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SUBJECT: Forwards request for relief for use of adequate alternative examinations in lieu of code-required examinations for certain reactor vessel shell welds.

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CATEGORY 1 DOCUMENT

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DUKE POWER

March 13, 1997

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Subject: Duke Power Company
Oconee Nuclear Station, Units 1, 2, and 3
Docket Nos. 50-269, -270, and -287
Third Ten Year Inservice Inspection Interval
Request for Relief No. 97-02

Pursuant to 10CFR 50.55a, section (g)(6)(ii)(A)(5), attached is a Request for Relief from 10CFR 50.55a, section (g)(6)(ii)(A). 10CFR 50.55a section (g)(6)(ii)(A) specifically addresses augmented examination requirements for reactor vessel shell welds in addition to ASME Section XI requirements. This request for relief proposes the use of adequate alternative examinations, such as visual examinations of the inside of the reactor vessel, in lieu of the code-required examinations for certain reactor vessel shell welds. Achievement of greater than 90% ultrasonic examination coverage for these welds per the Code of Federal Regulations requirements is impractical due to piping/vessel geometry, joint configuration, interferences, and existing examination technology.

If there are any questions or further information is needed you may contact D. A. Nix at (864) 885-3634.

Very truly yours,

J. W. Hampton
Site Vice President

A047 1/1

Attachment

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Duke Power Company

Station: Oconee Units: 1, 2 and 3

10-YEAR INTERVAL REQUEST FOR ALTERNATIVE NO. 97-02

Pursuant to 10 CFR 50.55a(g)(6)(ii)(A)(5), Duke Power has determined that it is unable to conform with the examination requirements of 10 CFR 50.55a(g)(6)(ii)(A) for Oconee Nuclear Station. Accordingly, information is being submitted in support of this determination, and a request for alternative pursuant to 10 CFR 50.55a(g)(6)(ii)(A)(5) is being sought from the requirements of 10 CFR 50.55a(g)(6)(ii)(A).

Background:

In response to NRC Information Notice 96-32, "Implementation of 10 CFR 50.55a(g)(6)(ii)(A) Augmented Examination of Reactor Vessel", Duke Power has reviewed the information contained in this notice for applicability to its facilities and has taken action to avoid or mitigate the effects of limited inspections. These actions are taken to eliminate and/or reduce the concerns expressed in this Information Notice.

Because of concerns regarding the scope of inspection of reactor vessels, the NRC issued, in 1992, 10 CFR 50.55a(g)(6)(ii)(A), "Augmented Examination of Reactor Vessel", which contains requirements for an augmented examination of reactor vessels. The rule requires the licensee to implement, before the time required by normal updating of the inservice inspection (ISI) program, provisions in the 1989 Edition of the ASME, Boiler and Pressure Vessel Code, Section XI, to examine "essentially 100%" of the length of all reactor vessel shell welds. "Essentially 100%" examination as used in 10 CFR 50.55a(g)(6)(ii)(A)(2) means more than 90% of the examination volume of each weld, where the reduction in coverage is due to interference by another component, or part geometry".

In many cases, licensees have determined that the overall average examination coverage for reactor vessel shell welds may be more than 90%. However, the corresponding examination coverage for individual welds may be substantially less than 90%. In these cases, licensees are unable to completely satisfy the requirements for the augmented reactor vessel examination. Therefore, they must propose an alternative that would provide an acceptable level of quality and safety.

The licensee must expend all efforts using the latest methods and techniques to achieve acceptably adequate examinations during weld inspections. When examinations cannot be completed with 100% coverage, then a request for alternatives from the Code of Federal Regulations must be submitted.

I. Systems/Components For Which Alternative Is Requested:

Reactor Vessel shell welds specified in Item B1.10 of Examination Category B-A of the 1989 Edition of the ASME Section XI Code. These systems/components are ASME Section XI Code Class 1. The Construction Code of record is ASME Section III, 1965 Edition, through Summer 1967 Addenda, Class 1.

a. Reactor Vessel Shell Welds

Weld Numbers	Item Numbers
1RPV-WR17	B01.011.001
1RPV-WR18	B01.011.003
1RPV-WR34	B01.021.002[1]
2RPV-WR18	B01.011.003
2RPV-WR34	B01.021.002[1]
3RPV-WR18	B01.011.003
3RPV-WR34	B01.021.002[1]

Attachment 1 provides a drawing of the reactor vessel shell weld layout for Oconee Units 1, 2, and 3.

[1] This Item Number was incorrectly listed in the ISI Plan as a B1.20 category weld and should have been listed as a B1.10 category weld. This has been corrected for the third inservice inspection interval.

II. 10 CFR50 Requirement

10 CFR50.55a(g)(6)(ii)(A) requires all licensees to augment their reactor vessel examination by implementing once, as part of the inservice inspection interval in effect on September 8, 1992, the examination requirements for reactor vessel shell welds specified in Item B1.10 of Examination Category B-A "Pressure Retaining Welds in Reactor Vessel," in Table IWB-2500-1 of Subsection IWB of the 1989 Edition of Section XI, Division 1, of the ASME Boiler and Pressure Vessel Code, subject to the conditions specified in § 50.55a(g)(6)(ii)(A)(3) and (4). The augmented examination, when not deferred in accordance with the provisions of § 50.55a(g)(6)(ii)(A)(3), shall be performed in accordance with the related procedures specified in the Section XI Edition and Addenda applicable to the inservice inspection interval in effect on September 8, 1992, and may be used as a substitute for the reactor vessel shell weld examination scheduled for implementation during the inservice inspection interval in effect on September 8, 1992. For the purpose of this augmented examination, "essentially 100%" as used in Table IWB-2500-1 means more than 90% of the examination volume of each weld, where the reduction in coverage is due to interference by another component, or part geometry.

III. Requirement for Which Alternative is Requested

Alternative is sought to the requirement of obtaining "essentially 100%" examination volume coverage on the Oconee Units 1, 2 and 3 reactor vessel B1.10 welds specified in Section I above.

IV. Basis For Requesting Alternative:

If licensees make a determination that they are unable to completely satisfy the requirements for the augmented reactor vessel shell weld examination specified in 10 CRF50.55a(g)(6)(ii)(A); then
10 CFR50.55a(g)(6)(ii)(A)(5) requires the licensee to submit information to the Commission to support this determination and to propose an alternative to the examination requirements that would provide an acceptable level of quality and safety. The licensee may use the proposed alternative when authorized by the Director of the Office of NRR.

Attachment 2 provides the calculations documenting the actual amount of ASME Section XI Code required examination coverage obtained. A combination of multiple angles and ultrasonic techniques was used to obtain maximum coverage possible. The use of an alternate transducer head provided increased coverage through optimum transducer arrangement for scanning close to obstructions. During the ultrasonic examination of the welds shown below, the minimum 90% coverage requirement of 10 CRF50.55a(g)(6)(ii)(A)(2) could not be obtained due to part geometry and actual physical barriers.

Reactor Pressure Vessel Weld WR17[2] (B01.011.001)

This weld joins the nozzle belt region to the upper shell cylinder in the reactor vessel core region. The principal limitation for this weld is the presence of a taper at the ID surface starting at the upper edge of the weld and extending up on the nozzle belt section. The taper angle is approximately 18.4°. Due to this taper, it was not possible to position the transducer contact head. This taper acts like a wedge and forces the contact head off of the reactor vessel. The amount of coverage achieved was 49.0%.

Reactor Pressure Vessel Weld WR18[3] (B01.011.003)

This weld is located between nozzles, 13" below the nozzle centerline. The nozzles themselves form obstructions to 100% examination coverage. Between the inlet nozzles, below the core flood nozzle (2 regions), 25.7° out of 32.5° was scanned. The weld extends out on either side of this region intersecting the inlet nozzle-to-shell welds. Between each inlet nozzle and outlet nozzle (4 regions) 19.6° out of 27.8° was scanned. The weld extends out on either side of this region intersecting the inlet and outlet nozzle-to-shell welds. Additional coverage was lost in these regions due to interference by the outlet nozzle lip. The amount of coverage achieved was 73.4%.

Reactor Pressure Vessel Weld WR34[3] (B01.021.002)

Due to the core catcher lugs, the entire circumference of the vessel could not be scanned. Scanning was conducted between each of the 12 lugs.

[2] Weld WR17 is applicable to Oconee Unit 1 only.
[3] Welds WR18 and WR34 are applicable to Oconee Units 1, 2 and 3.

The total obstructed area for each lug is 10.5° for the axial scans, excluding the near surface and 0° scans. This results in a total obstruction of 126° for the axial scans.

The total obstructed area for each lug is 14.7° for the circumferential scans, including the axial near surface and 0° scans. This results in a total obstruction of 176.5° for these scans.

The actual circumferential scan volume examined between the core catcher lugs is limited due to the obstruction of the flow stabilizer stubs and the transition area between the shell and lower head which prevents increased scan coverage by the alternate transducer head. This results in a lower percentage of coverage, (31.7%) from the straight beam or 0° transducer. Including the circumferential scan coverage from the 45°, 60° and 70° transducers, the percentage of coverage increases to 67% for the examination area between the lugs.

The axial scans were performed from the shell side above the weld using a full node examination method due to obstructions from the flow stabilizer stubs on the lower head below the weld and the transition area between the shell and lower head. The full node examination yielded an average coverage of 95% in the axial direction.

The partial aggregate coverage from the area examined between the lugs is 74.2%. The actual aggregate coverage reduces to 43.5% when the area obscured by the lugs is included.

As a result of inspections performed, the 100% requirement has been determined to create a hardship for Oconee Nuclear Station. The reactor vessel B1.10 category welds were examined to the maximum extent practical in accordance with ASME Section V, Article 4 1980 Edition, Winter 1980 Addenda, and the additional requirements of Regulatory Guide 1.150. To meet the 10 CFR 50.55a(g)(6)(ii)(A)(2) examination coverage requirements, design modifications would be necessary to gain access to the welds in order to obtain complete coverage. The design modifications are impractical due to the vast scope of work that would be required. Imposition of this requirement would cause a considerable burden on Duke Power with no commensurate safety benefit realized.

V. Alternate Examinations:

In addition to the volumetric examination that has been performed on the Oconee reactor vessels, Duke Power has performed a visual examination of the internals and on the inside of the reactor vessel as required by ASME Section XI, Table IWB-2500-1. The visual examination did not identify any rejectable situations per ASME Section XI acceptance standards.

The use of radiography as an alternate volumetric examination method is not feasible due to component thickness and geometric configurations. Other restrictions which preclude the use of radiography as an alternative are the use of double wall techniques and physical barriers which prohibits access for placement of source, film, number bands, etc.

Performing the ultrasonic examination from the outside of the reactor vessel to is not a viable option. The design of Oconee's reactor building prohibits access for the equipment and personnel.

Duke Power Company will continue to perform ultrasonic examinations of all reactor vessel welds to the maximum extent practical in accordance with the requirements of ASME Section V, Article 4, 1989 Edition and Regulatory Guide 1.150, Revision 1, Appendix A. The application of Code Case N-460 will be utilized in all cases where less than 100% but greater than 90% weld coverage is obtained. In cases where weld coverage of less than 90% is obtained, a request for relief from ASME Section XI Code requirements will be submitted.

Although the coverage requirements of 10 CFR 50.55a(g)(6)(ii)(A)(2) could not be met, the amount of coverage obtained for these examinations provides an acceptable level of quality and safety. Based on these evaluations, the limited coverage will in no way endanger the health and safety of the general public.

No additional examinations will be required.

VI. Justification For Granting Alternative:

Due to the design of the Oconee reactor vessels and location of the physical obstructions, it is not feasible to obtain the examination coverage required by 10 CFR 50.55a(g)(6)(ii)(A)(2) without placing undue hardship on Duke Power. Based on the portions of the required volumetric and visual examinations that have been completed, any existing pattern of degradation would have been detected.

Duke Power Company will continue to ultrasonically examine the reactor vessel B1.10 category welds to the extent practical within the limits of original design and construction. This will provide reasonable assurance of weld/component integrity.

Pursuant to 10 CFR 50.55a(g)(6)(i), granting this alternative for the reactor vessel B1.10 category welds will provide reasonable assurance of weld/component integrity, is authorized by law, and will not endanger life or property or the common defense and security and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

VII. Implementation Schedule:

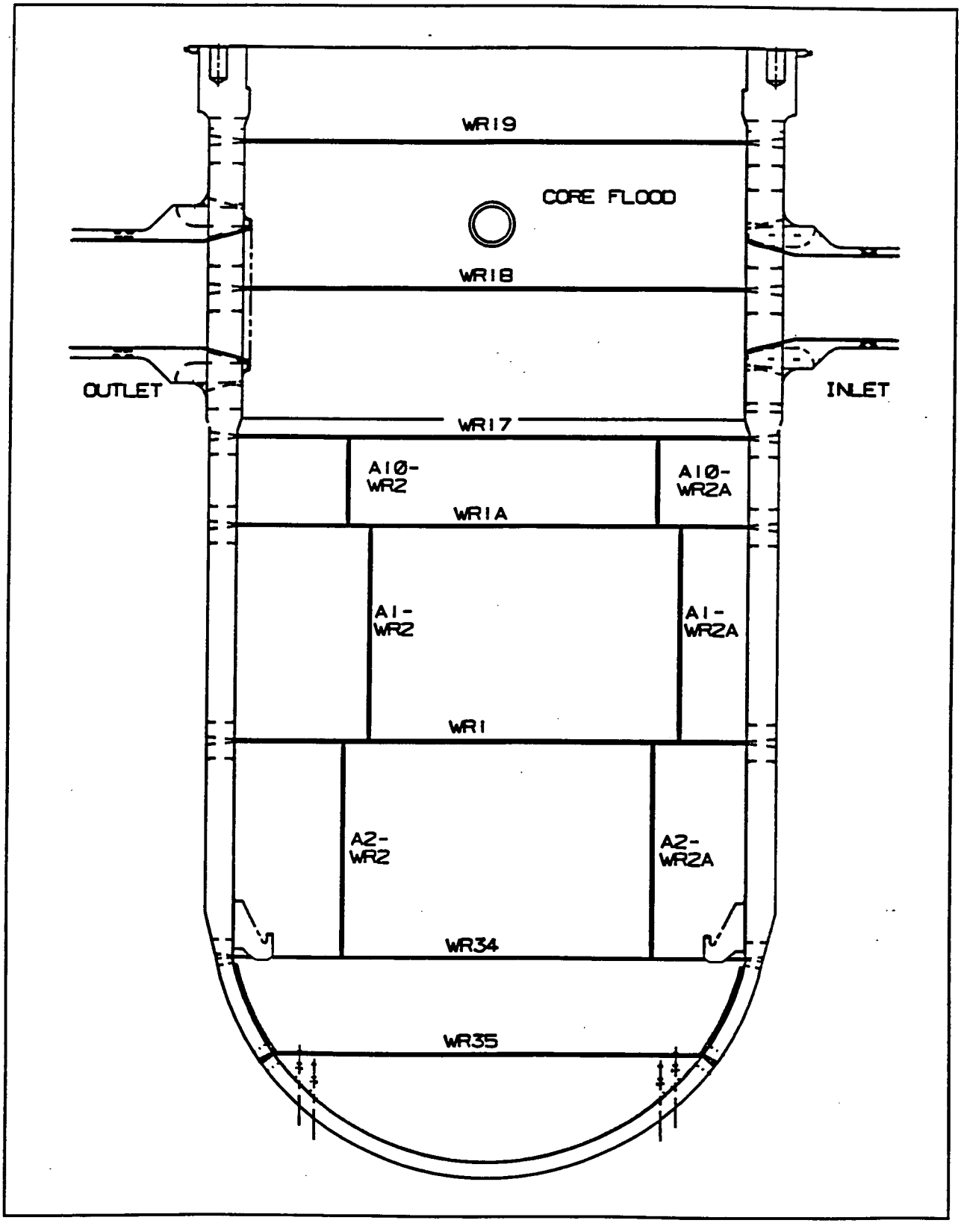
Oconee Unit 1 EOC13

Oconee Unit 2 EOC12

Oconee Unit 3 EOC13

Evaluated By: B G Rouse Date: 3/10/97

Reviewed By: J R Barlow Date: 3/10/97



Vessel Weld Layout for Unit 1

Request for Alternate 97-02
Attachment 1
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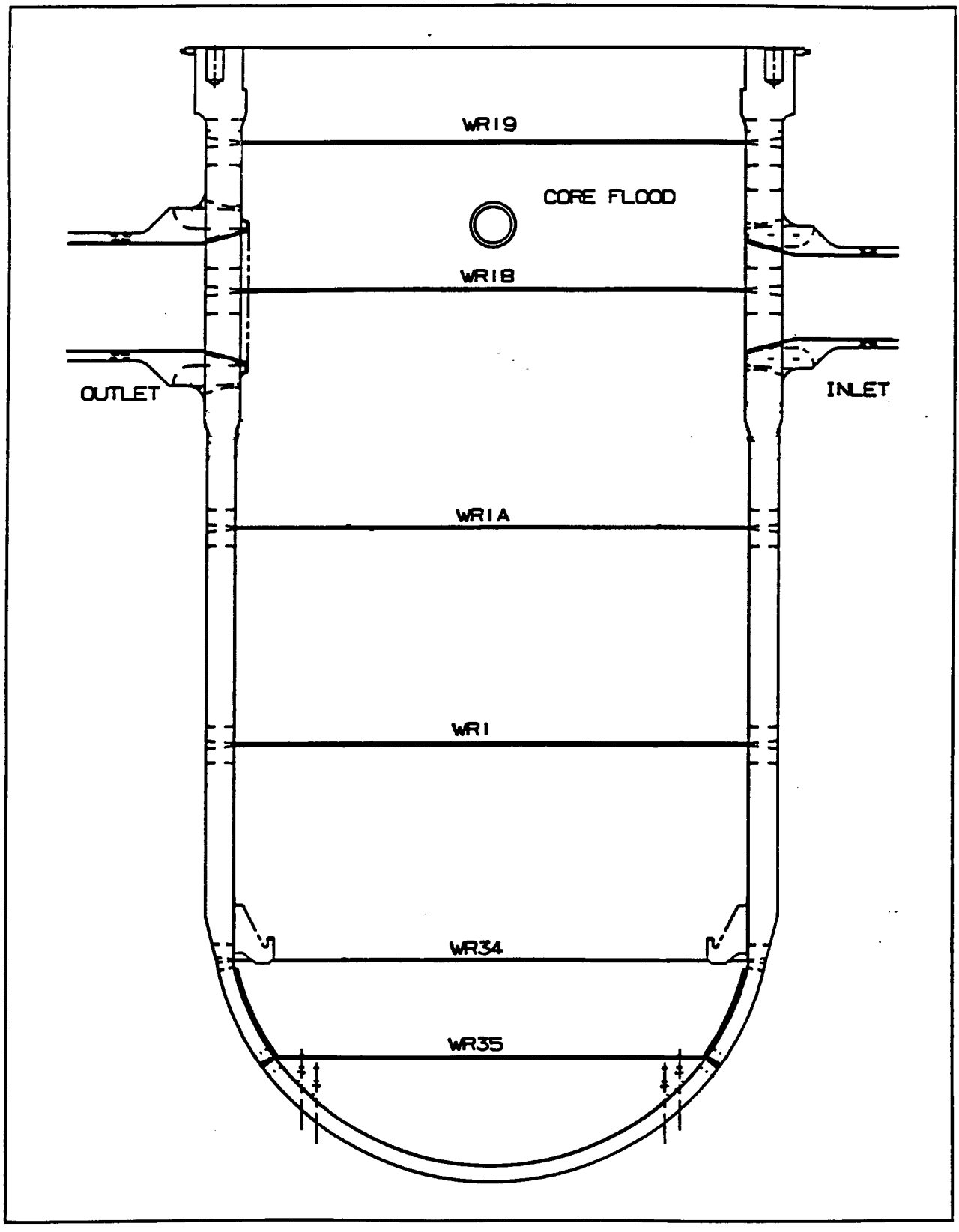

Vessel Weld Layout for Units 2 and 3

Request for Alternate 97-02
Attachment 1
Page 2 of 2

EXAMINATION COVERAGE FOR WELD: WR17

AGGREGATE COVERAGE OBTAINED: 49%

Zone Coverage Obtained

Weld: 51% Adjacent Base Metal 49% Near (ID) Surface: 63%

Examination Volume Definition

Weld Length: 537.212 in.

Area Measurement		Volume Calculation	
Weld	17.18 sq. in.	Weld	9229.302 cu. in.
Adjacent Base Metal	140.66 sq. in.	Adjacent Base Metal	75564.24 cu. in.
Near Surface	15.54 sq. in.	Near Surface	8348.274 cu. in.

Examination Coverage Calculations

Weld

Entry #	Exam. Angle (deg.)	Beam Direction	Area Examined (sq. in.)	Length Examined (in.)	Volume Examined (cu. in.)	Volume Required (cu. in.)	Percent Examined
1	0	n/a	9.0	537.2	4834.9	9229.3	52%
2	45	1	5.4	537.2	2907.4	9229.3	32%
3	45	2	8.6	537.2	4642.0	9229.3	50%
4	45	3	7.6	537.2	4061.3	9229.3	44%
5	45	4	7.6	537.2	4061.3	9229.3	44%
6	60	1	11.8	537.2	6360.6	9229.3	69%
7	60	2	13.3	537.2	7123.4	9229.3	77%
8	60	3	7.6	537.2	4061.5	9229.3	44%
9	60	4	7.6	537.2	4061.5	9229.3	44%
				Totals:	*42114.0*	*83063.7*	*51%*

Adjacent Base Metal

Entry #	Exam. Angle (deg.)	Beam Direction	Area Examined (sq. in.)	Length Examined (in.)	Volume Examined (cu. in.)	Volume Required (cu. in.)	Percent Examined
1	0	n/a	57.5	537.2	30889.7	75564.2	41%
2	45	1&2	104.0	537.2	55853.9	75564.2	74%
3	45	3	52.4	537.2	28165.1	75564.2	37%
4	45	4	44.9	537.2	24103.6	75564.2	32%
5	60	1&2	122.6	537.2	65867.6	75564.2	87%
6	60	1&2	55.0	20.4	1123.1	2872.3	39%
7	60	3	52.4	537.2	28165.1	75564.2	37%
8	60	4	44.9	537.2	24103.6	75564.2	32%
				Totals:	*258271.5*	*531822.0*	*49%*

Near Surface

Entry #	Exam. Angle (deg.)	Beam Direction	Area Examined (sq. in.)	Length Examined (in.)	Volume Examined (cu. in.)	Volume Required (cu. in.)	Percent Examined
1	70	axial	13.5	537.2	7273.9	8348.3	87%
2	70	circ	6.0	537.2	3247.5	8348.3	39%
				Totals:	*10521.4*	*16696.5*	*63%*

Coverage Calculation For Weld WR-17

WR18

(B01.011.003)

Total Exam Area = 183.27 in^2 (Near Surface + Weld + T/2)

Near Surface Area = 15.27 in^2 (Cross - Section)

Weld Area = 24.14 in^2 (Cross - Section)

T/2 Area = 159.13 in^2 (Cross - Section)

CIRC 70° Gets 100% Coverage of Near Surface Area

60° & 45° Gets 100% Coverage of Weld & T/2 Areas

0° Gets 100% Coverage of Total Exam Area

AXIAL 70° Gets 100% Coverage of Near Surface Area

45° Gets 100% Coverage of Weld & T/2 Areas

60° Gets 100% Coverage of Weld & T/2 Areas

WR18

AXIAL			CIRC			
70°	60°	45°	70°	60°	45°	0°
100	100	100	100	100	100	100

Aggregate Coverage =

$$[\ (100 + 100) \times 15.27 + (100 + 100 + 100) \times 159.13 + (100 + 100) \times (24.14 \times 2 + 159.13)\ ] / [\ 15.27 \times 2 + 159.13 \times 3 + (24.14 \times 2 + 159.13) \times 2\ ]$$

Partial Aggregate Coverage = 100%

WR18

(B01.011.003)

This weld is located between nozzles, 13" below the nozzle centerline. The nozzles themselves form obstructions to 100% coverage.

Between Inlet Nozzles, below the Core Flood Nozzle (2 regions), 25.7 degrees out of 32.5 degrees was scanned. The weld extends out on either side of this region intersecting the Inlet Nozzle-to-Shell welds.

Between each Inlet Nozzle and Outlet Nozzle (4 regions), 19.6 degrees out of 27.8 degrees was scanned. The weld extends out on either side of this region intersecting the Inlet and Outlet Nozzle-to-Shell welds. Extra coverage was lost in these regions due to the Outlet Nozzle lip.

[25.7 / 32.5 x 2 + 19.6 / 27.8 x 4] / 6

Actual Aggregate Coverage = 73.4%

WR34

(B01.021.002)

Total Exam Area = 53.27 in^2 (Near Surface + Weld + T/2)

Near Surface Area = 8.31 in^2 (Cross - Section)

Weld Area = 7.59 in^2 (Cross - Section)

T/2 Area = 45.68 in^2 (Cross - Section)

CIRC 0° Gets 16.89 in^2 of Total Exam Area (31.7%)

60° & 45° Gets 35.69 in^2 of Weld & T/2 Areas (67.0%)

70° Gets 5.58 in^2 of Near Surface Area (67.1%)

AXIAL 70° Gets 7.24 in^2 of Near Surface Area (87.1%)

45° Gets 100% Coverage of T/2 Area

45° - Up Gets 100% Coverage of Weld Area

45° - Down Gets 7.55 in^2 of Weld Area

$$45° \text{ Coverage} = \frac{7.59 + 7.55 + 45.68}{7.59 + 7.59 + 45.68} = 99.9\%$$

60° Gets 45.59 in^2 of T/2 Area

60° - Up Gets 100% of Weld Area

60° - Down Gets 6.28 in^2 of Weld Area

$$60° \text{ Coverage} = \frac{7.59 + 6.28 + 45.59}{7.59 + 7.59 + 45.68} = 97.7\%$$

WR34

(B01.021.002)

AXIAL			CIRC			
70°	60°	45°	70°	60°	45°	0°
87.1	97.7	99.9	67.1	67.0	67.0	31.7

Aggregate Coverage =

[(87.1 + 67.1) x 8.31 + (67.0 + 67.0 + 31.7)x 53.27 - (97.7 + 99.9) x (7.59 x 2 + 45.68)] / [8.31 x 2 + 53.27 x 3 + (7.59 x 2 + 45.68) x 2]

Partial Aggregate Coverage = 74.2%

WR34

(B01.021.002)

Due to the Core Catcher Lugs the entire circumference of the vessel could not be scanned. Scanning was conducted between each of the 12 lugs. Based on the configuration of the alternate head, the 0°, 70° Axial and all Circ scans obtained 15.3 degrees out of 30 (51%). The 45° & 60° Axial scans obtained 19.5 degrees out of 30 (65%).

Actual Coverage was as follows:

WR34

AXIAL			CIRC			
70°	60°	45°	70°	60°	45°	0°
44.4	63.4	64.8	34.2	34.2	34.2	16.2

Aggregate Coverage =

$$[\ (44.4 + 34.2) \times 8.31 + (34.2 + 34.2 + 16.2) \times 53.27 + (63.4 + 64.8) \times (7.59 \times 2 + 45.68)\ ] \ /\ [\ 8.31 \times 2 + 53.27 \times 3 + (7.59 \times 2 + 45.68) \times 2]$$

Actual Aggregate Coverage = 43.5%