 Coating on tube only, not on vessel although coatings are present in the junction area. The coating appears white, smooth and two dimensional. No annular gap is visible.
07:40 Coating on tube only, not on vessel. No annular gap noted.
08:23 Minimal coating is visible on the tube only, not on the vessel. Fifteen percent of annular gap visible.
08:50 Coating on tube only, not on vessel. No annular gap noted.
10:06 Coating on tube only, not on vessel. No annular gap noted.
11:08 Coatings are visible on the head near the tube, but not across the junction area. On the opposite side of the tube coatings are visible. No annular gap is noted for this view.
11:20 Coatings are seen on both the tube and the vessel. The annular gap is visible for the entire visible circumference.
11:43 Coating on tube only, not on vessel. No annular gap noted.
11:53 Coating are noted in Ten percent of the junction area. The annular gap is visible.
12:09 Coating on tube with some mottled coating on the vessel surface. No annular gap noted.
12:27 Coating on tube only, not on vessel. No annular gap noted.
12:43 The tube is stained with no heavy coating present. No annular gap noted.
12:49 Coating on tube only, not on vessel. A brown stain is visible on the tube. Forty-five percent of the annular gap is visible.
13:08 Coating on tube only, not on vessel. The annular gap is visible.
13:32 Coating on tube only, not on vessel. The annular gap is visible.
14:06 Coatings are in the junction area, the annular gap is visible.
14:27 Light coating on five percent of tube with no coatings in the junction area. No annular gap is visible.
14:49 Coatings are in the junctions area. No annular gap is visible.
15:17 Twenty five percent of the area is covered by coatings, the annular gap is visible. The remainder of the tube and vessel area is free of coatings.
16:01 Coating on tube only, not on vessel. No annular gap noted.
16:13 Coating on tube only, not on vessel. No annular gap noted.
16:31 Coating on tube only, not on vessel. No annular gap noted.
16:49 Coating on tube only, not on vessel. No annular gap noted.
16:57 Coating on tube only, not on vessel. No annular gap noted.
17:04 Coating on tube only, not on vessel. No annular gap noted.
17:26 Coating on tube only, not on vessel. Annular gap visible only on right side.
17:35 No coatings are present in the junction area.
17:56 No coatings are present in the junction area.
18:02 A small amount of coating is present in the junction area (twenty-five persent covered).
18:14 The vessel surface is clean with a small amount of coating in the junction area. The coating is smooth and two dimensional. No annular gap is visible.
18:21 No coatings are present in the junction area.
18:35 Coating on tube and junction only, not on vessel. No annular gap noted.
18:56 Coating on tube and junction only, not on vessel. No annular gap noted.
19:22 Coating covers ten percent of tube surface. The annular gap is visible.
19:53 Coating on tube only, not on vessel. The annular gap is visible.
20:30 Coating on tube only, not on vessel. The annular gap is visible.
21:01 Coating on tube only, not on vessel. The annular gap is visible.
21:28 Coating on tube only, not on vessel. No annular gap noted.
21:48 Coating on tube only, not on vessel. Twenty percent of the annular gap is visible.
22:04 The tube is clean with a rust stain streaming down. No coatings are located in the junction area. The annular gap is partially visible.
22:13 The tube is clean with a rust stain streaming down. No coatings are located in the junction area. No annular gap noted.
22:27 Coating on tube only, not on vessel. No annular gap noted.

22:40 Coating on tube only, not on vessel. Ten percent of the annular gap noted.
22:58 Twenty percent coating on tube. The remainder of the tube and the vessel are clear. No annular gap noted.
23:14 Coating on tube only, not on vessel. No annular gap noted.
23:27 Coating on tube but not in junction area. Brown stain on tube. No coating noted on vessel. No annular gap is visible.
23:44 Coating on tube only, not on vessel. Ten percent (10%) of the annular gap noted.
23:56 Coating on tube only, not on vessel. No annular gap noted.
24:27 Coating on tube only, not on vessel. No annular gap noted.
24:42 Five percent of the viewing area has a coating on the tube, the remainder is clean with the annular gap noted.
24:55 Coating on tube with a small patch on the vessel near the tube but not in the junction area. No annular gap noted.
25:46 Coating on tube only, not on vessel. No annular gap noted.
26:00 Rust stains noted on the tube surface, no coatings noted. No annular gap noted.
26:16 Coating on tube only, not on vessel. The annular gap is visible.
26:27 Coating on tube only, not on vessel. The annular gap is visible.
26:43 No coatings and the annular gap is visible.
26:53 No coatings noted on the tube or vessel.
27:42 Coating on tube only, not on vessel. The annular gap is visible.
27:50 Coatings are present on the tube and on the vessel; however, the gap is visible between the two.
28:21 Coating on tube only, not on vessel. The annular gap is visible.
29:24 Rust stains noted on tube surface, no coatings noted. T he annular gap is visible.
29:57 No coatings noted on tube or vessel. The annular gap is visible.
30:14 Coating on tube only, not on vessel. Rust stain on tube. No annular gap noted.
30:30 Coating on tube only, not on vessel. The annular gap is visible.
30:59 No coatings on the tube or vessel. The annular gap is visible.
32:32 No coatings noted on the tube or vessel.
32:54 Coating on tube only, not on vessel. The annular gap is visible.
33:11 No coatings noted on the tube or vessel.
33:39 Small amount of coating on the tube surface (fifteen to twenty percent). No coatings noted on the vessel.
33:56 Coating on tube only, not on vessel. No annular gap noted.
34:09 Coating on tube only, not on vessel. No annular gap noted.
34:31 Coating on tube only, not on vessel. Large rust stain running down tube. No annular gap noted.
34:50 Coating on tube only, not on vessel. No annular gap noted.
34:59 Rust stain noted on tube. No coatings on tube or vessel. No annular gap noted.
35:21 No coatings noted on the tube or vessel.
36:14 No coatings noted on the tube or vessel.
37:09 No coatings noted on the tube or vessel.
38:00 Coating on tube only, not on vessel. No annular gap noted.
39:01 Coating on tube only, not on vessel. No annular gap noted.
39:23 Coating on tube only, not on vessel. No annular gap noted.
39:57 Coating on tube only, small amount on vessel (two percent). The annular gap is visible.
41:17 No coatings noted on the tube or vessel.
42:13 Coating on tube only, not on vessel. No annular gap noted.
42:28 Coating on tube only with less than twenty five percent of the circumference covered. No coatings noted on the vessel.
42:47 No coatings noted on the tube or vessel.
43:25 Ten percent coating on tube, none on vessel.
44:25 Coating on tube only, not on vessel. The annular gap is visible.

ATTACHMENT 2

CATEGORIZATION OF CR-3 R16 BMN INSPECTION FINDINGS

VIDEO TIME	COATING ON TUBE AND VESSEL
00:31	Coating on the tube and on vessel near the tube, but not at the junction area. The annular gap is visible; however, the tube is flush against the annular area for one half of the visible area.
11:08	Coatings are visible on the head are near the tube, but not across the junction area. On the opposite side of the tube coatings are visible. No annular gap is noted for this view.
11:20	Coatings are seen on both the tube and the vessel. The annular gap is visible for the entire visible circumference.
12:09	Coating on tube with some mottled coating on the vessel surface. No annular gap noted.
15:17	Twenty five percent of the area is covered by coatings, the annular gap is visible. The remainder of the tube and vessel area is free of coatings.
24:55	Coating on tube with a small patch on the vessel near the tube but not in the junction area. No annular gap noted.
27:50	Coatings are present on the tube and on the vessel; however, the gap is visible between the two.
39:57	Coating on tube only, small amount on vessel (two percent). The annular gap is visible.
VIDEO TIME	**COATING ON TUBE ONLY, NOT ON VESSEL, OR NO COATINGS**
00:19	Coating on the tube only for one half of the visible surface. There is no coating on the vessel surface. The annular gap is visible; however, the tube is flush against the annular area for one half of the visible area.
00:45	Coating on the tube only for one half of the visible surface with a rusty streak on tube. The annular gap is visible, however, the tube is flush against the annular area for one half of the visible area.
00:54	Coating on tube only, not on vessel. The annular gap is visible.
01:20	Coating on tube only, not on vessel. The annular gap is visible.
01:32	Coating on tube only, not on vessel. The annular gap is visible.
01:56	Coating on tube only, not on vessel. The annular gap is visible.

02:12	Coating on tube only, not on vessel. No annular gap is visible due to the tight fit of the pipe.
02:31	Coating on tube only, not on vessel. No annular gap is visible due to the tight fit of the pipe.
03:16	Coating on tube only, not on vessel. The annular gap is visible on the left side of the tube only.
03:26	Coating on tube only, not on vessel. Rust stream on tube. No annular gap is visible due to the tight fit of the tube.
04:48	Coating on tube only, not on vessel. No annular gap noted.
05:02	Coating on tube only, not on vessel. No annular gap noted.
05:40	Coating on tube only, not on vessel. Ten percent of annular gap is visible.
07:40	Coating on tube only, not on vessel. No annular gap noted.
08:23	Minimal coating is visible on the tube only, not on the vessel. Fifteen percent of annular gap visible.
08:50	Coating on tube only, not on vessel. No annular gap noted.
10:06	Coating on tube only, not on vessel. No annular gap noted.
11:43	Coating on tube only, not on vessel. No annular gap noted.
12:27	Coating on tube only, not on vessel. No annular gap noted.
12:43	The tube is stained with no heavy coating present. No annular gap noted.
12:49	Coating on tube only, not on vessel. A brown stain is visible on the tube. Forty-five percent of the annular gap is visible.
13:08	Coating on tube only, not on vessel. The annular gap is visible.
13:32	Coating on tube only, not on vessel. The annular gap is visible.
14:27	Light coating on five percent of tube with no coatings in the junction area. No annular gap is visible.
16:01	Coating on tube only, not on vessel. No annular gap noted.
16:13	Coating on tube only, not on vessel. No annular gap noted.
16:31	Coating on tube only, not on vessel. No annular gap noted.
16:49	Coating on tube only, not on vessel. No annular gap noted.
16:57	Coating on tube only, not on vessel. No annular gap noted.

17:04	Coating on tube only, not on vessel. No annular gap noted.
17:26	Coating on tube only, not on vessel. Annular gap visible on right side only.
17:35	No coatings are present in the junction area.
17:56	No coatings are present in the junction area.
18:21	No coatings are present in the junction area.
19:22	Coating covers ten percent of tube surface. The annular gap is visible.
19:53	Coating on tube only, not on vessel. The annular gap is visible.
20:30	Coating on tube only, not on vessel. The annular gap is visible.
21:01	Coating on tube only, not on vessel. The annular gap is visible.
21:28	Coating on tube only, not on vessel. No annular gap noted.
21:48	Coating on tube only, not on vessel. Twenty percent of the annular gap is visible.
22:04	The tube is clean with a rust stain streaming down. No coatings are located in the junction area. The annular gap is partially visible.
22:13	The tube is clean with a rust stain streaming down. No coatings are located in the junction area. No annular gap noted.
22:27	Coating on tube only, not on vessel. No annular gap noted.
22:40	Coating on tube only, not on vessel. Ten percent of the annular gap noted.
22:58	Twenty percent coating on tube. The remainder of the tube and the vessel are clear. No annular gap noted.
23:14	Coating on tube only, not on vessel. No annular gap noted.
23:27	Coating on tube but not in junction area. Brown staining on tube. No coating noted on vessel. No annular gap is visible.
23:44	Coating on tube only, not on vessel. Ten percent of the annular gap noted.
23:56	Coating on tube only, not on vessel. No annular gap noted.
24:27	Coating on tube only, not on vessel. No annular gap noted.
24:42	Five percent of the viewing area has a coating on the tube, the remainder is clean with the annular gap noted.
25:46	Coating on tube only, not on vessel. No annular gap noted.

26:00	Rust stains noted on the tube surface, no coatings noted. No annular gap noted.
26:16	Coating on tube only, not on vessel. The annular gap is visible across 100% of the viewing area.
26:27	Coating on tube only, not on vessel. The annular gap is visible.
26:43	No coatings and the annular gap is visible for one hundred percent of the viewed area.
26:53	No coatings noted on the tube or vessel.
27:42	Coating on tube only, not on vessel. The annular gap is visible.
28:21	Coating on tube only, not on vessel. The annular gap is visible.
29:24	Rust stains noted on tube surface, no coatings noted. The annular gap is visible.
29:57	No coatings noted on tube or vessel. The annular gap is visible.
30:14	Coating on tube only, not on vessel. Rust stain on tube. No annular gap noted.
30:30	Coating on tube only, not on vessel. The annular gap is visible.
30:59	No coatings on the tube or vessel. The annular gap is visible for one hundred percent of the viewed area.
32:32	No coatings noted on the tube or vessel.
32:54	Coating on tube only, not on vessel. The annular gap is visible.
33:11	No coatings noted on the tube or vessel.
33:39	Small amount of coating on the tube surface (fifteen to twenty percent). No coatings noted on the vessel.
33:56	Coating on tube only, not on vessel. No annular gap noted.
34:09	Coating on tube only, not on vessel. No annular gap noted.
34:31	Coating on tube only, not on vessel. Large rust stain running down tube. No annular gap noted.
34:50	Coating on tube only, not on vessel. No annular gap noted.
34:59	Rust stain noted on tube. No coatings on tube or vessel. No annular gap noted.
35:21	No coatings noted on the tube or vessel.

36:14	No coatings noted on the tube or vessel.
37:09	No coatings noted on the tube or vessel.
38:00	Coating on tube only, not on vessel. No annular gap noted.
39:01	Coating on tube only, not on vessel. No annular gap noted.
39:23	Coating on tube only, not on vessel. No annular gap noted.
41:17	No coatings noted on the tube or vessel.
42:13	Coating on tube only, not on vessel. No annular gap noted.
42:28	Coating on tube only with less than twenty-five percent of the circumference covered. No coatings noted on the vessel.
42:47	No coatings noted on the tube or vessel.
43:25	10% coating on tube, none on vessel.
44:25	Coating on tube only, not on vessel. The annular gap is visible.
VIDEO TIME	**COATING IN JUNCTION AREA**
07:09	Coating on tube only, not on vessel although coatings are present in the junction area. The coating appears white, smooth and two dimensional. No annular gap is visible.
11:53	Coating noted in ten percent of the junction area. The annular gap is visible.
14:06	Coatings are in the junction area, the annular gap is visible.
14:49	Coatings are in the junction area. No annular gap is visible.
18:02	A small amount of coating is present in the junction area (twenty-five percent covered).
18:14	The vessel surface is clean with a small amount of coating in the junction area. The coating is smooth and two dimensional. No annular gap is visible.
18:35	Coating on tube and junction only, not on vessel. No annular gap noted.
18:56	Coating on tube and junction only, not on vessel. No annular gap noted.

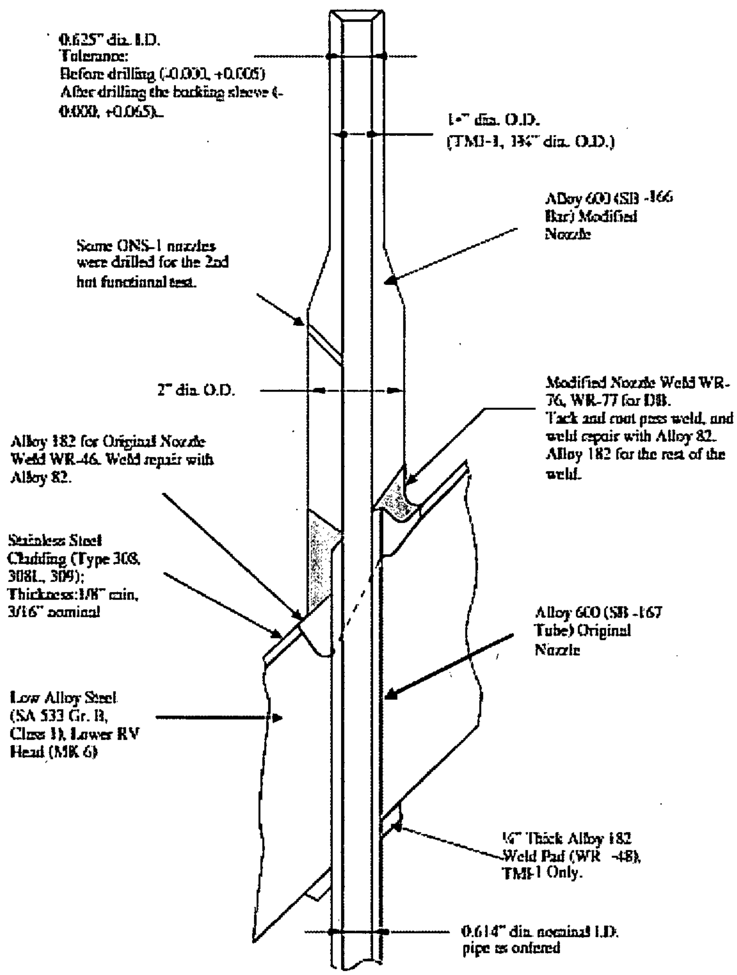

Figure 2-4
Modified Babcock & Wilcox BMN

Figure 1 – B&W repaired bottom nozzle configuration