

NOTE TO: Robert A. Gramm, Chief, Section 1
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

January 13, 2003

FROM: Thomas W. Alexion, Project Manager, Section 1
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

/RA/

SUBJECT: ARKANSAS NUCLEAR ONE, UNIT 1 (ANO-1) - SUMMARY OF VESSEL HEAD
AND VESSEL BOTTOM TELEPHONE CALLS FROM OCTOBER 8, 2002, TO
NOVEMBER 6, 2002

The U.S. Nuclear Regulatory Commission (NRC) staff has had several telephone calls with the licensee regarding their vessel head and vessel bottom inspection activities, and related issues. These calls took place from October 8, 2002, to November 6, 2002. A summary of the telephone calls is enclosed.

Docket No. 50-313

Enclosure: As stated

SUMMARY OF VESSEL HEAD AND VESSEL BOTTOM TELEPHONE CALLS
FROM OCTOBER 8, 2002, TO NOVEMBER 6, 2002
ARKANSAS NUCLEAR ONE, UNIT 1

Date: 10/08/02
Entergy: Guy Davant, Bill Bryce, Mike Krupa, Steve Lewis, Steve Bennett, Rick Lane, Joe Coaleski, Bobby Day, William Sims, et al.
NRC: Don Naujock, Keith Wichman, Terence Chan, Allen Hiser, Ed Andruszkiewicz, Mike Marshall, Tim Steingass, Bob Gramm, Kaly Kalyanam, Bill Reckley, Charles Marshall, Chuck Paulk, Russ Bywater, Jeff Clark, Lee Ellershaw, Wayne Sifre, Tom Alexion, et al.

Entergy (the licensee) indicated that they have completed a bare metal visual examination of the head and found that they have one small leaker (nozzle 56), which was the same one that leaked last outage (1R16). The licensee indicated that the 07/24/02 submittal describes the repair made during the last outage. Regarding nozzle 56, the NRC indicated that it would desire to know what occurred and if the flaw behaved as predicted. The NRC indicated that it would have a request for additional information (RAI) on Bulletin 2002-02, and that if there were any RAIs on the two open relief requests [the alternative for weld repairs dated 09/23/02 or the alternative to ASME (American Society of Mechanical Engineers) examination requirements dated 07/08/02], it would let the licensee know after the meeting with Westinghouse (Electric Company) on 10/09/02, but before 10/11/02.

Date: 10/10/02
Entergy: Guy Davant, Steve Lewis, Steve Bennett, et al.
NRC: Tom Alexion, Terence Chan, Robert Gramm, William Ruland, et al.

The licensee discussed the application of the overlay weld repair to the J-groove weld. The Westinghouse-specific method had a minimum 1/8-inch thick weld repair with two passes involved. This can result in a diluted first layer, with marginal protection. This becomes significant towards the edges of the repair. Alternatively, Entergy proposes to consider as a minimum, a three-layer repair totalling 3/8-inch thick.

The NRC commented that if a circumferential flaw is discovered in the inside diameter (ID) or outside diameter (OD) of the nozzle, that the licensee converse with the NRC before performing the repair. The NRC also commented that an acceptable analysis of flaw growth through the next cycle on nozzle 56 should consider primary water stress corrosion cracking (PWSCC) as well as fatigue.

Regarding the two relief requests, the NRC indicated that it saw no impediments to authorizing approval, if needed. However, this feedback did not constitute approval of the relief requests.

Date: 10/11/02
Entergy: Craig Anderson, Bill Campbell, Mike Krupa, Rick Lane, Guy Davant, et al.
NRC: Tad Marsh, Rich Barrett, Terence Chan, Allen Hiser, Bill Bateman, Bill Ruland, Bob Gramm, Tom Alexion, et al.

The licensee indicated that the flaws they are finding are not unexpected and that the embedded flaw on nozzle 56 has not shown any growth since the last outage. They still believe that their repair process isolates OD-embedded flaws from the PWSCC environment and that they haven't seen anything in ultrasonic testing (UT) or dye-penetrant testing (PT) that would alter their position.

The NRC indicated that generally across the industry, the number of cracks and leaks seems to be escalating (similar to steam generators) and that the NRC and the industry continue to be surprised by the latest inspection findings. Regarding ANO-1, the NRC has concerns about weld overlay for two cycles because the overlay may not be as perfect as Entergy is assuming and because there are many dissimilar metals involved. The NRC and Entergy continued to disagree during the call on whether the analysis of the flaw left in place needs to consider PWSCC during the next cycle of operation.

The NRC asked about the inspection/repair status. The licensee indicated that they have completed the volumetric and PT inspection of nozzle 56, and that the repair plan of nozzle 56 is not finalized. The licensee is in the process of volumetric examination of the other nozzles. The NRC indicated that if the licensee finds a circumferential flaw above the J-groove weld, then the licensee needs to talk to the NRC.

The NRC indicated that if there continues to be disagreement on the need to assume PWSCC crack growth rates in the flaw evaluation, then we need another telephone call or meeting to discuss our concerns and the next step in regulatory space. The NRC made the following comments at the close of the call: NRC is uneasy with not assuming a wetted surface in the flaw evaluation; NRC needs the results of the non-destructive examination (NDE) of the rest of the head; if the flaw evaluation assumes a dry environment, then a mid-cycle outage is needed; if the flaw evaluation shows that 75% through-wall will be exceeded at the end of the cycle, then a different repair configuration needs to be considered; NRC is very cautious in today's environment; NRC does not have confidence in the repair technique; and NRC continues to be concerned about flaws not being isolated from a wetted environment.

Date: 10/16/02

PUBLIC MEETING WITH ENTERGY ON WELD REPAIR IS DISCUSSED SEPARATELY IN THE ASSOCIATED PUBLIC MEETING SUMMARY

Date: 10/17/02
Entergy: Mike Krupa, et al.
NRC: Bill Reckley, Bob Gramm, Tom Alexion

The NRC informed the licensee that regarding nozzle 56, the repair process described at the meeting on 10/16/02 seems reasonable, that NRC encourages them to use the weld inlay process, and concerns with the ASME Boiler and Pressure Vessel Code (Code) are alleviated with the use of the inlay process. The NRC indicated that its position on repairs for other nozzles was similar for cases where outside-diameter flaws are left in place. However, if the licensee did not choose to use the inlay process for those cases, then the NRC would desire a case-by-case discussion of each nozzle.

Date: 10/17/02
Entergy: Bill Campbell, Guy Davant, Mike Krupa, Rick Lane, Craig Anderson
NRC: Tom Alexion, Robert Gramm, Bill Bateman, Terence Chan, et al.

The NRC reaffirmed its position that it desired to remain conservative and that the licensee should include PWSCC in its crack growth rate calculations if it does not use the inlay repair configuration. The licensee asked if NRC desired a UT examination of the center nozzle, and the NRC indicated that it needed more information on the inspection results before providing this feedback.

Date: 10/18/02
Entergy: Mike Krupa
NRC: Tom Alexion

The NRC indicated that it desires the licensee to perform a UT examination of the center nozzle, and that this position is coming from the Director, Division of Engineering (Rich Barrett).

Date: 10/18/02
Entergy: Mike Krupa, Steve Bennett, Jerry Burford, et al.
NRC: Bob Gramm, Ralph Caruso, Gene Hsii, Mike Marshall, Tom Alexion, et al.

The licensee indicated that it had planned, per their Bulletin 2002-02 response, to not perform a UT examination of the center nozzle due to the RADCAL instrument (for the Reactor Vessel Level Monitoring System) in there and the high-risk maneuver to remove it and then reinstall it (there are difficulties with seals, leakage, galling, and spare parts). They indicated that they had not heard that NRC was concerned about the center nozzle until the public meeting two days ago, and now they are hearing at this late date that the NRC wants them to inspect the center nozzle. They indicated that they still desired to see an RAI on Bulletin 2002-02 on the center nozzle. They desired to leave the RADCAL instrument out for two cycles and seal-weld a plate at the flange for that nozzle. The last time they removed the RADCAL instrument, they had to cycle the plant four times during startup to get the seal to stop leaking. They indicated that the technical specifications (TSs) allow them to operate without the RADCAL instrument, but 10 CFR 50.59 does not. They believe they can still monitor for inadequate core cooling in case of an accident with redundant and diverse equipment. They indicated that they could not provide details of this equipment because the appropriate personnel did not arrive for the call, but they did say that they have hot leg monitors, core exit thermocouples, and subcooling monitors. They indicated that they would need a TS change approved by the 28th or 29th of October 2002.

The NRC indicated that any application for license amendment would need to describe the alternative measures, compensatory actions, and show that their proposal meets the detailed regulatory position discussed in NUREG-0737, Item II.F.2. In addition, their proposal should provide details of the spare parts needed, why they need NRC to approve the license amendment, and why they didn't make contingency plans.

Date: 10/18/02

NRC PROVIDES AN RAI ON BULLETIN 2002-02 (see Attachment 1)

Date: 10/18/02
Entergy: Mike Krupa
NRC: Bob Gramm

Entergy indicated that they have decided to use the inlay repair method on nozzle 56, and therefore requested verbal approval of the related relief request on an alternative to the ASME examination requirements. Bob Gramm verbally authorized Entergy to use the alternative examination within the scope and limitations of the 07/08/02 application for ANO-1 (Entergy letter #CNRO-2002-0040).

Date: 10/22/02
Entergy: Steve Bennett, Glen Ashley, Sherrie Cotton, Mike Krupa
NRC: Steve Long, Travis Tate, Allen Hiser, Bob Gramm, Keith Wichman, Tom Alexion, Linda Smith, Chuck Paulk, Lee Ellershaw, et al.

The licensee provided status on the inspection of the vessel head, followed by a discussion of their planned response to the staff's RAI (2 questions) on Bulletin 2002-02.

The inspection of the vessel head nozzles is continuing. To date, 47 of the 69 nozzles have had a volumetric examination. Thirty-one of the nozzles were cleared by Westinghouse, and due to a slower than expected examination rate, the balance of the nozzles are being examined by Framatome. The licensee has also decided to perform a volumetric examination of the center nozzle. Previously, the licensee indicated (in their Bulletin 2002-02 response) that they did not desire to perform a volumetric examination of this nozzle due to various hardships.

To date, three nozzles appear to be candidates for repair (nozzles 56, 54 and 68). Nozzle 56 was the only leaker identified from the bare metal examination. Nozzle 56 was also the nozzle that was found to have leaked during the previous refueling outage and it was discussed in detail in a public meeting on October 16, 2002. Regarding the other two nozzles, the licensee is still collecting additional data on nozzle 54 to completely characterize its flaws, and the licensee currently believes that the indication seen in nozzle 68 is a weld reflection of a porosity dot in the weld material.

Regarding Question 1 of the staff's RAI, on whether the licensee plans to alter its decision to not directly examine the J-groove weld of all of the nozzles in light of the findings at North Anna Power Station (North Anna), Unit 2, the licensee indicated that the planned volumetric examination using the blade probe will give a clear indication of cracking in the nozzle and any leakage into the annulus will be visible on top of the head. Therefore, the licensee sees little value added in performing other examinations because the volumetric examination and the bare metal examination will identify any indications. The staff commented that other licensees have provided satisfactory responses without directly examining the J-groove weld; however, these other licensees have also committed to analyze "leak-path" data to identify through-wall leakage that hasn't resulted in boron deposits on top of the head.

Regarding Question 2 of the staff's RAI, on the technical/safety basis for excluding the center nozzle from the scope of the volumetric examinations, the licensee indicated that they have decided to perform a volumetric examination of the center nozzle. The licensee informed us that they recently removed the RADCAL instrument and pulled the guide tube, and they plan to place a sleeve in the nozzle and use a blade probe to volumetrically examine the nozzle.

Date: 10/25/02
Entergy: Steve Bennett, Craig Anderson, Bill Campbell, Rick Lane, William Sims, Steve Lewis, et al.
NRC: Tom Alexion, Allen Hiser, Don Naujock, Andrea Lee, Andrea Keim, Terence Chan, Robert Gramm, Chuck Paulk, Russ Bywater, Jeffrey Clark

The licensee provided some brief inspection status, followed by a discussion of their proposed relief request. To date, 66 of 69 vessel head nozzles have been volumetrically examined (nozzles 50, 38 and 51 have not been examined). Some nozzles may need a rescan, 8 may need repair (3, 17, 33, 15, 6, 56, 54, and 68), and 5 may need further characterization. There are no circumferential cracks and nozzle 56 is the only nozzle with a flaw above the weld. At the meeting on 10/16/02, the licensee indicated that their options included performing an inlay repair, a 3/8-inch overlay repair of the weld, or an overlay of the tube. These options are still being considered, and they can tell us now that nozzles 54 and 68 will receive an overlay repair. In addition, they are now considering using the Framatome repair method, which involves severing the tube past the flaw and applying a new structural weld. So the licensee's repair options will include an overlay repair, an inlay repair, or the Framatome repair method.

The licensee indicated that the Framatome relief request will have 2 parts: an ambient temper-bead process and the NDE, similar to the Oconee Nuclear Station (Oconee) application. The ambient temper-bead process should be straightforward. The NDE will have 3 issues: the Code requirement to perform flaw characterization (but the licensee says they don't need to assume a specific flaw in the J-weld since all flaws are bounded by analysis), the Code requirement to perform successive exams in the J-weld (but the licensee says they will replace the head before this requirement is applicable), and any anomaly in the new pressure boundary should be detectable by ultrasound (but the licensee says that it is not a Code requirement to look at the repair during the next outage). The licensee also acknowledged that they are going at their own risk on planning these repairs, and said that so far, all of the cracks are axial and none of the indications are out of the norm. In addition, the licensee indicated that they were planning to make their ANO-1 application by 10/28/02.

The NRC commented that the first 2 issues of the licensee's NDE discussion sounded reasonable; however, regarding the third issue (on the anomaly), the NRC indicated that the licensee will need to address it because they are planning on operating for 2 more cycles after this outage before replacing the vessel head. The NRC also added that any variations from the Oconee application, including variations in Code editions, will need to be fully explained and justified.

Date: 10/30/02
Entergy: Steve Bennett, Joe Coaleski, Sherrie Cotton, Glen Ashley, Mike Krupa, Guy Davant, William Sims, Steve Lewis, Bob Beamont, et al.
NRC: Tom Alexion, Allen Hiser, Don Naujock, Andrea Keim, Ed Andruszkiewicz, Travis Tate, Russ Bywater, Jeffrey Clark, Lee Ellershaw

The licensee indicated that they have completed 100% volumetric inspections (360° around) on all 69 nozzles. Eight nozzles will need to be repaired. Six of the nozzles have axial indications (nozzles 3, 17, 33, 15, 6, 54), one nozzle has a rounded indication in the weld material (nozzle 68), and one nozzle (nozzle 56) has multiple indications in the original J-groove weld metal (surrounding the weld nugget from the prior repair) and in the nozzle base material. With the exception of nozzle 56, none of the nozzles exhibited a leakage path.

The licensee plans on performing a J-groove weld overlay using the Westinghouse method for nozzles 54 and 68, and plans on installing a new pressure boundary weld between the shortened nozzle and the inside bore of the vessel head base material using the Framatome method for nozzles 3, 17, 33, 15, 6 and 56. The licensee indicated that the crack depths ranged from 0.125 inch to 0.38 inch, and the lengths ranged from 0.28 inch to 1.81 inches. The NRC requested that the licensee provide the length, depth, and location relative to the weld in the licensee's post-outage 30-day response to Bulletin 2002-02.

Regarding the two relief requests associated with the Framatome repair method (both were submitted by letter dated 10/28/02), the licensee indicated that even though the letter says that repairs are targeted for completion by 11/12/02, the repairs appear to be going well and verbal relief from the NRC may be needed by 11/08/02.

Date: 10/31/02

ENTERGY PROVIDES THEIR FORMAL RESPONSE TO THE NRC'S RAI ON BULLETIN 2002-02

Date: 11/01/02
Entergy: Glenn Ashley, Mike Krupa, Craig Anderson, Bob Beamont, Joe Coaleski, William Sims, Lee Schwartz, et al.
NRC: Tom Alexion, Ted Sullivan, Bob Gramm, Stephanie Coffin, Andrea Lee, Allen Hiser, Keith Wichman, Linda Smith, Russ Bywater, Lee Ellershaw

This telephone call pertained to the bottom of the reactor vessel, specifically the incore instrumentation nozzles. The licensee indicated that ANO-1 has 52 incore nozzles, of 3/4-inch diameter Alloy 600-type material, and that the J-welds are on the inside of the vessel. The vessel support skirt is welded to the vessel, 360° around the vessel. In previous outages, the licensee conducted VT-2 examinations (looking for an active leak) in accordance with the Code, and what they saw is the nozzles and the insulation underneath the vessel, looking up from below the insulation. This outage, while conducting a visual inspection on the outside of the insulation, the licensee identified 4 nozzles with boric acid deposits on the nozzle and on the insulation, at the plane where the insulation intersects the nozzles. For these 4 nozzles, the licensee removed the insulation ring around the nozzle and inserted a boroscope through the

insulation and videotaped 360° around where the nozzle intersects the vessel. The licensee believes that they see boric acid staining on the lower head as a result of previous overflow/splashing events during past refueling outages, and not leakage from the incore instrumentation nozzles. The licensee also indicated that they could not get a sample of the staining, that this inspection was done prior to receiving information from Framatome regarding inspection of these nozzles, and that in the future they will continue to follow the Owners Group's activities on this subject.

The NRC staff expressed concern about the susceptibility and stresses on the Alloy 82/182 weld material. In addition, the NRC staff found that the boric acid flow path postulated by the licensee was not readily obvious. Therefore, the NRC asked the licensee to provide information early next week to support their position. The information requested by the NRC is included in Attachment 2.

The NRC staff told the licensee that the staff needs the information early next week, that any information provided to headquarters will be placed in the public document room, and the information requested will be treated as an RAI under Bulletin 2002-01 (Item 3.A covers the remainder of the reactor coolant pressure boundary).

Date: 11/05/02

ENERGY PROVIDES THEIR DRAFT RESPONSE TO THE NRC'S RAI ON BULLETIN 2002-01 (see Attachment 3)

Date: 11/06/02
Entergy: Guy Davant, Brian Grey
NRC: Tom Alexion, Terence Chan, Andrea Keim, Bob Gramm

In response to Entergy's request for verbal approval of the relief requests associated with the Framatome repair method (which includes an alternative for weld repairs and an alternative to evaluating flaw characteristics) by the end of the working day, to support repairs to be performed later that night, Bob Gramm verbally authorized Entergy to use the alternatives within the scope and limitations of the 10/28/02 application for ANO-1 (Entergy letter #CNRO-2002-0052). At the request of the NRC, Entergy indicated that it would supplement the application within 2 weeks with: (1) the completed flaw evaluation for a postulated radial corner crack on the uphill side of the vessel head penetration (page 5 of 11 of the application), (2) the completed evaluation to determine the potential for debris from a cracking J-groove partial penetration weld (page 5 of 11), and (3) the completed load limit analysis considering the ductile Alloy 600/Alloy 690 materials along flaw propagation path 1 (page 7 of 11).

Attachment 1

REQUEST FOR ADDITIONAL INFORMATION

BULLETIN 2002-02

1. In Entergy's 30-day response to NRC Bulletin 2002-02 for Arkansas Nuclear One, Unit 1, on page 3 of 5, the scope of the reactor pressure vessel (RPV) head inspections for refueling outage 1R17 is described. The inspection scope is limited to bare metal visual examination of the RPV head and volumetric examination of 68 of 69 the RPV head penetrations. As a result of recent inspection findings at North Anna, Unit 2, the NRC has concerns about the combination of non-destructive examinations and the inspection scope of the RPV head during refueling outage 1R17. The concern is that through-weld cracks in the J-groove welds may provide the conditions that could lead to circumferential cracking in the nozzle base material at or above the J-groove weld with no visual indications of leakage deposits on the RPV head.

The licensee for North Anna, Unit 2, has identified circumferential cracks in nozzles examined with ultrasonic testing and indications were identified on the J-groove weld for a high percentage of the penetrations. According to the licensee for North Anna, Unit 2, there were no visual indications of boric acid deposits on the surface of the RPV head at all of these nozzles. This finding, if verified, indicates that cracks in the J-groove welds may provide the conditions that could lead to circumferential cracking in the nozzle base material at or above the J-groove weld with no visual indications of leakage deposits on the surface of the RPV head.

Considering the discussion above, please supplement your Bulletin 2002-02 response with a discussion of whether the findings at North Anna, Unit 2, alters your decision to not directly examine the J-groove welds of all of the 69 nozzles.

2. In Entergy's 30-day response to NRC Bulletin 2002-02 for Arkansas Nuclear One, Unit 1, on page 3 of 5, it is stated that volumetric examination of nozzle 1 may be performed if the visual inspection of the nozzle is inconclusive. In the bulletin response, it is explained that the basis for excluding nozzle 1 from the scope of the volumetric examination is that a RADCAL instrument would have to be removed, but a technical/safety basis is not provided.

The staff acknowledges discussions held during the meeting on October 16, 2002, and follow-up discussions on October 17 and 18, 2002. Information you provided during those discussions does not provide sufficient technical justification to exclude nozzle 1 from volumetric examination.

What is the technical/safety basis for excluding nozzle 1 from the scope of the volumetric examination? Specifically, what is the technical justification that nozzle 1 does not have a circumferential crack which may lead to nozzle ejection?

Attachment 2

Request for Additional Information Related to Bulletin 2002-01 Arkansas Nuclear One, Unit 1 (ANO-1)

1. Provide detailed drawings and dimensions of the vessel bottom (including the vessel skirt, insulation, etc.) showing the instrumentation nozzles; include on these drawings the boric acid deposits (e.g., staining) based on information obtained from your videotapes. Show the nozzles in the vicinity of nozzle 30 down to nozzle 1, and in the vicinity of nozzle 15 down to nozzle 1.
2. Explain your best efforts to locate the source of the boric acid deposits. Address the feasibility of performing additional inspections of the annulus between the vessel/support skirt and the vertical insulation or from the under vessel area to provide further evidence of the path of borated water through the 2 inch support skirt openings.
3. Characterize the boric acid deposits.
4. Describe what you see in the space between the vessel base metal and the outside diameter of the instrumentation nozzles.
5. Provide the Owners Group's susceptibility report for the instrumentation nozzles and welds, as installed.
6. Describe the previous boric acid overfill events and corrective actions taken in response to these events.
7. Explain how identification of these boric acid deposits and any corrective actions comport with your boric acid control program and the ASME Code requirements. Discuss any program or procedure changes you plan to undertake as a result of this experience.
8. Summarize recommendations received from Framatome for inspection of the incore instrumentation nozzles and your disposition of these recommendations, and provide the basis for any recommendation not followed.

Attachment 3

**ENTERGY'S DRAFT RESPONSE TO THE NRC'S RAI
ON BULLETIN 2002-01**

NOTE TO: Robert A. Gramm, Chief, Section 1
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

January 13, 2003

FROM: Thomas W. Alexion, Project Manager, Section 1
Project Directorate IV
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