AmerenUE
Callaway Plant

PO Box 620
Fulton, MO 65251

December 13, 2007

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

Ladies and Gentlemen: ULNRC-05458

DOCKET NUMBER 50-483
CALLAWAY PLANT UNIT 1
UNION ELECTRIC CO.
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING REQUESTS FOR RELIEF FROM ASME SECTION XI CODE EXAMINATION REQUIREMENTS (RELIEF REQUESTS ISI-34 AND ISI-40)

Reference 1: AmerenUE Letter ULNRC-05183, "Requests for Relief from ASME Section XI Code Inservice Examination Requirements," dated October 25, 2006

Reference 2: AmerenUE Letter ULNRC-05423, "Response to Requests for Additional Information Regarding Requests for Relief from ASME Section XI Code Examination Requirements (Including Withdrawal of Relief Request ISI-37)," dated June 29, 2007

Reference 3: AmerenUE Letter ULNRC-05452, "Additional Information Regarding Request for Relief from ASME Section XI Code Examination Requirements (Relief Request ISI-38)," dated June 29, 2007

By letter dated October 25, 2006 (Reference 1) and pursuant to 10 CFR 50.55a(a)(3) and/or 10 CFR 50.55a(g)(5)(iii), AmerenUE (Union Electric Company) submitted eight requests for relief from applicable examination requirements of Section XI of the American Society of Mechanical Engineers (ASME) Code. The relief requests (identified as ISI-34, -35, -36, -37, -38, -39, -40, and -41) were submitted for application to the second 10-year interval of the Inservice Inspection (ISI) Program at the Callaway plant, which ended on December 18, 2005. As noted in the letter, the Code Edition(s) and Addenda that applied to Callaway's second 10-year ISI interval are ASME Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," 1989 Edition, with no Addenda (and 1995 Edition with 1996 Addenda, as applicable).

To date, the NRC staff has completed its review and processing of most of the relief requests submitted by AmerenUE's October 25, 2006 letter. Relief

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Request ISI-35 was approved by NRC letter dated January 18, 2007, and Relief Requests ISI-36 and ISI-39 were approved by NRC letter dated September 17, 2007. The NRC staff's review of Relief Requests ISI-34, ISI-37, ISI-38 and ISI-40 prompted several requests for information to which AmerenUE responded via its letter dated June 29, 2007 (Reference 2). (AmerenUE's June 29, 2007 letter included a request for withdrawing Relief Request ISI-37, which was acknowledged in the NRC's September 17, 2007 letter.)

After reviewing the responses provided by AmerenUE in its June 29, 2007 letter, the NRC identified a further need for information for the three remaining relief requests (ISI-34, ISI-38, and ISI-40), and therefore a second RAI was transmitted to AmerenUE (via E-mail) in August 2007. AmerenUE provided a response to that RAI for the portion concerning ISI-38 via its letter dated October 25, 2007 (Reference 3). Relief Request ISI-38 was subsequently approved by the NRC via its letter dated November 2, 2007. AmerenUE is now providing its response to the second RAI for the portion concerning ISI-34 and ISI-40 (which are the only remaining relief requests) via this letter.

The responses to the RAI questions/requests for ISI-34 and ISI-40 require several documents to be attached to this letter. Attachment 1 provides AmerenUE's responses to the RAI questions/ requests themselves. Note that ISI-34 is addressed in Part I of the attachment, and ISI-40 is addressed in Part II (of the same attachment). In support of the RAI responses, examination volume profiles for the welds addressed by ISI-34 and ISI-40 are provided, as these profiles (figures) are referred to in the RAI responses. Attachment 2 provides the examination volume profiles for the welds addressed by relief Request ISI-34, and Attachment 3 provides the examination volume profiles for the welds addressed by Relief Request ISI-40. Additionally, in developing the RAI responses for these relief requests, it was confirmed that the relief request documents themselves should be revised. Therefore, revised Relief Request ISI-34 is provided as Attachment 4, and revised Relief Request ISI-40 is provided as Attachment 5. These attached, revised relief requests supersede the original versions provided per Reference 1.

AmerenUE appreciates the NRC staff's effort to complete the review and processing of the subject relief requests. For any questions regarding the attached information, please contact Scott A. Maglio at 573-676-8719 or Tom Elwood at 573-676-6479.

Sincerely,

Luke H. Graessle
Manager - Regulatory Affairs

TBE/nls

Attachments:

1. Responses to RAI Questions
2. Examination Volume Profiles for Welds Associated with RR ISI-34
3. Examination Volume Profiles for Welds Associated with RR ISI-40
4. Revised Relief Request ISI-34
5. Revised Relief Request ISI-40

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Attachment 1

Responses to RAI Questions

Responses to RAI Questions

By letter dated October 25, 2006, the Union Electric Company (AmerenUE) submitted several requests for relief (RRs) from certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), as applicable to the second ten-year inservice inspection (ISI) interval for the Callaway Plant, Unit 1. Included in the submittal were Relief Requests (RRs) ISI-34 and ISI-40, which concern limited coverage for ultrasonic examination of Class 1 and 2 pressure-retaining piping welds.

Subsequent to AmerenUE's October 25, 2006 submittal, the NRC staff communicated several requests for additional information (RAIs) via E-mail. AmerenUE responded to those RAIs in a supplemental letter dated June 29, 2007. After reviewing AmerenUE's responses, the NRC staff identified a further need for additional information and clarifications to some of the responses, and another RAI was therefore transmitted to AmerenUE in August 2007. The requests/questions contained in that RAI pertained to RRs ISI-34 and ISI-40 (as well as RR ISI-38, but for which responses were provided by AmerenUE in a separate letter dated October 25, 2007). Responses to the questions/requests pertaining to RRs ISI-34 and ISI-40 are hereby provided in this attachment.

Responses to the questions/requests pertaining to RR ISI-34 are provided in Part I, and responses for RR ISI-40 are provided in Part II, as follows. In each case, each applicable NRC question/request is stated and then immediately followed by AmerenUE's response.

I. Request for Additional Information for ISI-34

1. The October 25, 2006 submittal identified the applicable Code requirements as Title 10 of the Code of Federal Regulations 10 CFR 50.55a(b)(2)(xv)(A)(1) and (2). This is a regulation and is not an appropriate reference for an ASME Code Requirement from which relief is requested in accordance with sections of 10 CFR 50.55a. Provide the specific ASME Code requirement from which relief is being requested.

Callaway Response:

Section 3 of ISI-34 has been revised to clarify the applicable Code requirements for each weld as detailed below.

For 2-BB-04-F004, ASME Section XI, Figure IWB-2500-8(c) (1989 Edition with no addenda) requires surface examination of the weld crown and 1/2 inch on either side of the weld crown 360 degrees around the pipe, as well as volumetric examination of a minimum volume of the inner 1/3 t (one third of the thickness) extending into the piping base metal for a distance of 1/4 inch past the edge of the weld crown.

For 2-BB-02-F019, 2-BG-24-FW061, 2-BG-24-FW062, and 2-BG-24-FW067, ASME Section XI, Figure IWB-2500-8(b) (1989 Edition with no addenda) requires surface examination of the weld crown and 1/2 inch on either side of the weld crown 360 degrees around the pipe.

For 2-BG-02-S046-A and 2-BG-02-S046-C, and 2-BG-02-FW040, ASME Section XI, Figure IWC-2500-7(a) (1989 Edition with no addenda) requires surface examination of

the weld crown and 1/2 inch on either side of the weld crown 360 degrees around the pipe, as well as volumetric examination of a minimum volume of the inner 1/3 t (one third of the thickness) extending into the piping base metal for a distance of 1/4 inch past the edge of the weld crown.

In a letter dated January 30, 2002 from the NRC to AmerenUE, the NRC approved a relief request for Callaway for the application of a risk-informed inservice inspection (RI-ISI) program for ASME Code Class 1 and 2 piping. As approved, the methodology in EPRI TR-1 12657 Rev. B-A is utilized for the method of examination of the subject welds, as well as the selection of welds to be examined. The RI-ISI program does not require surface examination, but requires volumetric examination of all selected welds and extends the Code-required examination volume to the inner ⅓t for a distance 1/4 inch on either side of the weld counterbore or 1/2 inch past the edge of the weld crown if no counterbore is present.

Both ASME and RI-ISI require 100% examination of the required weld volume. Both Code Case N-460 and NRC Information Notice (IN) 98-42, "Implementation of 10 CFR 50.55a(g) Inservice Inspection Requirements," have interpreted coverage of greater than 90% to be acceptable. However, relief is being requested because greater than 90% coverage could not be obtained for the subject welds.

The difficulty in complying with the coverage requirements stems from Appendix VIII requirements as modified by 10CFR50.55a. Per 10 CFR 50.55a(b)(2)(xv)(A)(2), "Where examination from both sides is not possible on austenitic welds or dissimilar metal welds, full coverage credit from a single side may be claimed only after completing a successful single-sided Appendix VIII demonstration using flaws on the opposite side of the weld." Further, per 10 CFR 50.55a(b)(2)(xvi)(B), "Examinations performed from one side of a ferritic or stainless steel pipe weld must be conducted with equipment, procedures, and personnel that have demonstrated proficiency with single side examinations. To demonstrate equivalency to two sided examinations, the demonstration must be performed to the requirements of Appendix VIII as modified by this paragraph and § 50.55a(b)(2)(xv)(A)."

The Performance Demonstration Initiative (PDI) has not been able to develop an examination procedure that meets the above criteria; therefore, only 50% coverage can be claimed with single sided access.

2. **The October 25, 2006, submittal identified the subject welds as welds within the licensee's RI-ISI program. The licensee's June 29, 2007 response to previous RAI Question 2 stated that insights from Code Case N-711 were used to take credit for examining 100% of the area of interest of the subject welds. The NRC has not endorsed Code Case N-711. The NRC approval letter for the licensee's RI-ISI program, dated January 30, 2002, only referenced topical report EPRI-TR-112657, Revision B-A, which has a process for resolving examination coverage issues. Provide a discussion on the licensee's application of the topical report process (RI category, important considerations, degradation severity, etc.) for resolving coverage issues for each weld. In the event that a flaw existed in the unexamined portion of the weld and leakage occurred, provide a discussion on the licensee's leakage detection capability and discuss the consequences that the leakage would have on reactor operations.**

Callaway Response:

The reference to Code Case N-711 was intended as supporting information to reflect industry operating experience that failure of a pipe-to-component weld not subject to a damage mechanism or thermal fatigue is most likely to occur on the pipe side of the weld. Therefore, while only 50% coverage can be claimed, greater that 50% of the risk associated with the welds was addressed. The intent was not to invoke Code Case N-711 or to claim 100% coverage.

The EPRI RI-ISI topical report (TR-112657 Rev. B-A) states (per Section 6.4):

Relief Requests pertaining to limited examination coverage of piping elements will be subject to the following requirements.

1. *An existing relief request is no longer required if the piping element is not a RI-ISI selection. Such relief requests shall be formally withdrawn by the licensee.*
2. *An existing relief request is unaffected if the piping element is a RI-ISI selection and the examination volume remains unchanged.*
3. *An existing relief request may require modification if the piping element is a RI-ISI selection and the examination volume has been expanded (e.g., thermal fatigue).*
4. *A new relief request will be generated for any RI-ISI piping element selection for which greater than 90 percent coverage is not achieved.*

The welds in question (identified in the table below) meet requirement #4 above, i.e., that a new relief request must be generated since greater than 90 percent coverage was not achieved.

Weld ID	RI-ISI Item Number	RI Category	Degradation Mechanism	Previously Selected for Sect XI
2-BB-04-F004	R1.20-4	4	None	No
2-BB-02-F019	R1.11-2	2	Thermal Fatigue	No
2-BG-24-FW061	R1.11-5	5	Thermal Fatigue	No
2-BG-24-FW062	R1.11-2	2	Thermal Fatigue	No
2-BG-24-FW067	R1.20-4	4	None	No
2-BG-02-S046-A	R1.20-4	4	None	No
2-BG-02-S046-C	R1.20-4	4	None	No
2-BG-02-FW040	R1.20-4	4	None	No

Locations for the applicable welds were selected based on risk category, degradation mechanism, and accessibility. None of these locations had known or predicted degradation.

Note

It should be noted that the list of welds in the above table contains an additional weld relative to what was originally identified in RR ISI-34. The added weld, 2-BG-02-FW040, was originally included in the scope of RR ISI-40. Based on further review and evaluation, however, it was determined that this weld more appropriately belongs in the scope of RR ISI-34, as the relief requested per RR ISI-34 is applicable to this weld. RRs ISI-34 and ISI-40 have thus been revised to reflect the removal/addition of weld 2-BG-02-FW040. Revised RR ISI-34 is provided as Attachment 4, and revised RR ISI-40 is provided as Attachment 5.

Regarding the remainder of this RAI question, the following information is provided:

2-BB-04-F004, 2-BB-02-F019, 2-BG-24-FW061, 2-BG-24-FW062, and 2-BG-24-FW067 are located outside the bioshield in the containment building. Periodic, at-power walkdowns are performed in these areas to check for leaks. Additionally, the containment atmosphere and sump water levels are monitored from the Control Room, and leak rate calculations are performed as part of the Control Room log requirements.

2-BG-02-S046-A, 2-BG-02-S046-C, and 2-BG-02-FW040 are located in the Auxiliary Building. They are in rooms that are checked twice per shift by Operations.

3. **The licensee's June 29, 2007 response to previous RAI Question 1 stated that it was known at the time of selection that a potential conflict existed between the required weld volume and ultrasonic testing (UT) inspection qualification rules. Prior knowledge of the conflict should have given the licensee time to research the problem and develop solutions. Provide a discussion on the licensee's effort to resolve the conflict and to achieve qualified procedures and personnel for examination of the subject weld.**

Callaway Response:

The issue of single-sided access of austenitic component welds has been an ongoing issue in the nuclear power NDE field for many years. As such, Callaway is actively addressing these technical issues via several strategies:

- Participation in the Materials Reliability Program, which in turn has engaged the EPRI NDE Center.
- Participation in ASME Section XI Code activities, which develops the rules for examination of these welds.
- Participation in the EPRI NDE Product Group Steering Committee to develop research of new or improved technologies to allow for better examination of these types of welds.
- Participation in the Performance Demonstration Initiative to evaluate and qualify new technology to be used in these applications.
- Partnering with vendor and utility personnel to evaluate new technology to improve coverage of these welds.

Callaway will continue to employ the best qualified technology and methods available to assure that maximum coverage of these types of welds is obtained.

4. **Elaborate on the June 29, 2007 response to previous RAI Question 5 which pertained to the evaluation of other non-destructive (NDE) examination methods and UT techniques for these welds. Provide a discussion on additional coverage, if any, achievable with other NDE methods and UT Techniques. Include, in the discussion, the difficulties that may be associated with other NDE methods and UT techniques.**

Callaway Response:

The intent of the response to RAI Question 5 was to point out that Callaway is not a research facility and does not have the means or the expertise to perform experimental NDE. As such, Callaway employs EPRI as the research facility for the industry. Based upon the work that is being performed at EPRI, the best qualified techniques have been employed.

For each of the subject welds, 100% of the weld was examined but only 50% coverage can be credited because no UT procedures are qualified for detection or flaw sizing on the far side of the weld when only single side access is available. The method used to examine the far side of the weld was that offered by EPRI as the "best effort" technology for these configurations.

Digital radiography was not used. Callaway, as well as the industry, does not have a digital radiographic process that meets the requirements of the PDI program. Therefore, a digital radiograph would not yield useful results for increasing the coverage of the examination. Utilization of processes such as digital radiography without a clear understanding or method for interpreting the results would not serve a useful purpose.

The inside diameter of these welds was not available to the examiner. The burden of draining the reactor coolant system and the BG (Chemical Volume and Control) system prohibits draining for the sake of performing NDE. Since the area of interest in these exams is the inner 1/3 of the weld and adjacent metal, surface exams such as PT, MT, and ET were not considered. It may also be noted that at the time of the examinations there were no qualified phased array techniques for examination of the welds from the outside diameter.

Section 4 of RR ISI-34 has been expanded/revised to clarify the "Impracticality of Compliance" discussion, consistent with the above.

5. **The June 29, 2007 response to previous RAI Question 3 showed typical sketches for the three configurations. It is not clear from the sketches where interferences begin to affect examination coverage, nor is it clear on the volume associated with the best effort coverage. Using the appropriate sketch on page 6 of the October 25, 2006, submittal (or similar sketch), identify the volume examined with qualified UT and the volume examined using best effort UT. Describe the volume scanned in each direction (two opposite axial scans and two opposite circumferential scans) and provide an estimated value attributed to best effort coverage for each weld.**

Callaway Response:

The axial scans were limited to one direction in the areas specified as having one-sided access only. Circumferential scans were performed in both the clockwise and counter-clockwise directions on the base metal of the unrestricted side of the weld and on the entire weld crown. More detailed examination volume profiles have been provided for information and are given in Attachment 2, in support of RR ISI-34.

Note

Upon further review of the examination profiles provided, it was identified that additional coverage may be potentially obtainable on weld 2-BG-24-FW061 (reported as 50% coverage). This can only be confirmed by visually examining the weld at the next opportunity. (The weld is in containment and is inaccessible during plant operation.) As a conservative measure, AmerenUE intends to visually examine the weld configuration during the next refueling outage at Callaway. If it is determined that additional coverage is obtainable, a UT examination will be performed at that time, and the results obtained will be included in the Refuel 16 ISI Summary Report.

II. Request for Additional Information for ISI-40

1. **The October 25, 2006, submittal identified the applicable Code requirements as 10 CFR 50.55a(b)(2)(xv)(A)(1) and (2). This regulation is not an appropriate reference for an ASME Code requirement. Provide the specific ASME Code requirement from which relief is being requested.**

Callaway Response:

ASME Section XI, Figure IWB-2500-8(c) (1989 Edition with no addenda) requires surface examination of the weld crown and 1/2 inch on either side of the weld crown 360 degrees around the pipe, and volumetric examination of a minimum volume of the inner ⅓t (one third of the thickness) extending into the piping base metal for a distance of 1/4 inch past the edge of the weld crown.

In a letter dated January 30, 2002, from the NRC to AmerenUE, the NRC approved a relief request for Callaway for the application of a risk-informed inservice inspection (RI-ISI) program for ASME Code Class 1 and 2 piping. As approved, the methodology in EPRI TR-1 12657 Rev. B-A is utilized for the method of examination of the subject welds, as well as the selection of welds to be examined. The RI-ISI program does not require surface examination but requires volumetric examination of all selected welds and extends the Code required examination volume to the inner ⅓t for a distance 1/4 inch on either side of the weld counterbore or 1/2 inch past the edge of the weld crown if no counterbore is present.

Both ASME and RI-ISI require 100% examination of the required weld volume. Both Code Case N-460 and NRC Information Notice (IN) 98-42, "Implementation of 10 CFR 50.55a(g) Inservice Inspection Requirements," have interpreted coverage of greater than 90% to be acceptable.

Relief is being requested because greater than 90% coverage could not be obtained for the subject welds.

The difficulty in complying with the coverage requirements stems from appendix VIII requirements as modified by 10CFR50.55a.

Per 10 CFR 50.55a(b)(2)(xv)(A)(2), "Where examination from both sides is not possible on austenitic welds or dissimilar metal welds, full coverage credit from a single side may be claimed only after completing a successful single-sided Appendix VIII demonstration using flaws on the opposite side of the weld." Further per 10 CFR 50.55a(b)(2)(xvi)(B), "Examinations performed from one side of a ferritic or stainless steel pipe weld must be conducted with equipment, procedures, and personnel that have demonstrated proficiency with single side examinations. To demonstrate equivalency to two sided examinations, the demonstration must be performed to the requirements of Appendix VIII as modified by this paragraph and § 50.55a(b)(2)(xv)(A)."

The Performance Demonstration Initiative (PDI) has not been able to develop an examination procedure that meets the above criteria; therefore, only 50% coverage can be claimed.

2. **The June 29, 2007 response to previous RAI Question 1 provides two typical sketches for two configurations. It is not clear from the sketches where interferences begin to affect examination coverage, nor is it clear what volume is associated with the "best effort" coverage. For each weld, show the required examination volume, identify the examination volume interrogated by the different transducers (center ray projection through the examination volume), and identify the volume examined with qualified UT and examined with best effort UT. Describe the volume scanned in each direction (two opposite axial scans and two opposite circumferential scans). Provide an estimated coverage value attributed to best effort for each weld.**

Callaway Response:

The axial scans were limited to one direction in the areas specified as having one-sided access only. Circumferential scans were performed in both the clockwise and counter-clockwise directions on the base metal of the unrestricted side of the weld and on the entire weld crown. More detailed examination volume profiles have been provided for information and are given in Attachment 3, in support of RR ISI-40.

3. **In expanding on the June 29, 2007 answer to previous RAI Question 4, provide the following: (a) Since radiography testing (RT) was used for the Section III fabrication examination, discuss the examination value that can be contributed toward the preservice examination. (b) The need for a preservice examination is usually associated with a repair or replacement activity. Depending on the extensiveness of the activity, opportunities may exist for changing a design**

configuration to a design that is conducive to UT examinations. Discuss the considerations given to a design change and explain the reasoning for maintaining the current configuration. (c) Provide a discussion on additional coverage, if any, achievable with other NDE methods and UT techniques. Include in the discussion the difficulties that may be associated with other NDE methods and UT technique.

Callaway Response:

(a) Radiography is well suited for Section III fabrication examination construction defects are readily identified (slag inclusions, porosity, etc.). Since for inservice inspection, however, ultrasonic examination is better suited for identifying inservice defects such as cracking. For this reason and because the use of radiography for inservice inspections presents radiological and outage complexity concerns, ultrasonic examination is the preferred technique for preservice examination (which provides baseline examination for future inservice examinations). Additionally, the regulator has indicated that volumetric examination is the preferred technique by endorsement of Appendix VIII which only addresses ultrasonic examination.

(b) The Repair/Replacement activity that prompted the need for the preservice examination was performed in conjunction with Callaway's steam generator replacement project (all four steam generators). This project provided an opportunity to replace the valves with a more reliable design. The valves and flanges used were designed in accordance with the ANSI standards identified in ASME Section III. These components have been shown by the industry to be safe and reliable and have been used for many years with no identified problems. Obtaining components that meet a design conducive to UT examination of a significantly greater degree would represent an unreasonable burden on Callaway as the time required to evaluate, obtain and complete Repair/Replacement activities would be greatly increased.

Additionally, the industry is actively working on increasing inspection volumes in austenitic components such as these. It is expected that, in the future, greater coverage will be obtained by advances in technology. Callaway, through participation in the ASME Code process, EPRI, PDI, and other industry groups will evaluate and utilize such advances as appropriate.

(c) As stated previously, Callaway continues to monitor advances in the technologies for performing NDE. Callaway will adopt new technologies as appropriate, once they become proven, demonstrated, and available. It is important to point out that the Section XI preservice examination is performed to provide a baseline for future inservice examinations. The ASME Section III NDE (RT) to identify construction flaws was performed on these components with no rejectable conditions identified. No other NDE technique was identified which would have provided additional coverage.

5. **Relief Request ISI-40 identifies 16 welds associated with preservice inspections and one weld, 2-BG-02-FW040, associated with inservice inspection. ISI-40 does not contain technical information to support a request for relief from inservice inspection coverage. The technical information for inservice inspections would be similar to the information supplied for RR ISI-34. Provide the technical information to support the relief request for weld 2-BG-02-FW040.**

Callaway Response:

As noted in the response to RAI Question 2 for RR ISI-34 (in Part I), weld 2-BG-02-FW040 was removed from the scope of RR ISI-40 and included instead in RR ISI-34. Information pertaining to this weld is therefore addressed in the RAI responses provided for RR ISI-34 (in Part I). As also noted previously, RRs ISI-34 and ISI-40 have been revised to reflect the addition/removal of this weld, and the revised RRs are provided as Attachments 4 and 5, respectively.

Attachment 2

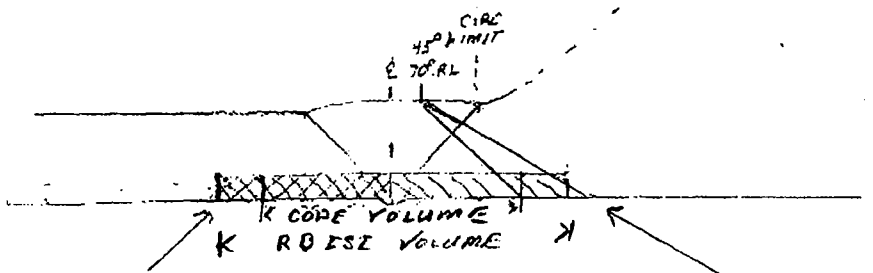
Examination Volume Profiles

For

Welds Associated with RR ISI-34

2-BB-04-F004
4" Schedule 160 Pipe to Valve
Examination limited to one side for 360 degrees due to valve body.

Pipe valve



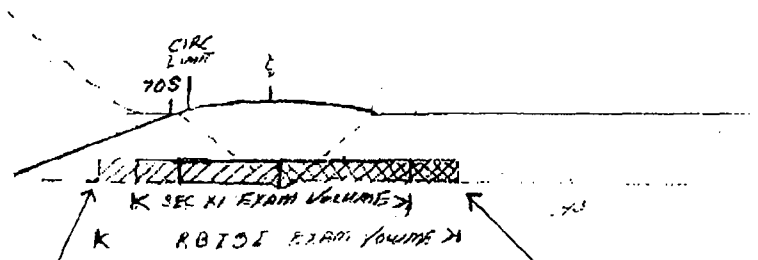
Appendix VIII Qualified Examination Volume 50% on pipe side

Incomplete examination volume 50% on valve side of weld. Best effort examination performed on valve side with 45 & 70 degree RL

Nominal Code required volume	Width 1.5" X Depth .177"= .2655 sq in .2655" X Circumference 11.36"= 3.02 cu in
Total code volume achieved	1.51 cu in 50% combined coverage
Nominal RBISI Volume	Width 2" X depth .177= .354 sq in .354" X circumference 11.36 =4.02 cu in
Total RBISI Volume achieved	2.01 cu in 50% combined coverage

2-BB-02-F019
3" Schdule 160 Pipe to Valve
Examination limited to one side for 360 degrees due to valve body.

Valve Pipe



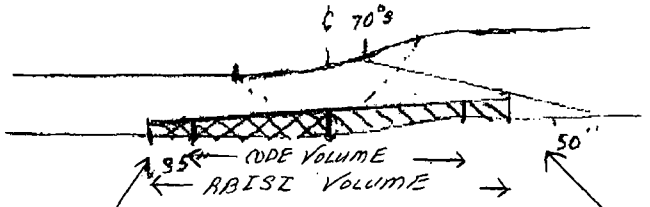
Incomplete examination volume 50% on valve side of weld. Best effort examination performed on valve side with 70 degree shear.

Appendix VIII qualified examination volume 50% pipe side.

Nominal Code required volume	Width 1.6" X Depth .146"= .234 sq in Sq in .234" X Circumference 8.70"= 2.04 cu in
Total code volume achieved	1.02 cu in 50% combined coverage
Nominal RBISI Volume	Width 2.1" X depth .146 = .306 sq in .306" X circumference 8.70 = 2.66 cu in
Total RBISI Volume achieved	1.33 cu in 50% combined coverage

2-BG-24-FW061
2" Schdule 160 Pipe to pup piece
Examination limited to one side for 360 degrees due to pup piece .

Pipe Pup piece



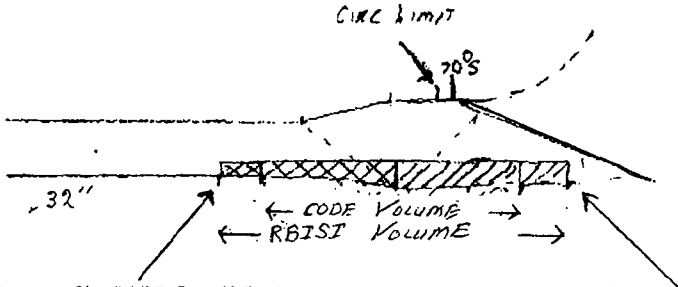
Appendix VIII Qualified Examination Volume 50% on pipe side

Incomplete examination volume 50% on pup piece side of weld. Best effort examination performed on pup piece side with 70 degree

Nominal Code required volume	Width 1.5" X Depth .166"= .25 sq in Sq in .25" X Circumference 7.98"= 1.995 cu in
Total code volume achieved	.9975 cu in 50% combined coverage
Nominal RBISI Volume	Width 2" X depth .166 " = .332 sq in .332" X circumference 7.98" =2.65 cu in
Total RBISI Volume achieved	1.325 cu in 50% combined coverage

2-BG 24-FW062 & 2–BG-24-FW067
2" Schedule 160 Pipe to Tee
Examination limited to one side for 120 degrees" due to tee blend.

Pipe (pup piece) Tee



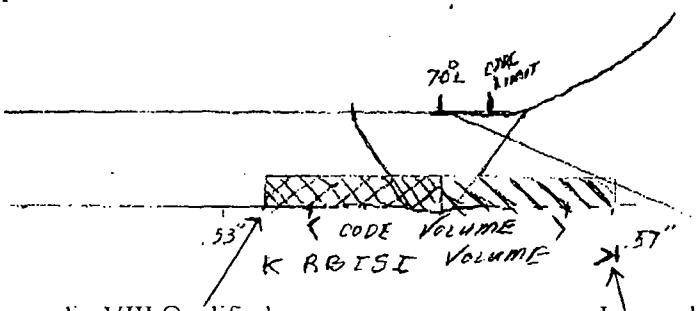
Appendix VIII Qualified
Examination Volume 50%
on pipe side in obstructed area

Incomplete examination volume
50% on tee side of weld in .
obstructed area best effort 70 degree

Nominal Code required volume	Width 1.5" X Depth .18"= .27 sq in Sq in .27" X Circumference 6.70"=1.8 cu in
Obstructed area Total code volume achieved	Circumference 2.23" x .135" = .30 cu In 1.5 cu in 83.3% combined coverage
Nominal RBISI Volume	Width 2" X depth .18" = .36 sq in .36" X circumference 6.70 = 2.4 cu in
Obstructed area Total RBISI Volume achieved	Circumference 2.23 X .18 = .40 cu in 2 Cu In 83.3% Combined coverage

2-BG-24-S046- A & C
4" Schdule 160 Pipe to tee piece
Examination limited to one side for 360 degrees due to Tee .

Pipe Tee



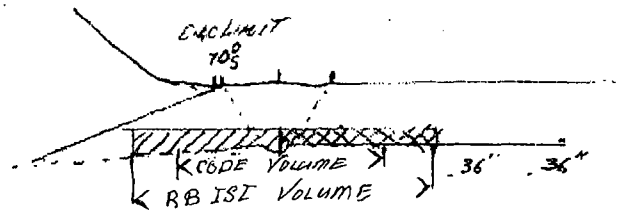
Appendix VIII Qualified Examination Volume 50% on pipe side

Incomplete examination volume 50% on tee side of weld. Best effort examination performed on tee side with 70 degree

Nominal Code required volume	Width 1.5" X Depth .176"= .265 sq in Sq in .265" X Circumference 11.35"= 3.0 cu in
Total code volume achieved	1.5 cu in 50% combined coverage
Nominal RBISI Volume	Width 2" X depth .176" = .352 sq in .352" X circumference 11.35" =3.99 cu in
Total RBISI Volume achieved	1.99" cu in 50% combined coverage

2-BG-02-FW040
2" Schedule 160 Pipe to Valve
Examination limited to one side for 360 degrees due to valve body.

Valve



Pipe

Incomplete examination volume 50% on valve side of weld. Best effort examination performed on Valve side with 70 degree shear.

Appendix VIII qualified inspection Volume limited to50% on pipe side of weld

Nominal Code required volume	Width 1.1" X Depth .12"= .132 sq in .132 sq in X Circumference 5.68"= .75 cu in
Total code volume achieved	.375 cu in 50% combined coverage
Nominal RBISI Volume	Width 1.6" X depth .12" = .192" sq in .192 Sq in X circumference 5.68" = 1.09 cu in
Total RBISI Volume achieved	.545 cu in 50% combined coverage

Attachment 3

Examination Volume Profiles

For

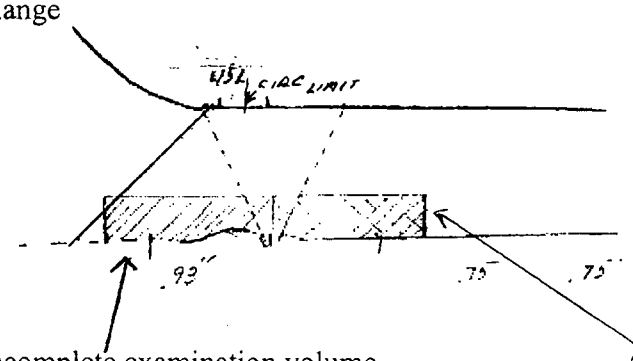
Welds Associated with RR ISI-40

2-EP-01-3066A WDC-002-FW2
2-EP-01-3066A WDC-003-FW3
2-EP-01-3066D WDC-002-FW2
2-EP-01-3066D WDC-003-FW3

6" Schedule 160 Pipe to Flange
Examination limited to one side for 360 degrees due to flange body.

Flange

Pipe



Incomplete examination volume 50% on valve side of weld. Best effort examination performed on flange side with 45 degree RL

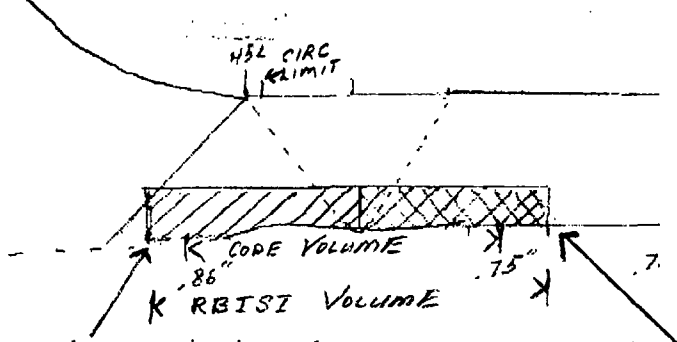
Appendix VIII qualified inspection Volume limited to50% on pipe side of weld

Nominal Code required volume	Width 1.3" X Depth .25"= .325 sq in Sq in .325" X Circumference 17.1"= 5.56 cu in
Total code volume achieved	2.78 cu in 50% combined coverage
Nominal RBISI Volume	Width 1.8" X depth .25" = .45" sq in .45" X circumference 17.1 = 7.7 cu in
Total RBISI Volume achieved	3.85 cu in 50% combined coverage

2-EP-01-8818A 1& 2
2-EP-01-8818B 1&2
2-EP-01-8818C 1 & 2
2-EP-01-8818D 1&2

6" Schdule 160 Pipe to Valve
Examination limited to one side for 360 degrees due to valve body.

Valve Pipe



Incomplete examination volume 50% on valve side of weld. Best effort examination performed on valve side with 45 degree RL

Appendix VIII qualified inspection Volume limited to50% on pipe side of weld

Nominal Code required volume	Width 1.6" X Depth .25"= .4 sq in Sq in .4" X Circumference 17.1"= 6.84 cu in
Total code volume achieved	3.42 cu in 50% combined coverage
Nominal RBISI Volume	Width 2.1" X depth .25" = .525" sq in .525" X circumference 17.1 = 8.97 cu in
Total RBISI Volume achieved	4.49 cu in 50% combined coverage

Attachment 4

Revised Relief Request ISI-34

10 CFR 50.55a Request Number ISI-34

Proposed Alternative
In Accordance with 10 CFR 50.55a(g)(5)(iii)
--Inservice Inspection Impracticality--

1. ASME Code Component(s) Affected

Class 1 and Class 2 Pressure Retaining Piping Welds examined from the outside surface of Pressurized Water Reactors using procedures, personnel, and equipment qualified to ASME Section XI, Appendix VIII, Supplement 2 criteria.

CODE CATEGORY B-J and C-F-1 PIPING WELDS

Code Item	RI-ISI Item Number	Description	Weld No.	Degradation Mechanism	RI Category	Previously Selected for Sect XI
B9.11	R1.20-4	4" Pipe to BBPCV0455B Weld	2-BB-04-F004	None	4	No
B9.21	R1.11-2	3" Pipe to valve PCV-456A	2-BB-02-F019	Thermal Fatigue	2	No
B9.21	R1.11-5	2" Pipe to pup-piece weld	2-BG-24-FW061	Thermal Fatigue	5	No
B9.21	R1.11-2	2" Pup-piece to 2" X 2" X ¾" Tee	2-BG-24-FW062	Thermal Fatigue	2	No
B9.21	R1.20-4	2" X 2" X ¾" Tee to 2" Pipe	2-BG-24-FW067	None	4	No
C5.21	R1.20-4	4" Straight Tee to 4" Pipe	2-BG-02-S046-A	None	4	No
C5.21	R1.20-4	4" Pipe to 4" Straight Tee	2-BG-02-S046-C	None	4	No
C5.21	R1.20-4	2" Pipe to Valve	2-BG-02-FW040	None	4	No

2. Applicable Code Edition and Addenda

- ASME Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," 1989 Edition, with no Addenda.
- ASME Section XI, 1995 Edition 1996 Addenda.

3. Applicable Code Requirement

For 2-BB-04-F004, ASME Section Xl, Figure IWB-2500-8(c) 1989 Edition with no addenda requires surface examination of the weld crown and 1/2 inch on either side of the weld crown 360 degrees around the pipe, and volumetric examination of a minimum volume of the inner ⅓t (one third of the thickness) extending into the piping base metal for a distance of 1/4 inch past the edge of the weld crown.

For 2-BB-02-F019, 2-BG-24-FW061, 2-BG-24-FW062, and 2-BG-24-FW067, ASME Section Xl, Figure IWB-2500-8(b) 1989 Edition with no addenda requires surface examination of the weld crown and 1/2 inch on either side of the weld crown 360 degrees around the pipe.

For 2-BG-02-S046-A and 2-BG-02-S046-C, and 2-BG-02-FW040, ASME Section Xl, Figure IWC-2500-7(a)1989 Edition with no addenda requires surface examination of the weld crown and 1/2 inch on either side of the weld crown 360 degrees around the pipe, and volumetric examination of a minimum volume of the inner ⅓t (one third of the thickness) extending into the piping base metal for a distance of 1/4 inch past the edge of the weld crown.

In a letter dated January 30, 2002, from the NRC to AmerenUE, the NRC approved a relief request for Callaway for the application of a risk-informed inservice inspection (RI-ISI) program for ASME Code Class 1 and 2 piping. As approved, the methodology in EPRI TR-1 12657 Rev. B-A is utilized for the method of examination of the subject welds, as well as the selection of welds to be examined. The RI-ISI program does not require surface examination but requires volumetric examination of all selected welds and extends the Code required examination volume of the inner ⅓t to a distance 1/4 inch on either side of the weld counterbore or 1/2 inch past the edge of the weld crown if no counterbore is present.

Both ASME and RI-ISI require 100% examination of the required weld volume. Both Code Case N-460 and NRC Information Notice (IN) 98-42, "Implementation of 10 CFR 50.55a(g) Inservice Inspection Requirements," have interpreted coverage of greater than 90% to be acceptable.

Relief is being requested because greater than 90% coverage could not be obtained for the subject welds.

4. Impracticality of Compliance

The difficulty in complying with the coverage requirements stems from appendix VIII requirements as modified by 10CFR50.55a.

From 10 CFR 50.55a(b)(2)(xv)(A)(2): "Where examination from both sides is not possible on austenitic welds or dissimilar metal welds, full coverage credit from a single side may be claimed only after completing a successful single-sided Appendix VIII demonstration using flaws on the opposite side of the weld."

From 10 CFR 50.55a(b)(2)(xvi)(B): "Examinations performed from one side of a ferritic or stainless steel pipe weld must be conducted with equipment, procedures, and personnel that have demonstrated proficiency with single side examinations. To demonstrate equivalency to two sided examinations, the demonstration must be performed to the requirements of Appendix VIII as modified by this paragraph and § 50.55a(b)(2)(xv)(A)."

The Performance Demonstration Initiative (PDI) has not been able to develop an examination procedure that meets the above criteria; therefore, only 50% coverage can be claimed with single sided access.

Digital radiography was not used. Callaway, as well as the industry, does not have a digital radiographic process that meets the requirements of the PDI program. Therefore, a digital radiograph would not yield useful results for increasing the coverage of the examination. Utilization of processes such as digital radiography without a clear understanding or method for interpreting the results would not serve a useful purpose.

The inside diameter of these welds was not available to the examiner. The burden of draining the RCS and the BG system (charging) prohibits draining for the sake of performing NDE. Since the area of interest in these exams is the inner 1/3 of the weld and adjacent metal, surface exams such as PT, MT, and ET were not considered.

In addition, at the time of the examinations there were no qualified phased array techniques for examination of the welds from the outside diameter.

Description of Coverage Limitations

Weld No.	Coverage Achieved	Limitation
2-BB-04-F004	50%	Pipe to valve weld with limited access to the valve side. The weld configuration obstructs 100% of one circ and one axial scan.
2-BB-02-F019	50%	Pipe to valve weld with limited access to the valve side. The weld configuration obstructs 100% of one circ and one axial scan.
2-BG-24-FW061	50%	The examination is limited to one side due to OD configuration. The pipe and the pup piece are of different thickness. The circ and axial scan are 100% obstructed from one side.
2-BG-24-FW062	83.3%	Weld is obstructed on one side due to lift off in crotch area of tee. The length of the obstruction is 2.5" and obstructs 33% of the axial scan and 33% of the circ scan on one side of the weld. All other scans are complete.

Weld No.	Coverage Achieved	Limitation
2-BG-24-FW067	83.3%	Weld is obstructed on one side due to lift off in crotch area of tee. The length of the obstruction is 2.5" and obstructs 33% of the axial scan and 33% of the circ scan on one side of the weld. All other scans are complete.
2-BG-02-S046-A	50	Pipe to Tee weld. Considered 50% coverage due to geometry of tee. Performed best effort examination of both sides of weld.
2-BG-02-S046-C	50	Tee to Pipe weld. Considered 50% coverage due to geometry of tee. Performed best effort examination of both sides of weld.
2-BG-02-FW040	50	Pipe to valve weld with limited access to the valve side. The weld configuration obstructs 100% of one circ and one axial scan.

5. Burden Caused by Compliance

There are currently no qualified single side examination procedures that demonstrate equivalency to two-sided examination procedures on austenitic piping welds. Current technology is not capable of reliably detecting or sizing flaws on the far side of an austenitic weld for configurations common to US nuclear applications.

Callaway does not have the means or the expertise to perform experimental NDE. As such, Callaway employs EPRI as the research facility for the industry. Based upon the work that is being performed at EPRI, the best qualified techniques were employed.

The issue of single-sided access of cast austenitic component welds has been an ongoing issue in the nuclear power NDE field for many years. As such, Callaway is actively addressing these technical issues via several strategies:

- Participation in the Materials Reliability Program, which in turn has engaged the EPRI NDE Center.
- Participation in ASME Section XI Code activities, which develops the rules for examination of these welds.
- Participation in the EPRI NDE Product Group Steering Committee to develop research of new or improved technologies to allow for better examination of these types of welds.
- Participation in the Performance Demonstration Initiative to evaluate and qualify

new technology to use in these applications.

- Partnering with vendor and utility personnel to evaluate new technology to improve coverage of these welds.

Callaway will continue to employ the best qualified technology and methods available to assure that maximum coverage of these types of welds is obtained.

6. Proposed Alternative and Basis for Use

The following alternatives are proposed in lieu of the required examination coverage of essentially 100%:

> Ultrasonic Testing (UT) of the subject welds was performed to the maximum extent practical due to design configuration restrictions. This includes a best effort examination of the far side of each component to the extent possible utilizing a longitudinal search unit that provides adequate coverage on the far side of the weld for components with thickness greater than 0.5 inch and utilizing a 70 degree shear wave search unit for components with thickness equal to or less than 0.5 inch.
>
> Pressure test VT-2 visual examinations were performed as required by Code Category B-P during the second ten-year interval. No evidence of leakage was identified for these components.

Basis for Use:

> 100% of the welds were examined, but only 50% coverage can be credited in those areas where only single sided access is available. No UT procedures are qualified on wrought austenitic piping welds for detection or flaw sizing on the far side of the weld when only single side access is available. The method used to examine the far side of the weld was that offered by EPRI as the "best effort" technology for these configurations. Industry experience shows that failure of pipe to component welds either not subject to a damage mechanism or subject to thermal fatigue are most likely to occur on the pipe side of the weld. Therefore, while only 50% coverage can be claimed, greater that 50% of the risk associated with the welds were addressed.
>
> 2-BB-04-F004, 2-BB-02-F019, 2-BG-24-FW061, 2-BG-24-FW062, and 2-BG-24-FW067 are located outside the bioshield in the containment building. Periodic, at-power walkdowns are performed in these areas to check for leaks.
>
> 2-BG-02-S046-A, 2-BG-02-S046-C, and 2-BG-02-FW040 are located in the Auxiliary Building in rooms that are checked twice per shift by Operations.

The containment atmosphere and sump levels are monitored from the Control Room, and leak rate calculations are performed as part of the Control Room log requirements.

7. Duration of Proposed Alternative

Callaway Plant requests that the proposed alternative be approved for the remainder of the Second Inservice Inspection Interval.

Attachment 5

Revised Relief Request ISI-40

10 CFR 50.55a Request Number ISI-40

Relief Requested
in Accordance with 10 CFR 50.55a(g)(5)(iii) / 10 CFR 50.55a(a)(3)

--Preservice & Inservice Inspection Impracticality--

1. ASME Code Components Affected

Code Item	RI-ISI Item Number	Description	Weld Number	Degradation Mechanism	RI Category	Comment
B9.11	R1.20-4	6" PIPE TO VALVE	2-EP-01-8818A-1	None	4	PSI
B9.11	R1.20-6	6" PIPE TO VALVE	2-EP-01-8818A-2	None	6	PSI
B9.11	R1.20-4	6" PIPE TO VALVE	2-EP-02-8818B-1	None	4	PSI
B9.11	R1.20-6	6" PIPE TO VALVE	2-EP-02-8818B-2	None	6	PSI
B9.11	R1.20-4	6" PIPE TO VALVE	2-EP-02-8818C-1	None	4	PSI
B9.11	R1.20-6	6" PIPE TO VALVE	2-EP-02-8818C-2	None	6	PSI
B9.11	R1.20-4	6" PIPE TO VALVE	2-EP-01-8818D-1	None	4	PSI
B9.11	R1.20-6	6" PIPE TO VALVE	2-EP-01-8818D-2	None	6	PSI
B9.11	R1.20-6	6" PIPE TO FLANGE	2-EP-01-3066A-WDC-002-FW2	None	6	PSI
B9.11	R1.20-6	6" PIPE TO FLANGE	2-EP-01-3066A-WDC-003-FW3	None	6	PSI
B9.11	R1.20-6	6" PIPE TO FLANGE	2-EP-01-3066D-WDC-002-FW2	None	6	PSI
B9.11	R1.20-6	6" PIPE TO FLANGE	2-EP-01-3066D-WDC-003-FW3	None	6	PSI

These are austenitic welds limited to single-side access and are subject to ultrasonic examination in accordance with Supplement 2 of Appendix VIII to the 1995 Edition with 1996 Addenda of ASME Section XI. Only 50% volume coverage can be claimed for these exams.

2. Applicable Code Edition and Addenda

ASME Code Section XI – 1989 Edition, Appendix VIII of Section XI, 1995 Edition with the 1996 Addenda.

3. Applicable Code Requirement

ASME Section XI, Figure IWB-2500-8(c) 1989 Edition with no addenda requires surface examination of the weld crown and 1/2 inch on either side of the weld crown 360 degrees around the pipe, and volumetric examination of a minimum volume of the inner ⅓t (one third of the thickness) extending into the piping base metal for a distance of 1/4 inch past the edge of the weld crown.

In a letter dated January 30, 2002, from the NRC to AmerenUE, the NRC approved a relief request for Callaway for the application of a risk-informed inservice inspection (RI-ISI) program for ASME Code Class 1 and 2 piping. As approved, the

methodology in EPRI TR-1 12657 Rev. B-A is utilized for the method of examination of the subject welds, as well as the selection of welds to be examined. The RI-ISI program does not require surface examination but requires volumetric examination of all selected welds and extends the Code required examination volume of the inner ⅓t to a distance 1/4 inch on either side of the weld counterbore or 1/2 inch past the edge of the weld crown if no counterbore is present.

Both ASME and RI-ISI require 100% examination of the required weld volume. Both Code Case N-460 and NRC Information Notice (IN) 98-42, "Implementation of 10 CFR 50.55a(g) Inservice Inspection Requirements," have interpreted coverage of greater than 90% to be acceptable.

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The Performance Demonstration Initiative (PDI) has not been able to develop an examination procedure that meets the above criteria; therefore, only 50% coverage can be claimed with single sided access.

Digital radiography was not used. Callaway, as well as the industry, does not have a digital radiographic process that meets the requirements of the PDI program. Therefore, a digital radiograph would not yield useful results for increasing the coverage of the examination. Utilization of processes such as digital radiography without a clear understanding or method for interpreting the results would not serve a useful purpose.

The inside diameter of these welds was not available to the examiner. The burden of draining the RCS and the BG system (charging) prohibits draining for the sake of performing NDE. Since the area of interest in these exams is the inner 1/3 of the weld and adjacent metal, surface exams such as PT, MT, and ET were not considered.

In addition, at the time of the examinations there were no qualified phased array techniques for examination of the welds from the outside diameter.

5. Burden Caused by Compliance

There are currently no qualified single side examination procedures that demonstrate equivalency to two-sided examination procedures on austenitic piping welds. Current technology is not capable of reliably detecting or sizing flaws on the far side of an austenitic weld for configurations common to US nuclear applications.

Callaway does not have the means or the expertise to perform experimental NDE. As such, Callaway employs EPRI as the research facility for the industry. Based upon the work that is being performed at EPRI, the best qualified techniques were employed.

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- Participation in the EPRI NDE Product Group Steering Committee to develop research of new or improved technologies to allow for better examination of these types of welds.
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- Partnering with vendor and utility personnel to evaluate new technology to improve coverage of these welds.

Callaway will continue to employ the best qualified technology and methods available to assure that maximum coverage of these types of welds is obtained.

6. Proposed Alternative and Basis for Use

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Ultrasonic Testing (UT) of the subject welds was performed to the maximum extent practical due to design configuration restrictions. This includes a best effort examination of the far side of each component to the extent possible utilizing a 70 degree shear wave search unit.

Pressure test VT-2 visual examinations were performed as required by Code Category B-P during the second ten-year interval. No evidence of leakage was identified for these components.

Basis for Use:

100% of the welds were examined, but only 50% coverage can be credited in those areas where only single sided access is available. No UT procedures are qualified on wrought austenitic piping welds for detection or flaw sizing on the far side of the weld when only single side access is available. The method used to examine the far side of the weld was that offered by EPRI as the "best effort" technology for these configurations. Industry experience shows that failure of pipe to component welds either not subject to a damage mechanism or subject to thermal fatigue are most likely to occur on the pipe side of the weld. Therefore, while only 50% coverage can be claimed, greater that 50% of the risk associated with the welds were addressed.

These welds are located outside the bioshield in the containment building. Periodic, at-power walkdowns are performed in these areas to check for leaks.

The containment atmosphere sump levels are monitored from the Control Room, and leak rate calculations are performed as part of the Control Room log requirements.

7. Duration of Proposed Alternative

The remainder of the 2nd 10-Year Interval.

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