From: Thomas Alexion
To: BENNETT, STEVE A
Date: 11/13/02 3:18PM
Subject: VESSEL PHONE CALLS

Steve,

Please check the attached file on vessel head and vessel bottom phone calls for accuracy. Thanks.

Tom

Mail Envelope Properties (3DD2B395.5D8 : 0 : 20628)

Subject:	VESSEL PHONE CALLS
Creation Date:	11/13/02 3:18PM
From:	Thomas Alexion
Created By:	TWA@nrc.gov

Recipients	**Action**	**Date & Time**
entergy.com		
SBENNE2 (BENNETT, STEVE A)		

Post Office	**Delivered**	**Route**
	Pending	entergy.com

Files	**Size**	**Date & Time**
VesselCalls.wpd	33952	11/13/02 02:04PM
MESSAGE	738	11/13/02 03:18PM

Options

Auto Delete:	No
Expiration Date:	None
Notify Recipients:	Yes
Priority:	Standard
Reply Requested:	No
Return Notification:	None
Concealed Subject:	No
Security:	Standard
To Be Delivered:	Immediate
Status Tracking:	Delivered & Opened

SUMMARY OF VESSEL HEAD AND VESSEL BOTTOM PHONE CALLS

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 Andruskevich, 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 examination requirements dated 07/08/02), it would let the licensee know after the meeting with Westinghouse on 10/09/02, but before 10/11/02.

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 a three-layer repair with each layer being 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 comment 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.

10/11/02

Entergy: Craig Anderson, Bill Campbell, Mike Krupa, Rick Lane, Guy Davant, et al.

NRC: Tad Marsh, Rich Barrett, Terence Chan, Alan 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 continues 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 repairs 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 consider PWSCC, then we need another phone 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, NRC needs the results of the examination of the rest of the head, NRC does not agree with the repair technique (so if the calculations show that the flaw does not go through-wall, then a mid-cycle outage is needed; if the calculations show that the flaw does go through-wall, then a different repair is needed), 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.

10/16/02: PUBLIC MEETING WITH ENTERGY ON WELD REPAIR IS DISCUSSED SEPERATELY IN THE ASSOCIATED PUBLIC MEETING SUMMARY

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 Code are alleviated with the use of the inlay process. The NRC indicated that its position on repairs for other nozzles was similar. However, if the licensee did not chose to use the inlay process, then the NRC would desire a case-by-case discussion of each nozzle.

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 welding process. 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.

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).

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 manuver 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. 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 TSs allow them to operate without the RADCAL instrument, but 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.

10/18/02: NRC PROVIDES AN RAI ON BULLETIN 2002-02 (see Attachment 1)

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).

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 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-tight data.

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 will be placing a sleeve in the nozzle and using a blade probe to volumetrically examine the nozzle.

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 non-destructive examination (NDE), similar to the 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 flaw in the J-weld), 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 they will replace the head before this requirement is applicable). 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.

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 depths 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.

10/31/02: ENTERGY PROVIDES THEIR FORMAL RESPONSE TO THE NRC'S RAI ON BULLETIN 2002-02

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 phone 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 160-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-degrees around where the nozzle intersects the vessel. The licensee believes that they see boric acid staining as a result of previous overfill/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 a request for additional information under Bulletin 2002-01 (Item 3.A covers the remainder of the reactor coolant pressure boundary).

11/05/02: ENTERGY PROVIDES THEIR DRAFT RESPONSE TO THE NRC'S RAI ON BULLETIN 2002-01 (see Attachment 3)

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

From: "BENNETT, STEVE A" <SBENNE2@entergy.com>
To: "Tom Alexion" <twa@nrc.gov>
Date: 11/5/02 9:14PM
Subject: ANO-1 Draft Response to NRC Bulletin 2002-01

Tom,

Attached is the draft ANO-1 follow-up response to the Bulletin on the ICI nozzles. It has 3 files. The main response and two attachments. Let me know if you have any trouble opening them.

Steve Bennett

Mail Envelope Properties (3DC87877.138 : 14 : 37176)

Subject:	ANO-1 Draft Response to NRC Bulletin 2002-01
Creation Date:	11/5/02 9:03PM
From:	"BENNETT, STEVE A" <SBENNE2@entergy.com>
Created By:	SBENNE2@entergy.com

Recipients
nrc.gov
owf4_po.OWFN_DO
TWA (Thomas Alexion)

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Files	**Size**	**Date & Time**
MESSAGE	215	11/05/02 09:03PM
Draft NRCB 2002-01 RAI on ICI.pdf		48586
Attach 1 to ICI RAI.pdf	31435	
Attach 2 to ICI RAI	31157	
Mime.822	154283	

Options

Expiration Date:	None
Priority:	Standard
Reply Requested:	No
Return Notification:	None
Concealed Subject:	No
Security:	Standard

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 video tapes. Show the nozzles in the vicinity of nozzle 30 down to nozzle 1 and in the vicinity of nozzle 15 down to nozzle 1.

Response:

Attachment 1 (Diagrams of penetrations through vessel skirt, nozzle layout, and description) identifies the nozzles that were inspected using a boroscope and the results. The four nozzles inspected by a boroscope were the only incore tubes that had staining below the insulation. The purpose of the boroscope inspection was to determine whether these nozzles had any evidence of leakage at the vessel interface. Attachment 2 provides a scale composite drawing showing the dimensions of the reactor vessel, support skirt, insulation details, and nozzle 1 and 30.

The attachments are included as separate documents.

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.

Response:

The purpose of the inspection was to determine if there was any evidence of incore instrument nozzle leakage. The initial inspection of the under vessel area was a 360 degree visual inspection of each incore tube in the area where it penetrated the insulation under the vessel. There is a small annulus between the insulation and the tubing. Since the tubing runs vertically directly to the vessel and the distance between the vessel and the insulation varies from approximately 2 to 18 inches, leakage of an incore nozzle would be evident by boric acid deposits at the area where the tubing penetrates the insulation. There were two conditions noted during this inspection. 1) Four incore tubes had white staining on them below the insulation. 2) There was staining on the concrete pedestal walls, staining on some insulation seams and staining with some small boric acid deposits on the floor. None of the staining was moist or appeared to be from active leaks.

A condition report was initiated documenting the traces of boron found on the ANO-1 incore instrument tubes and the boric acid staining in the general area.

To ascertain the source of the staining on the four incore tubes, the insulation collars around each tube were removed and a boroscope inspection of the tubing above the insulation up to and including the nozzle to vessel interface was performed. The inspection revealed that the staining was not originating from the nozzle at the vessel interface or from the tubing. There were faint stains indicating fluid had dripped down the bottom curvature of the vessel. These traces appeared to initiate above the uppermost circle of tubes and was clearly not generated from the incore nozzles.

A search of historical records, previous photographs of the area and interviews of personnel who had previously performed VT2 inspections was conducted. It was determined from that review that the conditions in the undervessel area had been essentially the same for several years and there was no evidence of a change in the appearance of the area this outage.

Based on discussions with site personnel (refueling team, operations, maintenance staff) that were familiar with past activities and issues in the reactor vessel area, instances of cavity seal plate leakage were identified as likely sources for the staining identified in the general area under the vessel. In order to understand the relationship of the vessel, the insulation, the concrete structure, and the drainage path for cavity seal plate leakage, the composite drawing previously identified was developed for this area. Additionally, it was determined that decontamination efforts of the transfer canal near the vessel flange area during the 1980's and early 1990's included rinsing fluid into the cavity seal plate area when the plate was not installed. During this time frame, cavity seal plate leakage was a fairly common occurrence as well as CRDM flange and RVLMS flange leakage decontamination efforts with the cavity seal plate removed. Also an overflow of the incore tank (R-8) that occurred in September 1999 was identified as a source for some of the boron residue identified on the floor in the area under the reactor vessel. Based on these reviews, probable flow paths have been identified that correspond to the indications seen. Documented inspections of the area under the vessel from the previous two outages to the present do not indicate any change in condition to this area.

The reactor cavity seal plate leakage would traverse the annulus area between the vessel and the mirror insulation to reach the undervessel area. The ability to perform additional inspections of the vertical annulus area between the vessel and the mirror insulation has been evaluated. To provide direct visual evidence of the path of borated water through the 2 inch holes in the support skirt above the undervessel insulation, access to the annulus would have to be gained. Possible access routes to inspect the area are limited to access from the top of the reactor vessel and access from below the vessel. There are no access locations between the top and bottom of the vessel because of the primary shield wall. The only openings through the shield wall are around the reactor vessel nozzles and these are too tight a fit to permit access. Access from the top of the vessel to the annulus between the shield wall and the reactor vessel is restricted by the reactor shield blocks. They consist of concrete filled, steel lined blocks. The shield blocks are located below the permanent seal ring at the top of the vessel and above the reactor vessel nozzles. These shield blocks provide a radiation shield in the annulus between the top of the reactor vessel and the floor of the refueling canal. There is no access through these blocks without removing them from above. This can only be accomplished by removing portions of the permanent seal plate.

The only other access to the area between the vessel skirt and the vessel insulation is from the bottom of the vessel. Access of this area is difficult to accomplish. One horizontal insulation panel in proximity to nozzle 30 could be removed to gain access to the area below the holes and a boroscope inserted through the area between the two adjacent incore nozzles, up to the accessible two (2) inch diameter holes located around the circumference of the skirt. Once through the hole, a limited local area between the skirt and insulation could be viewed.

Given the minimal information to be gained, coupled with the clear evidence that the boric acid traces originated above the ICI nozzles, it is our conclusion that further inspection activities are not warranted.

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.

Response (3 and 4):

See Table Below

1R17 Under-Vessel Inspection

Summary of Observations

Boron or Stain Location	General Description / Characterization	Probable Source	Leakage Path for Probable Source	Supporting Evidence
Walls of Reactor Pedestal	Generally straight streaks that originate from out of sight at the top of the wall and extend to the floor. They appear to be the residue from liquid that has flowed down the walls of the cavity from above. The streaks exhibit fairly uniform radial spacing.	Seal plate leakage.	Past the ID or OD of the seal plate, down the sides of the vessel either inside or outside of the vertical insulation panel, through the lower 9.25" or 2" holes in the vessel support skirt, and down the walls of the cavity.	History of seal plate leakage. By the design the holes in the vessel skirt and the cavity walls themselves represent the only drain path from the annulus around the vessel. Walls would be shielded from ICI nozzle leakage by the bottom head insulation panels.
Floor of Reactor Cavity	Similar to the indications on the cavity walls. Flow paths meandered to the low point of the floor instead of forming straight streaks.	Seal plate leakage. A natural continuation of the indications seen on the walls.	See discussion above.	See discussion above. The minor indications seen on the 4 ICI tubes would not account for the degree of staining observed on the cavity floor.
ICI Tubing Near the Incore Tunnel / Tubing Support	White drips and runs starting at points on the tubing near the floor and tunnel opening.	Drips from seal plate leakage coming off the wall above the incore tunnel.	See discussion above.	None of these indications originate from points near the bottom head insulation panels.
Nozzle 1	Faint white staining is visible on the nozzle piping extending from the vessel down through the insulation to below the insulation. The stain ranges in width from ¼ to ½ the circumference of the nozzle pipe. Some barely noticeable brown staining is visible on the nozzle piping (approximately 1 pencil width wide. A 360-degree close-up inspection of the nozzle shows no indication of boron originating from the annulus between the	The faint indications suggest small amounts of moisture from seal plate leakage or decon activities.	Past the ID or OD of the seal plate, down the side of the vessel inside the vertical insulation panel, through the upper 2" holes in the vessel support skirt, splashing onto the underside of the vessel or onto the top of the bottom head insulation panel.	No indications of flows or traces from adjacent nozzles.

	nozzle and the lower vessel wall.			
Nozzle 7	Two very small, very thin, brown traces extend down the nozzle pipe, one approximately 2" to 3" long. The other trace extends approximately ½" down the pipe. The traces are ½" apart. Numerous small individual stain spots are visible on one side of the nozzle piping, approximately 120 degrees around from the brown traces. These spots appear to be dried residue from moisture droplets. A 360-degree close-up inspection of the nozzle shows no indication of boron originating from the annulus between the nozzle and the lower vessel wall.	See above.	See above.	See above.
Nozzle 15	A single faint white stain can be seen on the nozzle piping just below the vessel, extending down below the insulation. The stain appears to be approximately a pencil width wide. A 360-degree close-up inspection of the nozzle shows no indication of boron originating from the annulus between the nozzle and the lower vessel wall.	See above.	See above.	See above.
Nozzle 30	Two thin, faint white traces appear uphill. The source is out of sight of the boroscope on the vessel. The traces run to and down Nozzle 30. The traces appear less than a pencil width	Seal plate leakage that splashed onto the bottom of the vessel.	Past the ID or OD of the seal plate, down the side of the vessel inside the vertical insulation panel, through the upper 2" holes in the vessel support skirt, splashing onto the underside of	Nozzle 30 is on the outer edge of the ICI nozzle pattern, which means there are no other nozzles located uphill of Nozzle 30 that could have acted as a source for these traces.

	wide and are approximately 1 inch to 1.5 inches apart. Faint white staining of the nozzle piping is visible (approximately one to two pencil widths wide). These traces appeared to be residue left over from a past occurrence when fluid may have gotten on and ran down the side of the vessel. A 360-degree close-up inspection of the nozzle shows no indication of boron originating from the annulus between the nozzle and the lower vessel wall.		the vessel, and down the underside of the vessel to Nozzle 30.	
Bottom head insulation panel lap straps	Faint white residue along the edges of some insulation panel lap straps (joint cover strips).	Seal plate leakage that has run onto the top of the insulation panel.	Past the ID or OD of the seal plate, down the side of the vessel inside the vertical insulation panel, through the upper 2" holes in the vessel support skirt, onto the top of the bottom head insulation panel, and down between the joints of the insulation panels.	History of seal plate leakage.

5. Provide the Owners Group's susceptibility report for the instrumentation nozzles and welds, as installed.

Response:

B&W Owners Group Report 51-5001951-01, *Alloy 600 PWSCC Susceptibility Model* dated December 16, 1998 was developed by the BWOG members to provide a relative ranking for potential failure of Alloy 600 components to PWSCC. This report is proprietary to the Owners and cannot be released without each of their authorizations. This cannot be accomplished in the time frame for response to this RAI. However, the following is a summary of the model development and the relative ranking of the ANO-1 nozzles, including the ICI nozzles, for NRC consideration.

The three primary considerations that went into the model development was:

- the susceptibility of the A600 materials including chemical composition, heat treatment, material microstructure and general operating parameters,
- stress factors including residual stresses (surface effects, weld geometry and stress relief) and operating stresses, and
- the PWR primary water environment of the material including temperature, hydrogen, boron content, and sulfur intrusions

The susceptibility model used the CIRSE crack initiation approach used for the CRDM nozzle PWSCC susceptibility predictions. In addition, a statistical process was applied using the Monte Carlo Method for allowing input parameters to have distributed values. As a result, susceptibility factors, stress factors, and environmental factors were built into the model based on information acquired from fabrication and plant operations. Relative susceptibility rankings were then established to result in predicted 10% cracking for each of the Alloy 600 components.

For ANO-1 the following provides the results relative time to failure (RTTF) of the ICI nozzles to other ANO-1 susceptible components:

Component	RTTF	Rank
Pressurizer replacement level tap nozzle	.061	1
Pressurizer thermowell nozzle in lower sensing line	.070	2
Pressurizer vent nozzle	1.99	4
RCS Hot Leg Pressure tap nozzle	4.63	8
CRDM nozzles	4.78 – 23.13	9
Instrument penetration (ICI nozzles)	95.96	35
Modified instrument penetration (ICI nozzles)*	532.28	47
Total components ranked	—	54

*- The ANO-1 ICI nozzles have been modified. The nozzle piece yield strength and weld design differ from the original nozzle material resulting in differences in susceptibility.

6. Describe the previous boric acid overfill events and corrective actions taken in response to these events.

Response:

Cavity seal leakage events prior to installation of the permanent canal seal plate were not consistently documented in condition reports. Thus, documentation of the number of these occurrences and the leak rates is not readily available. Canal seal plate leakage events can be inferred from a review of the history of ANO-1 Procedure OP-1504.005, Canal Seal Plate Installation. That history, indicates that the procedure was revised three times to address torquing of the seal plate nuts, three times to address use of RTV and once to address the thickness of the seal gasket. All revisions were made to address continuing leakage concerns. To understand the extent of the leakage, an internal memorandum dated January 8, 1985, indicates that after re-torquing the nuts in a previous outage, the leakage was reduced to 0.8 gpm. On the high side, discussions with a former ANO-1 Operations Manager indicates that it was not uncommon to have initial seal plate leak rates of 15-20 gpm. When this type leakage occurred, it would result in lowering of the canal water level to re-torque bolts or add RTV to reduce the leak rate to an acceptable level. A permanent seal plate was installed in 1993 to provide a permanent fix to the concern. There has not been a history of leakage concerns since that time.

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 changers you plan to undertake as a result of this experience.

Response:

Inspection for boric acid deposits under the Unit 1 Reactor Vessel is currently documented in procedure 2311.009 "ANO Unit 1 and Unit 2 Alloy 600 Inspection". This procedure was revised prior to 1R17 to enhance undervessel inspections. It was determined that more thorough examinations than the previous VT-2 inspections were warranted for 1R17. Form 1 of this procedure contains a sign-off for a "Lower Rx Vessel Head" inspection. This procedure states "This inspection is intended to perform an effective 360 degree inspection of the incore nozzles from below the insulation and report any sign of boric acid or discoloration. For nozzles with indications, inspect the nozzle to head interface for signs of leakage."

The ASME code inspection (VT-2) is controlled by procedure 5120.243 "Unit 1 Post Outage Pressure Test." The inspection of the RCS pressure boundary is performed by and documented in this procedure. These inspections are performed by qualified VT-2 inspectors when the plant is at normal operating pressure and temperature greater than 500 degrees F. Attachment 1, section 1.E of the procedure calls for an inspection of the "Instrument Nozzles" (Observe under vessel).

It is expected that the procedure 2311.009 "ANO Unit 1 and Unit2 Alloy 600 Inspection" will be reviewed to: 1) Make the 360° visual inspection of the ICI nozzles apply to future ANO-1 refueling outages and to include requirements to do a bare metal visual inspection of any tube that has boric acid traces detected below the insulation. 2) Evaluate the procedure to ensure adequate inspections of Unit 2 I-600 nozzles are included in the procedure based on lessons learned. A condition report action item has been issued to track the procedure change and evaluation (CR-ANO-1-2002-1233, Corrective Action #3)

8. Summarize recommendations received from Framatome for the inspection of the incore instrumentation nozzles and your disposition of these recommendations, and provide the basis for any recommendation not followed.

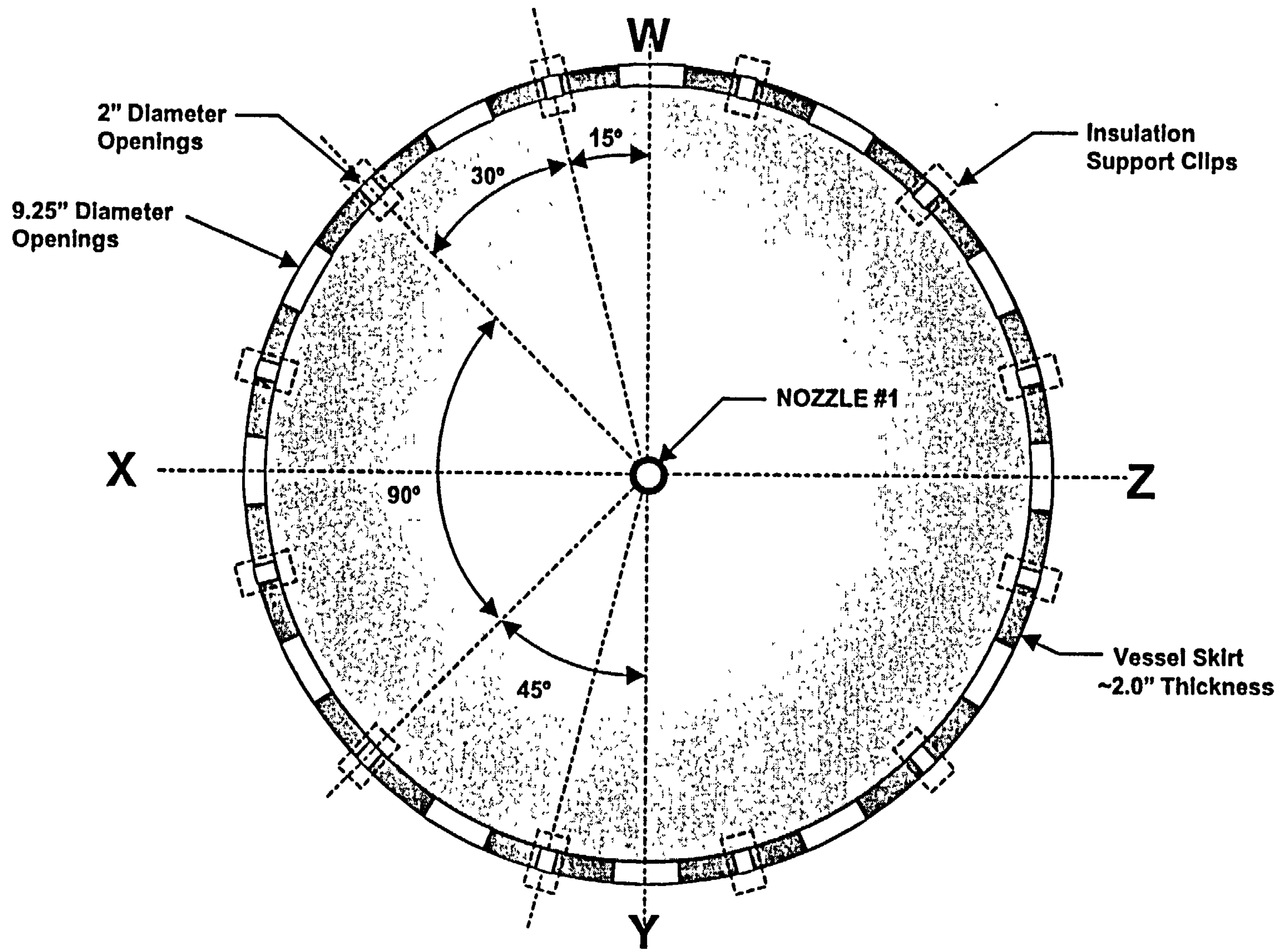
Response:

ANO has received documentation from Framatome ANP which includes the following statements of recommendation, "Under ideal circumstances, NDE (UT/ECT/PT) would be the suggested corrective action. However, given the current state of qualified NDE techniques and accessibility concerns, a bare metal visual examination of the IMI nozzle/lower RV head interface area at all B&W – fabricated 177-FA reactor vessels should be performed at the earliest opportunity. Other actions may also be appropriate to consider." (from Preliminary Report of Safety Concerns); and "For this reason, Framatome ANP recommended that a visual inspection of the IMI nozzles at ANO-1 and ONS-2 be conducted during the current refueling outages. A visual inspection for this purpose would, ideally, be a bare metal examination of all 52 IMI nozzles and the lower reactor vessel head." (Framatome ANP letter to W.R. Campbell, Entergy Operations, Inc.).

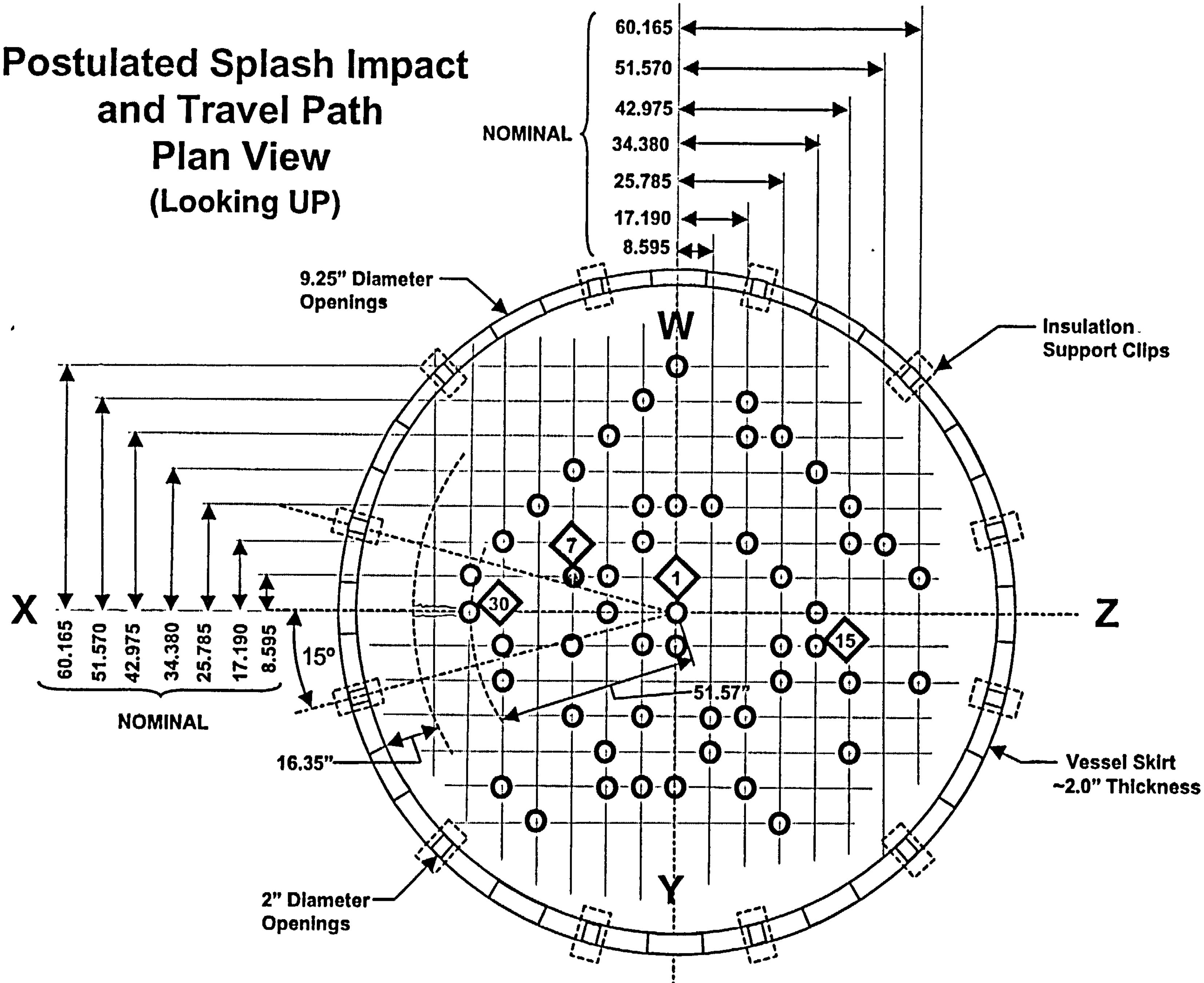
However, in further discussion with Framatome the above recommendations were made with the concern of not being able to identify leakage below the insulation. The recommendations were also based on the configuration of the insulation package at a plant that has a different design than ANO. Entergy believes that the insulation design at ANO-1 allows an easier flow path for boric acid leakage to be visibly revealed from below the insulation. Therefore, boric acid leakage would be more readily manifested below the insulation and would have a higher potential to be identified from our inspections. It is recognized that the Framatome recommendation to perform a complete bare metal visual inspection provides some higher level confidence of early detection. In light of information received by Entergy to date we believe that the inspection conducted by ANO-1 is adequate to detect boric acid indicative of a leak. Entergy intends to work with Framatome and the other Owners to better understand needed inspection techniques and potential repair options.

To determine the most appropriate inspection, the relative susceptibility, projected dose and the ability to individually inspect the vessel/nozzle interface of nozzles indicating evidence of boric acid were considered. Based on these considerations the most appropriate inspection was determined to be a thorough (360 degree) inspection of all nozzles below the insulation, with specific follow up inspections of the vessel/nozzle interface for nozzles indicating evidence of boric acid. From the geometry of the incore tubing and insulation, there is a high probability leakage would be evident below the insulation. A video inspection that focused on identifying any indications of borated water leakage has been performed. This inspection consisted of thorough visual inspection of the bottom of the reactor vessel insulation and ICI nozzles looking for any signs of boron crystals or staining on the nozzles. Based on this inspection, four nozzles (#1, #7, #15, and #30, see attached diagram) were identified as having evidence of a substance on the nozzle pipe. These indications resulted in additional inspections at nozzles #1, #7, #15, and #30 using a boroscope to look at the areas where the nozzles penetrate the reactor vessel as well as the reactor vessel surface immediately adjacent to the nozzles. These examinations did not identify any signs of leakage from the nozzles and indicated the sensitivity of a below the insulation inspection to identify small traces of fluid leakage from above. Based on the geometry of the nozzle configurations and the precedence of other RCS leaks resulting in easily identifiable indications of leakage, no other inspections are deemed necessary. The lack of boron evidence on any of the other nozzles below the insulation gives a high degree of confidence that no leaks are present.

Reactor Vessel Skirt Openings and Locations
Plan View – Looking UP



Postulated Splash Impact and Travel Path Plan View (Looking UP)



Boroscopic Inspections of ICI Nozzles

The annuli between Nozzles 1 and 30 and the Rx vessel were inspected with a boroscope on 10/7/02, and the annuli of Nozzles 7 and 15 were inspected on 10/8/02.

In general, the vessel itself was noted to be relatively clean and in good condition, with uniform brown spotted discoloration of the silver-colored, high-temperature coating. The conditions noted were characterized as normal considering the age of the vessel. No "popcorn" type boric acid deposits or other typical boric acid accumulations were seen at or near the nozzles inspected. The condition noted during the inspection was generally faint white staining of the nozzle piping. Some light brown staining was observed on two nozzles but this is attributed to moisture external to the vessel. Limited boroscope video of the top side of the vessel insulation was obtained in the areas of nozzle # 15 and # 7. This video showed no staining or accumulation of boron on the insulation. The angle iron support structure for the insulation was very clean, with a few small widely spaced surface corrosion areas noted.

30

Two thin, faint white traces appear uphill, out of sight of the boroscope on the vessel and run to and down Nozzle 30. The traces appear less than a pencil width wide and are approximately 1 inch to 1.5 inches apart. Faint white staining of the nozzle piping is visible (approximately one to two pencil widths wide). These traces did not appear to be "active" sources, but rather appeared to be residue left over from a past occurrence when fluid may have gotten on and ran down the side of the vessel. A 360-degree close-up inspection of the nozzle shows no indication of boron originating from the annulus.

Boroscopic Inspections of ICI Nozzles

15

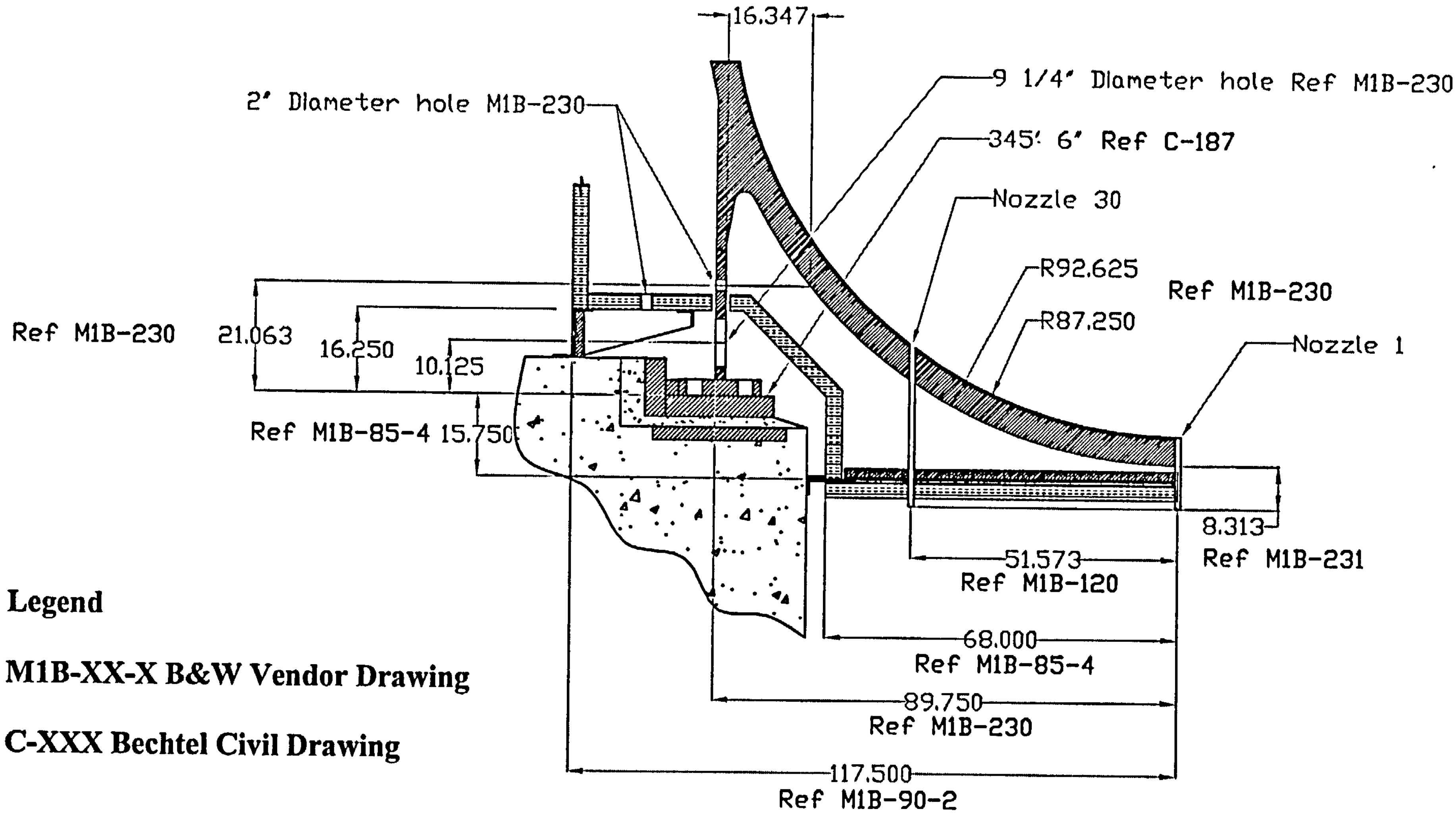
A single faint white stain can be seen of the nozzle piping just below the vessel, extending down below the insulation. The stain appears to be approximately a pencil width wide. A 360-degree close-up inspection of the nozzle shows no indication of boron originating from the annulus.

7

Two very small, very thin, brown traces extend down the nozzle pipe, one approximately 2" to 3" long. The other trace extends approximately ½" down the pipe. The traces are ½" apart. Numerous small individual stain spots are visible on one side of the nozzle piping, approximately 120 degrees around from the brown traces. These spots appear to be dried residue from moisture droplets. A 360-degree close-up inspection of the nozzle shows no indication of boron originating from the annulus.

1

Faint white staining is visible on the nozzle piping extending from the vessel down through the insulation to below the insulation. The stain ranges in width from ¼ to ½ the circumference of the nozzle pipe. Some barely noticeable brown staining is visible on the nozzle piping (approximately 1 pencil width wide. A 360-degree close-up inspection of the nozzle shows no indication of boron originating from the annulus.



Legend

M1B-XX-X B&W Vendor Drawing

C-XXX Bechtel Civil Drawing