VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

August 10, 2004

United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D. C. 20555

Serial No. 04-237A
NL&OS/GDM R1
Docket Nos. 50-280, 281
License Nos. DPR-32, 37

VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION)
SURRY POWER STATION UNITS 1 AND 2
ASME SECTION XI INSERVICE INSPECTION PROGRAM
REACTOR PRESSURE VESSEL WELD EXAMINATION RELIEF REQUESTS
REVISED RELIEF REQUESTS SR-031 AND SR-036

Reactor pressure vessel (RPV) nozzle to shell, shell to flange and nozzle to piping weld examinations are required to be performed during the Third Inservice Inspection (ISI) Interval for Surry Power Station Units 1 and 2 in accordance with Surry's ASME Section XI Inservice Inspection Program. In a letter dated May 13, 2004 (Serial No. 04-237), Dominion submitted relief requests to permit the use of updated examination methodologies when performing the RPV weld examinations. The bases for the requested relief were provided in Relief Requests SR-029, 030, 031 and 032 for Surry Unit 1 and in Relief Requests SR-034, 035, 036 and 037 for Surry Unit 2.

On July 27, 2004, a conference call was held between Dominion and the NRC to discuss the proposed alternative requirements included in Relief Request SR-031, Alternative RPV Nozzle to Piping Weld Examination Requirements. Specifically, the NRC took exception to the visual examination that was specified in the relief request for the RPV nozzle to piping weld and stated that a surface examination (i.e., eddy current) of the weld would provide more meaningful information. At the conclusion of the conference call, Dominion agreed to revise Relief Request SR-031 to require that a surface examination be performed on the RPV nozzle to piping weld rather than a visual examination. The revised Relief Request SR-031 is provided in Enclosure 1 for your review. Relief Request SR-036, the complementary relief request for Surry Unit 2, has been similarly revised and is provided in Enclosure 2.

If you have any questions or require additional information, please contact Mr. Gary D. Miller at (804) 273-2771.

Very truly yours,

Leslie N. Hartz
Vice President - Nuclear Engineering

Enclosures (2)

Commitments made in this letter: None

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Enclosure 1

Relief Request SR-031, Rev. 1
Reactor Vessel Weld Examinations

Surry Power Station Unit 1

Virginia Electric and Power Company
(Dominion)

Relief Request No. SR-031, Rev. 1
Alternative RPV Nozzle to Piping Weld Examination Requirements
Surry Power Station Unit 1

I. Identification of Components

ASME Section XI, Class I, Examination Category R-A, Risk Informed Piping Examinations, Item R1.11, Elements Subject to Thermal Fatigue (formerly B-F, Pressure Retaining Dissimilar Metal Welds in Vessel Nozzles, Item B5.10, NPS 4 or Larger Nozzle-to-Safe End Butt Welds) at Surry Unit 1 subject to examination using procedures, personnel, and equipment qualified to ASME Section XI, Appendix VIII, Supplement 10 criteria. The specific welds involved are:

Weld No.	ID	Wall Thickness	Base Metal	Weld Metal
29"-RC-1-2501R-1-01DM (loop A hot leg)	29"	2.70"	SA508 Class 2 / ASTM A-376 TP 316	austenitic stainless steel
27-1/2"-RC-3-2501R-1-17DM (loop A cold leg)	27-1/2"	2.56"	SA508 Class 2 / SA351 CF8M	austenitic stainless steel
29"-RC-4-2501R-1-01DM (loop B hot leg)	29"	2.70"	SA508 Class 2 / ASTM A-376 TP 316	austenitic stainless steel
27-1/2"-RC-6-2501R-1-17DM (loop B cold leg)	27-1/2"	2.56"	SA508 Class 2/ SA351 CF8M	austenitic stainless steel
29"-RC-7-2501R-1-01DM (loop C hot leg)	29"	2.70"	SA508 Class 2 / ASTM A-376 TP 316	austenitic stainless steel
27-1/2"-RC-9-2501R-1-17DM (loop B cold leg)	27-1/2"	2.56"	SA508 Class 2/ SA351 CF8M	austenitic stainless steel

II. Code Examination Requirements

Rules for Inservice Inspection of Nuclear Power Plant Components, Section XI, 1989 Edition, Class I, Examination Category R-A, Risk Informed Piping Examinations, Item R1.11, Elements Subject to Thermal Fatigue (Examination Category B-F, Pressure Retaining Dissimilar Metal Welds in Vessel Nozzles, Item B5.10, NPS 4 or Larger Nozzle-to-Safe End Butt Welds), Figure Number IWB-2500-8 and the requirements of the 1995 Edition and 1996 Addenda of ASME Section XI, Appendix VIII, Supplement 10.

The following paragraphs or statements are from ASME Section XI, Appendix VIII, Supplement 10, and identify the specific requirements that are included in this request for relief.

Item 1 - Paragraph 1.1(b) states in part - Pipe diameters within a range of 0.9 to 1.5 times a nominal diameter shall be considered equivalent.

Item 2 - Paragraph 1.1(d) states - All flaws in the specimen set shall be cracks.

Item 3 - Paragraph 1.1(d)(1) states - At least 50% of the cracks shall be in austenitic material. At least 50% of the cracks in austenitic material shall be contained wholly in weld or buttering material. At least 10% of the cracks shall be in ferritic material. The remainder of the cracks may be in either austenitic or ferritic material.

Item 4 - Paragraph 1.2(b) states in part - The number of unflawed grading units shall be at least twice the number of flawed grading units.

Item 5 - Paragraph 1.2(c)(1) and 1.3(c) state in part - At least 1/3 of the flaws, rounded to the next higher whole number, shall have depths between 10% and 30% of the nominal pipe wall thickness. Paragraph 1.4(b) distribution table requires 20% of the flaws to have depths between 10% and 30%.

Item 6 - Paragraph 2.0 first sentence states - The specimen inside surface and identification shall be concealed from the candidate.

Item 7 - Paragraph 2.2(b) states in part - The regions containing a flaw to be sized shall be identified to the candidate.

Item 8 - Paragraph 2.2(c) states in part - For a separate length sizing test, the regions of each specimen containing a flaw to be sized shall be identified to the candidate.

Item 9 - Paragraph 2.3(a) states - For the depth sizing test, 80% of the flaws shall be sized at a specific location on the surface of the specimen identified to the candidate.

Item 10 - Paragraph 2.3(b) states - For the remaining flaws, the regions of each specimen containing a flaw to be sized shall be identified to the candidate. The candidate shall determine the maximum depth of the flaw in each region.

Item 11 - Table VIII-S2-1 provides the false call criteria when the number of unflawed grading units is at least twice the number of flawed grading units.

Item 12 – Paragraph 3.1 states – Examination procedures, equipment and personnel are qualified for detection when the results of the performance demonstration satisfy the acceptance criteria of Table VIII-S2-1 for both detection and false calls.

Item 13 – Paragraph 3.2(b) states – Examination procedures, equipment, and personnel are qualified for depth sizing when the RMS error of the flaw depth measurement, as compared to the true flaw depth, is less than or equal to 0.125 in.

III. Requested Relief

Pursuant to 10 CFR 50.55a(a)(3)(i), relief is requested to implement an alternative to the requirements of Appendix VIII, Supplement 10. This alternative will be implemented through the PDI Program.

A copy of the text of Code Case N-695, which was approved by ASME on May 21, 2003, is attached for reference. It can be seen that the alternatives to the existing Code requirements detailed in the next section substantially conform to the Code Case.

IV. Basis for Relief

Item 1 - The proposed alternative to Paragraph 1.1(b) states:

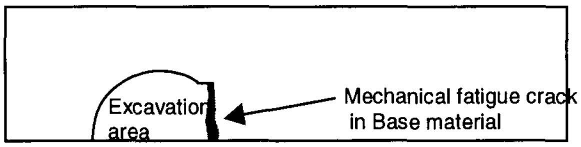
"The specimen set shall include the minimum and maximum pipe diameters and thicknesses for which the examination procedure is applicable. Pipe diameters within a range of 1/2 in. (13 mm) of the nominal diameter shall be considered equivalent. Pipe diameters larger than 24 in. (610 mm) shall be considered to be flat. When a range of thicknesses is to be examined, a thickness tolerance of ±25% is acceptable."

Technical Basis - The change in the minimum pipe diameter tolerance from 0.9 times the diameter to the nominal diameter minus 0.5 inch provides tolerances more in line with industry practice. Although the alternative is less stringent for small pipe diameters, they typically have a thinner wall thickness than larger diameter piping. A thinner wall thickness results in shorter sound path distances that reduce the detrimental effects of the curvature. This change maintains consistency between Supplement 10 and the recent revision to Supplement 2.

Item 2 - The proposed alternative to Paragraph 1.1(d) states:

"At least 60% of the flaws shall be cracks, the remainder shall be alternative flaws. Specimens with intergranular stress corrosion cracking (IGSCC) shall be used when available. Alternative flaws, if used, shall provide crack-like reflective characteristics and shall be limited to the case where implantation of cracks produces spurious reflectors that are uncharacteristic of actual flaws. Alternative flaw mechanisms shall have a tip width of less than or equal to 0.002 in. (.05 mm). Note, to avoid confusion the proposed alternative modifies instances of the term "cracks" or "cracking" to the term "flaws" because of the use of alternative flaw mechanisms."

Technical Basis - As illustrated below, implanting a crack requires excavation of the base material on at least one side of the flaw. While this may be satisfactory for ferritic materials, it does not produce a useable axial flaw in austenitic materials. The sound beam, which normally passes only through base material, must now travel through weld material on at least one side, thereby producing an unrealistic flaw response. In addition, it is important to preserve the dendritic structure present in field welds that would otherwise be destroyed by the implantation process. To resolve these issues, the proposed alternative allows the use of up to 40% fabricated flaws as an alternative flaw mechanism under controlled conditions. The fabricated flaws are isostatically compressed, which produces ultrasonic reflective characteristics similar to tight cracks.



Item 3 - The proposed alternative to Paragraph 1.1(d)(1) states:

"At least 80% of the flaws shall be contained wholly in weld or buttering material. At least one and a maximum of 10% of the flaws shall be in ferritic base material. At least one and a maximum of 10% of the flaws shall be in austenitic base material."

Technical Basis - Under the current Code, as few as 25% of the flaws are contained in austenitic weld or buttering material. Based on recent experience, the flaws are most likely to be contained within the weld. The metallurgical structure of austenitic weld material is ultrasonically more challenging than either ferritic or austenitic base material. The proposed alternative is therefore more challenging than the current Code.

Item 4 - The proposed alternative to Paragraph 1.2(b) states:

"Detection sets shall be selected from Table VIII-S10-1. The number of unflawed grading units shall be at least one and a half times the number of flawed grading units."

Technical Basis - Table S10-1 provides a statistically based ratio between the number of unflawed grading units and the number of flawed grading units. The proposed alternative reduces the ratio to 1.5 times to reduce the number of test samples to a more reasonable number from a human factors perspective. However, the statistical basis used for screening personnel and procedures is still maintained at the same level with competent personnel being successful and less skilled personnel being unsuccessful. The acceptance criteria for the statistical basis are in Table VIII-S10-1.

Item 5 - The proposed alternative to the flaw distribution requirements of Paragraph 1.2(c)(1) (detection) and 1.3(c) (length) is to use the Paragraph 1.4(b) (depth) distribution table (see below) for all qualifications.

Flaw Depth (% Wall Thickness)	Minimum Number of Flaws
10 - 30%	20%
31 - 60%	20%
61 - 100%	20%

Technical Basis - The proposed alternative uses the depth sizing distribution for both detection and depth sizing because it provides for a better distribution of flaw sizes within the test set. This distribution allows candidates to perform detection, length, and depth sizing demonstrations simultaneously utilizing the same test set. The requirement that at least 75% of the flaws shall be in the range of 10 to 60% of wall thickness provides an overall distribution tolerance yet the distribution uncertainty decreases the possibilities for testmanship that would be inherent to a uniform distribution. It must be noted that it is possible to achieve the same distribution utilizing the present requirements, but it is preferable to make the criteria consistent.

Item 6 - The proposed alternative to Paragraph 2.0 first sentence states:

"For qualifications from the outside surface, the specimen inside surface and identification shall be concealed from the candidate. When qualifications are performed from the inside surface, the flaw location and specimen identification shall be obscured to maintain a "blind test"."

Technical Basis - The current Code requires that the inside surface be concealed from the candidate. This makes qualifications conducted from the inside of the pipe (e.g., PWR nozzle to safe end welds) impractical. The proposed alternative differentiates between ID and OD scanning surfaces, requires that they be conducted separately, and requires that flaws be concealed from the candidate. This is consistent with the recent revision to Supplement 2.

Items 7 and 8 - The proposed alternatives to Paragraph 2.2(b) and 2.2(c) state:

"... containing a flaw to be sized may be identified to the candidate."

Technical Basis - The current Code requires that the regions of each specimen containing a flaw to be length sized shall be identified to the candidate. The candidate shall determine the length of the flaw in each region. (Note, that length and depth sizing use the term "regions" while detection uses the term "grading units" - the two terms define different concepts and are not intended to be equal or interchangeable). To ensure security of the samples, the proposed alternative modifies the first "shall" to a "may" to allow the test administrator the option of not identifying specifically where a flaw is located. This is consistent with the recent revision to Supplement 2.

Items 9 and 10 - The proposed alternative to Paragraph 2.3(a) and 2.3(b) states:

"... regions of each specimen containing a flaw to be sized may be identified to the candidate."

Technical Basis - The current Code requires that a large number of flaws be sized at a specific location. The proposed alternative changes the "shall" to a "may" which modifies this from a specific area to a more generalized region to ensure security of samples. This is consistent with the recent revision to Supplement 2. It also incorporates terminology from length sizing for additional clarity.

Item 11 - The proposed alternative modifies the acceptance criteria of Table VIII-S2-1 as follows:

TABLE 1
PERSONNEL PERFORMANCE DEMONSTRATION DETECTION TEST
ACCEPTANCE CRITERIA

Detection Test Acceptance Criteria		False Call Acceptance Criteria	
No. of Flawed Grading Units	Minimum Detection Criteria	No. of Unflawed Grading Units	Maximum No. of False Calls
10	8	15	2
11	9	17	3
12	9	18	3
13	10	20	3
14	10	21	3
15	11	23	3
16	12	24	4
17	12	26	4
18	13	27	4
19	13	29	4
20	14	30	5

Technical Basis - The proposed alternative is identified as Table 1 above. It was modified to reflect a reduced number of unflawed grading units and allowable false calls. The revised table was developed as a part of ongoing Code activities involving Pacific Northwest Nuclear Laboratory (PNNL), which reviewed the statistical significance of these revisions and offered the revised acceptance criteria in Table 1.

Item 12 - During the qualification process, the ultrasonic examiners concluded that transducer contact could not be maintained in certain areas of the specimen during scanning for axial defects. In the procedure performance summary issued by PDI, a limitation is noted for the detection of axial flaws in Supplement 10 field weld configurations.

As an alternative methodology to address the procedure detection limitation, Dominion proposes to use surface geometry profiling software to help the examiner confirm locations where the raw data indicates lack of transducer contact due to problematic surface geometry. In this technique, a focused immersion transducer is positioned ahead of the transducer bundle on the examination array. This transducer location permits accurate profile data across the examination volume with minimal tilt and jitter from the array. The software translates this data into a scale representation of the examination surface where specific points in the raw data can be imported and correlated with the surface geometry.

With this data the examiner can adjust flaw bounding dimensions, determine metal ligament, if applicable, and better judge if limitations apparent in the raw data can be supported by local surface profile data. This last feature is the more important capability of the process as it pertains directly to the anticipated surface geometry of the Dominion primary loop dissimilar metal (DM) welds. Procedures made specific to Dominion will require the following:

1) Regular 22 mm x 22 mm transducers for detection of circumferential defects. This is the "standard technique" qualified for detection and length sizing. These transducers will also be used initially for axial defect scans.

2) 100% profiling of all nozzle to primary piping DM weld ID surfaces (Hot Leg and Cold Leg).

3) Evaluation of the raw data for transducer contact and profile data for supporting evidence.

The information thus generated will allow assessment of the limitations of coverage for detection from the axial scans.

To supplement the axial detection capability, Dominion proposes to use eddy current examination techniques to interrogate the surface of the examination volume for all 6 primary loop DM welds at Surry Unit 1. Eddy current data will be used to provide assurance of detection of surface breaking defects in both the axial and circumferential orientations and will serve to supplement the ultrasonic procedure in that regard. The eddy current probes are pencil sized and spring loaded, allowing them to more closely follow the surface geometry of counter-bore, miss-match, and root protrusions.

Technical Basis – The weld locations in question have been inspected during construction, during preservice inspection, and in two subsequent inservice inspections with no unacceptable indications discovered. The construction examinations were radiographic and surface examinations while the preservice examinations were conducted ultrasonically. The last inservice examinations were performed from the inside of the piping with immersion ultrasonic techniques, which might have been more likely to detect axial flaws than the PDI qualified contact techniques which are more subject to problems associated with irregular surface condition.

These weld inspection locations encompass dissimilar metal welds made between cast austenitic stainless steel and ferritic nozzles made with austenitic stainless steel weld metal. The nozzles are clad with austenitic stainless steel. The material is known to be highly resistant to either IGSCC or transgranular stress corrosion cracking (TGSCC) in pressurized water reactor (PWR) reactor coolant environments so that the possibility of service induced environmental cracking is very low. Furthermore, during development of the Risk Informed Inservice Inspection (RI-ISI) Program at Surry Unit 1, the welds in question were found to have low safety significance and did not require inspection. The RI-ISI Expert Panel added the welds to the inspection matrix for defense-in-depth considerations only.

These previous flaw free examinations, the fact that all of the materials exposed to the reactor water environment at these locations are resistant to SCC, and the results of the RI-ISI work indicate that the proposed alternative inspections provide an adequate level of quality and assurance of safety.

Item 13 - During the PDI qualification activity, the contractor that has been selected for the reactor vessel (RV) nozzle to piping weld examinations was able to achieve a depth sizing accuracy of 0.189 in. RMS rather than the 0.125 in. RMS required by paragraph 3.2(b) of Supplement 10. Dominion proposes that for any flaws detected and depth sized in the subject welds, the difference between the Supplement 10 required 0.125 in. RMS and the demonstrated 0.189 in. RMS, namely 0.064 in., will be added to the flaw depth sizing.

Technical Basis – Use of the difference between the Code required depth sizing accuracy and the achieved sizing accuracy as an addition to the size of any flaws discovered by the examination will insure that the flaw acceptability and evaluation is based on an appropriately conservative size. The use of 0.064 in. is appropriate because it was determined as a result of demonstrated performance under the auspices of the PDI process.

V. Proposed Alternative

In lieu of the requirements of ASME Section XI, 1995 Edition, 1996 Addenda, Appendix VIII, Supplement 10, the alternatives proposed above shall be used.

VI. Justification for Granting Relief

Pursuant to 10 CFR 50.55a(a)(3)(i), approval is requested to use the proposed alternatives described above as opposed to the ASME Section XI, Appendix VIII, Supplement 10 requirements. Compliance with the proposed alternatives will provide an adequate level of quality and safety for examination of the affected welds.

Similar relief for items 1 through 11 above, was granted to South Carolina Electric & Gas Company for the Virgil C. Summer Nuclear Station as documented in the February 3, 2004 letter from the USNRC to Mr. Stephen A Byrne, Senior Vice President, Nuclear Operations, Virgil C. Summer Nuclear Station – Second 10-Year Inservice Inspection, request for Relief R-II-20, RR-II-20 Addenda, RR-II-21 (TAC No. MCO108).

VII. Implementation Schedule

The relief is requested for the last period of the Third Inservice Inspection Interval.

Attachment 1

Case N-695
Qualification Requirements for Dissimilar Metal Piping Welds
Section XI, Division 1

Inquiry: What alternative to the requirements of Appendix VIII, Supplement 10, may be used for qualification requirements for dissimilar metal piping welds?

Reply: It is the opinion of the Committee that as an alternative to the requirements of Appendix VIII, Supplement 10, the following requirements may be used.

1 SCOPE

This Case is applicable to dissimilar metal piping welds examined from either the inside or outside surface. This Case is not applicable to piping welds containing supplemental corrosion resistant clad (CRC) applied to mitigate intergranular stress corrosion cracking (IGSCC).

2 SPECIMEN REQUIREMENTS

Qualification test specimens shall meet the requirements listed herein, unless a set of specimens is designed to accommodate specific limitations stated in the scope of the examination procedure (e.g., pipe size, weld joint configuration, access limitations). The same specimens may be used to demonstrate both detection and sizing qualification.

2.1 General

The specimen set shall conform to the following requirements:

(a) The minimum number of flaws in a specimen set shall be ten.

(b) Specimens shall have sufficient volume to minimize spurious reflections that may interfere with the interpretation process.

(c) The specimen set shall include the minimum and maximum pipe diameters and thicknesses for which the examination procedure is applicable. Pipe diameters within 1/2 in. (13 mm) of the nominal diameter shall be considered equivalent. Pipe diameters larger than 24 in. (610 mm) shall be considered to be flat. When a range of thicknesses is to be examined, a thickness tolerance of + 25% is acceptable.

(d) The specimen set shall include examples of the following fabrication conditions:

(1) geometric and material conditions that normally require discrimination from flaws (e.g. counterbore or weld root conditions, cladding, weld buttering, remnants of previous welds, adjacent welds in close proximity, weld repair areas);

(2) typical limited scanning surface conditions shall be included as follows:

(a) for outside surface examination, weld crowns, diametrical shrink, single-side access due to nozzle and safe end external tapers;

(b) for inside surface examinations, internal tapers, exposed weld roots, and cladding conditions.

(e) Qualification requirements shall be satisfied separately for outside surface and inside surface examinations.

2.2 Flaw Location

At least 80% of the flaws shall be contained wholly in weld or buttering material. At least one and no more than 10% of the flaws shall be in ferritic base material. At least one and no more than 10% of the flaws shall be in austenitic base material.

2.3 Flaw Type

(a) At least 60% of the flaws shall be cracks, and the remainder shall be alternative flaws. Specimens with IGSCC shall be used when available. Alternative flaws shall meet the following requirements:

(1) Alternative flaws, if used, shall provide crack-like reflective characteristics and shall only be used when implantation of cracks would produce spurious reflectors that are uncharacteristic of service-induced flaws.

(2) Alternative flaws shall have a tip width no more than 0.002 in. (0.50 mm).

(b) At least 50% of the flaws shall be coincident with areas described in 2.1(d).

2.4 Flaw Depth

All flaw depths shall be greater than 10% of the nominal pipe wall thickness. Flaw depths shall exceed the nominal clad thickness when placed in cladding. Flaws in the specimen set shall be distributed as follows:

Flaw Depth (% Wall Thickness)	Minimum Number of Flaws
10 - 30%	20%
31 - 60%	20%
61 - 100%	20%

At least 75% of the flaws shall be in the range of 10 to 60% of wall thickness.

2.5 Flaw Orientation

(a) For other than sizing specimens at least 30% and no more than 70% of the flaws, rounded to the next higher whole number, shall be oriented axially. The remainder of the flaws shall be oriented circumferentially.

(b) Sizing specimens shall meet the following requirements:

(1) Length-sizing flaws shall be oriented circumferentially.

(2) Depth-sizing flaws shall be oriented as in 2.5(a).

3 PERFORMANCE DEMONSTRATION

Personnel and procedure performance demonstration tests shall be conducted according to the following requirements:

(a) For qualifications from the outside surface, the specimen inside surface and specimen identification shall be concealed from the candidate. When qualifications are performed from the inside surface, the flaw location and specimen identification shall be obscured to maintain a "blind test." All examinations shall be completed prior to grading the results and presenting the results to the candidate. Divulgence of particular specimen results or candidate viewing of unmasked specimens after the performance demonstration is prohibited.

3.1 Detection Test

(a) The specimen set shall include detection specimens that meet the following requirements:

(1) Specimens shall be divided into grading units.

(a) Each grading unit shall include at least 3 in. (76 mm) of weld length.

(b) The end of each flaw shall be separated from an unflawed grading unit by at least 1 in. (25 mm) of unflawed material. A flaw may be less than 3 in. (76 mm) in length.

(c) The segment of weld length used in one grading unit shall not be used in another grading unit.

(d) Grading units need not be uniformly spaced around the pipe specimen.

(2) Personnel performance demonstration detection test sets shall be selected from Table 1. The number of unflawed grading units shall be at least 1-1/2 times the number of flawed grading units.

(3) Flawed and unflawed grading units shall be randomly mixed.

(b) Examination equipment and personnel are qualified for detection when personnel performance demonstrations satisfy the acceptance criteria of Table 1 for both detection and false calls.

3.2 Length-Sizing Test

(a) Each reported circumferential flaw in the detection test shall be length-sized.

(b) When the length-sizing test is conducted in conjunction with the detection test, and less than ten circumferential flaws are detected, additional specimens shall be provided to the candidate such that at least ten flaws are sized. The regions of each specimen containing a flaw to be sized may be identified to the candidate. The candidate shall determine the length of the flaw in each region.

(c) For a separate length-sizing test, the regions of each specimen containing a flaw to be sized may be identified to the candidate. The candidate shall determine the length of the flaw in each region.

(d) Examination procedures, equipment, and personnel are qualified for length-sizing when the RMS error of the flaw length measurements, as compared to the true flaw lengths, do not exceed 0.75 in. (19 mm).

TABLE 1
PERSONNEL PERFORMANCE DEMONSTRATION DETECTION TEST
ACCEPTANCE CRITERIA

Detection Test Acceptance Criteria		False Call Acceptance Criteria	
No. of Flawed Grading Units	Minimum Detection Criteria	No. of Unflawed Grading Units	Maximum No. of False Calls
10	8	15	2
11	9	17	3
12	9	18	3
13	10	20	3
14	10	21	3
15	11	23	3
I6	12	24	4
17	12	26	4
18	13	27	4
19	13	29	4
20	14	30	5

3.3 Depth-Sizing Test

(a) The depth-sizing test may be conducted separately or in conjunction with the detection test. For a separate depth-sizing test, the regions of each specimen containing a flaw to be sized may be identified to the candidate. The candidate shall determine the maximum depth of the flaw in each region.

(b) When the depth-sizing test is conducted in conjunction with the detection test, and less than ten flaws are detected, additional specimens shall be provided to the candidate such that at least ten flaws are sized. The regions of each specimen containing a flaw to be sized may be identified to the candidate. The candidate shall determine the maximum depth of the flaw in each region.

(c) Examination procedures, equipment, and personnel are qualified for depth-sizing when the RMS error of the flaw depth measurements, as compared to the true flaw depths, do not exceed 0.125 in. (3 mm).

4 PROCEDURE QUALIFICATION

Procedure qualification shall include the following additional requirements:

(a) The specimen set shall include the equivalent of at least three personnel performance demonstration test sets. Successful personnel performance demonstrations may be combined to satisfy these requirements.

(b) Detectability of all flaws in the procedure qualification test set that are within the scope of the procedure shall be demonstrated. Length and depth sizing shall meet the requirements of 3.1, 3.2, and 3.3.

(c) At least one successful personnel performance demonstration shall be performed.

(d) To qualify new values of essential variables, at least one personnel performance demonstration test set is required. The acceptance criteria of 4(b) shall be met.

Enclosure 2

Relief Request SR-036, Rev. 1
Reactor Vessel Weld Examinations

Surry Power Station Unit 2

**Virginia Electric and Power Company
(Dominion)**

Relief Request No. SR-036, Rev. 1
Alternative RPV Nozzle–to-Piping Weld Examination Requirements
Surry Power Station Unit 2

I. Identification of Components

ASME Section XI, Class I, Examination Category R-A, Risk Informed Piping Examinations, Item R1.11 Elements Subject to Thermal Fatigue (formerly B-F, Pressure Retaining Dissimilar Metal Welds in Vessel Nozzles, Item B5.10, NPS 4 or Larger Nozzle-to-Safe End Butt Welds) at Surry Unit 2 subject to examination using procedures, personnel, and equipment qualified to ASME Section XI, Appendix VIII, Supplement 10 criteria. The specific welds involved are:

Weld No.	ID	Wall Thickness	Base Metal	Weld Metal
29"-RC-1-2501R-1-01DM (loop A hot leg)	29"	2.70"	SA508 Class 2 / ASTM A-376 TP 316	austenitic stainless steel
27-1/2"-RC-3-2501R-1-17DM (loop A cold leg)	27-1/2"	2.56"	SA508 Class 2 / SA351 CF8M	austenitic stainless steel
29"-RC-4-2501R-1-01DM (loop B hot leg)	29"	2.70"	SA508 Class 2 / ASTM A-376 TP 316	austenitic stainless steel
27-1/2"-RC-6-2501R-1-17DM (loop B cold leg)	27-1/2"	2.56"	SA508 Class 2/ SA351 CF8M	austenitic stainless steel
29"-RC-7-2501R-1-01DM (loop C hot leg)	29"	2.70"	SA508 Class 2 / ASTM A-376 TP 316	austenitic stainless steel
27-1/2"-RC-9-2501R-1-17DM (loop B cold leg)	27-1/2"	2.56"	SA508 Class 2/ SA351 CF8M	austenitic stainless steel

II. Code Examination Requirements

Rules for Inservice Inspection of Nuclear Power Plant Components, Section XI, 1989 Edition, Class I, Examination Category R-A, Risk Informed Piping Examinations, Item R1.11, Elements Subject to Thermal Fatigue (Examination Category B-F, Pressure Retaining Dissimilar Metal Welds in Vessel Nozzles, Item B5.10, NPS 4 or Larger Nozzle-to-Safe End Butt Welds), Figure Number IWB-2500-8 and the requirements of the 1995 Edition and 1996 Addenda of ASME Section XI, Appendix VIII, Supplement 10.

The following paragraphs or statements are from ASME Section XI, Appendix VIII, Supplement 10, and identify the specific requirements that are included in this request for relief.

Item 1 - Paragraph 1.1(b) states in part - Pipe diameters within a range of 0.9 to 1.5 times a nominal diameter shall be considered equivalent.

Item 2 - Paragraph 1.1(d) states - All flaws in the specimen set shall be cracks.

Item 3 - Paragraph 1.1(d)(1) states - At least 50% of the cracks shall be in austenitic material. At least 50% of the cracks in austenitic material shall be contained wholly in weld or buttering material. At least 10% of the cracks shall be in ferritic material. The remainder of the cracks may be in either austenitic or ferritic material.

Item 4 - Paragraph 1.2(b) states in part - The number of unflawed grading units shall be at least twice the number of flawed grading units.

Item 5 - Paragraph 1.2(c)(1) and 1.3(c) state in part - At least 1/3 of the flaws, rounded to the next higher whole number, shall have depths between 10% and 30% of the nominal pipe wall thickness. Paragraph 1.4(b) distribution table requires 20% of the flaws to have depths between 10% and 30%.

Item 6 - Paragraph 2.0 first sentence states - The specimen inside surface and identification shall be concealed from the candidate.

Item 7 - Paragraph 2.2(b) states in part - The regions containing a flaw to be sized shall be identified to the candidate.

Item 8 - Paragraph 2.2(c) states in part - For a separate length sizing test, the regions of each specimen containing a flaw to be sized shall be identified to the candidate.

Item 9 - Paragraph 2.3(a) states - For the depth sizing test, 80% of the flaws shall be sized at a specific location on the surface of the specimen identified to the candidate.

Item 10 - Paragraph 2.3(b) states - For the remaining flaws, the regions of each specimen containing a flaw to be sized shall be identified to the candidate. The candidate shall determine the maximum depth of the flaw in each region.

Item 11 - Table VIII-S2-1 provides the false call criteria when the number of unflawed grading units is at least twice the number of flawed grading units.

Item 12 – Paragraph 3.1 states – Examination procedures, equipment and personnel are qualified for detection when the results of the performance demonstration satisfy the acceptance criteria of Table VIII-S2-1 for both detection and false calls.

Item 13 – Paragraph 3.2(b) states – Examination procedures, equipment, and personnel are qualified for depth sizing when the RMS error of the flaw depth measurement, as compared to the true flaw depth, is less than or equal to 0.125 in.

III. Requested Relief

Pursuant to 10 CFR 50.55a(a)(3)(i), relief is requested to implement an alternative to the requirements of Appendix VIII, Supplement 10. This alternative will be implemented through the PDI Program.

A copy of the text of Code Case N-695, which was approved by ASME on May 21, 2003, is attached for reference. It can be seen that the alternatives to the existing Code requirements detailed in the next section substantially conform to the Code Case.

IV. Basis for Relief

Item 1 - The proposed alternative to Paragraph 1.1(b) states:

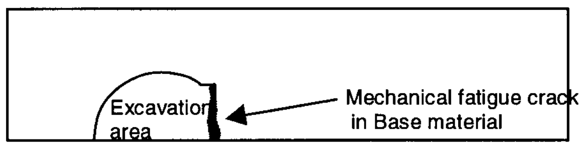
"The specimen set shall include the minimum and maximum pipe diameters and thicknesses for which the examination procedure is applicable. Pipe diameters within a range of 1/2 in. (13 mm) of the nominal diameter shall be considered equivalent. Pipe diameters larger than 24 in. (610 mm) shall be considered to be flat. When a range of thicknesses is to be examined, a thickness tolerance of ±25% is acceptable."

Technical Basis - The change in the minimum pipe diameter tolerance from 0.9 times the diameter to the nominal diameter minus 0.5 inch provides tolerances more in line with industry practice. Although the alternative is less stringent for small pipe diameters, they typically have a thinner wall thickness than larger diameter piping. A thinner wall thickness results in shorter sound path distances that reduce the detrimental effects of the curvature. This change maintains consistency between Supplement 10 and the recent revision to Supplement 2.

Item 2 - The proposed alternative to Paragraph 1.1(d) states:

"At least 60% of the flaws shall be cracks, the remainder shall be alternative flaws. Specimens with intergranular stress corrosion cracking (IGSCC) shall be used when available. Alternative flaws, if used, shall provide crack-like reflective characteristics and shall be limited to the case where implantation of cracks produces spurious reflectors that are uncharacteristic of actual flaws. Alternative flaw mechanisms shall have a tip width of less than or equal to 0.002 in. (.05 mm). Note, to avoid confusion the proposed alternative modifies instances of the term "cracks" or "cracking" to the term "flaws" because of the use of alternative flaw mechanisms."

Technical Basis - As illustrated below, implanting a crack requires excavation of the base material on at least one side of the flaw. While this may be satisfactory for ferritic materials, it does not produce a useable axial flaw in austenitic materials. The sound beam, which normally passes only through base material, must now travel through weld material on at least one side, thereby producing an unrealistic flaw response. In addition, it is important to preserve the dendritic structure present in field welds that would otherwise be destroyed by the implantation process. To resolve these issues, the proposed alternative allows the use of up to 40% fabricated flaws as an alternative flaw mechanism under controlled conditions. The fabricated flaws are isostatically compressed, which produces ultrasonic reflective characteristics similar to tight cracks.



Item 3 - The proposed alternative to Paragraph 1.1(d)(1) states:

"At least 80% of the flaws shall be contained wholly in weld or buttering material. At least one and a maximum of 10% of the flaws shall be in ferritic base material. At least one and a maximum of 10% of the flaws shall be in austenitic base material."

Technical Basis - Under the current Code, as few as 25% of the flaws are contained in austenitic weld or buttering material. Based on recent experience, flaws are most likely to be contained within the weld. The metallurgical structure of austenitic weld material is ultrasonically more challenging than either ferritic or austenitic base material. The proposed alternative is therefore more challenging than the current Code.

Item 4 - The proposed alternative to Paragraph 1.2(b) states:

"Detection sets shall be selected from Table VIII-S10-1. The number of unflawed grading units shall be at least one and a half times the number of flawed grading units."

Technical Basis - Table S10-1 provides a statistically based ratio between the number of unflawed grading units and the number of flawed grading units. The proposed alternative reduces the ratio to 1.5 times to reduce the number of test samples to a more reasonable number from a human factors perspective. However, the statistical basis used for screening personnel and procedures is still maintained at the same level with competent personnel being successful and less skilled personnel being unsuccessful. The acceptance criteria for the statistical basis are in Table VIII-S10-1.

Item 5 - The proposed alternative to the flaw distribution requirements of Paragraph 1.2(c)(1) (detection) and 1.3(c) (length) is to use the Paragraph 1.4(b) (depth) distribution table (see below) for all qualifications.

Flaw Depth (% Wall Thickness)	Minimum Number of Flaws
10 - 30%	20%
31 - 60%	20%
61 - 100%	20%

Technical Basis - The proposed alternative uses the depth sizing distribution for both detection and depth sizing because it provides for a better distribution of flaw sizes within the test set. This distribution allows candidates to perform detection, length, and depth sizing demonstrations simultaneously utilizing the same test set. The requirement that at least 75% of the flaws shall be in the range of 10 to 60% of wall thickness provides an overall distribution tolerance yet the distribution uncertainty decreases the possibilities for testmanship that would be inherent to a uniform distribution. It must be noted that it is possible to achieve the same distribution utilizing the present requirements, but it is preferable to make the criteria consistent.

Item 6 - The proposed alternative to Paragraph 2.0 first sentence states:

"For qualifications from the outside surface, the specimen inside surface and identification shall be concealed from the candidate. When qualifications are performed from the inside surface, the flaw location and specimen identification shall be obscured to maintain a "blind test"."

Technical Basis - The current Code requires that the inside surface be concealed from the candidate. This makes qualifications conducted from the inside of the pipe (e.g., PWR nozzle to safe end welds) impractical. The proposed alternative differentiates between ID and OD scanning surfaces, requires that they be conducted separately, and requires that flaws be concealed from the candidate. This is consistent with the recent revision to Supplement 2.

Items 7 and 8 - The proposed alternatives to Paragraph 2.2(b) and 2.2(c) state:

"... containing a flaw to be sized may be identified to the candidate."

Technical Basis - The current Code requires that the regions of each specimen containing a flaw to be length sized shall be identified to the candidate. The candidate shall determine the length of the flaw in each region. (Note, that length and depth sizing use the term "regions" while detection uses the term "grading units" - the two terms define different concepts and are not intended to be equal or interchangeable). To ensure security of the samples, the proposed alternative modifies the first "shall" to a "may" to allow the test administrator the option of not identifying specifically where a flaw is located. This is consistent with the recent revision to Supplement 2.

Items 9 and 10 - The proposed alternative to Paragraph 2.3(a) and 2.3(b) states:

"... regions of each specimen containing a flaw to be sized may be identified to the candidate."

Technical Basis - The current Code requires that a large number of flaws be sized at a specific location. The proposed alternative changes the "shall" to a "may" which modifies this from a specific area to a more generalized region to ensure security of samples. This is consistent with the recent revision to Supplement 2. It also incorporates terminology from length sizing for additional clarity.

Item 11 - The proposed alternative modifies the acceptance criteria of Table VIII-S2-1 as follows:

TABLE 1
PERSONNEL PERFORMANCE DEMONSTRATION DETECTION TEST ACCEPTANCE CRITERIA

Detection Test Acceptance Criteria		False Call Acceptance Criteria	
No. of Flawed Grading Units	Minimum Detection Criteria	No. of Unflawed Grading Units	Maximum No. of False Calls
10	8	15	2
11	9	17	3
12	9	18	3
13	10	20	3
14	10	21	3
15	11	23	3
l6	12	24	4
17	12	26	4
18	13	27	4
19	13	29	4
20	14	30	5

Technical Basis - The proposed alternative is identified as Table 1 above. It was modified to reflect a reduced number of unflawed grading units and allowable false calls. The revised table was developed as a part of ongoing Code activities involving Pacific Northwest Nuclear Laboratory (PNNL), which reviewed the statistical significance of these revisions and offered the revised acceptance criteria in Table 1.

Item 12 - During the qualification process, the ultrasonic examiners concluded that transducer contact could not be maintained in certain areas of the specimen during scanning for axial defects. In the procedure performance summary issued by PDI, a limitation is noted for the detection of axial flaws in Supplement 10 field weld configurations.

As an alternative methodology to address the procedure detection limitation, Dominion proposes to use surface geometry profiling software to help the examiner confirm locations where the raw data indicates lack of transducer contact due to problematic surface geometry. In this technique, a focused immersion transducer is positioned ahead of the transducer bundle on the examination array. This transducer location permits accurate profile data across the examination volume with minimal tilt and jitter from the array. The software translates this data into a scale representation of the examination surface where specific points in the raw data can be imported and correlated with the surface geometry.

With this data the examiner can adjust flaw bounding dimensions, determine metal ligament, if applicable, and better judge if limitations apparent in the raw data can be supported by local surface profile data. This last feature is the more important capability of the process as it pertains directly to the anticipated surface geometry of the Dominion primary loop dissimilar metal (DM) welds. Procedures made specific to Dominion will require the following:

1) Regular 22 mm x 22 mm transducers for detection of circumferential defects. This is the "standard technique" qualified for detection and length sizing. These transducers will also be used initially for axial defect scans.

2) 100% profiling of all nozzle to primary piping DM weld ID surfaces (Hot Leg and Cold Leg).

3) Evaluation of the raw data for transducer contact and profile data for supporting evidence.

The information thus generated will allow assessment of the limitations of coverage for detection from the axial scans.

To supplement the axial detection capability, Dominion proposes to use eddy current examination techniques to interrogate the surface of the examination volume for all 6 primary loop DM welds at Surry Unit 2. Eddy current data will be used to provide assurance of detection of surface breaking defects in both the axial and circumferential orientations and will serve to supplement the ultrasonic procedure in that regard. The eddy current probes are pencil sized and spring loaded, allowing them to more closely follow the surface geometry of counter-bore, miss-match, and root protrusions.

Technical Basis – The weld locations in question have been inspected during construction, during preservice inspection, and in two subsequent inservice inspections with no unacceptable indications discovered. The construction examinations were radiographic and surface examinations while the preservice examinations were conducted ultrasonically. The last inservice examinations were performed from the inside of the piping with immersion ultrasonic techniques, which might have been more likely to detect axial flaws than the PDI qualified contact techniques which are more subject to problems associated with irregular surface condition.

These weld inspection locations encompass dissimilar metal welds made between cast austenitic stainless steel and ferritic nozzles made with austenitic stainless steel weld metal. The nozzles are clad with austenitic stainless steel. The material is known to be highly resistant to either IGSCC or transgranular stress corrosion cracking (TGSCC) in pressurized water reactor (PWR) reactor coolant environments so that the possibility of service induced environmental cracking is very low. Furthermore, during development of the Risk Informed Inservice Inspection (RI-ISI) Program at Surry Unit 2, the welds in question were found to have low safety significance and did not require inspection. The RI-ISI Expert Panel added the welds to the inspection matrix for defense-in-depth considerations only.

These previous flaw free examinations, the fact that all of the materials exposed to the reactor water environment at these locations are resistant to SCC, and the results of the RI-ISI work indicate that the proposed alternative inspections provide an adequate level of quality and assurance of safety.

Item 13 - During the PDI qualification activity, the contractor that has been selected for the reactor vessel (RV) nozzle to piping weld examinations was able to achieve a depth sizing accuracy of 0.189 in. RMS rather than the 0.125 in. RMS required by paragraph 3.2(b) of Supplement 10. Dominion proposes that for any flaws detected and depth sized in the subject welds, the difference between the Supplement 10 required 0.125 in. RMS and the demonstrated 0.189 in. RMS, namely 0.064 in., will be added to the flaw depth sizing.

Technical Basis – Use of the difference between the Code required depth sizing accuracy and the achieved sizing accuracy as an addition to the size of any flaws discovered by the examination will insure that the flaw acceptability and evaluation is based on an appropriately conservative size. The use of 0.064 in. is appropriate because it was determined as a result of demonstrated performance under the auspices of the PDI process.

V. Proposed Alternative

In lieu of the requirements of ASME Section XI, 1995 Edition, 1996 Addenda, Appendix VIII, Supplement 10, the alternatives proposed above shall be used.

VI. Justification for Granting Relief

Pursuant to 10 CFR 50.55a(a)(3)(i), approval is requested to use the proposed alternatives described above as opposed to the ASME Section XI, Appendix VIII, Supplement 10 requirements. Compliance with the proposed alternatives will provide an adequate level of quality and safety for examination of the affected welds.

Similar relief for items 1 through 11 above, was granted to South Carolina Electric & Gas Company for the Virgil C. Summer Nuclear Station as documented in the February 3, 2004 letter from the USNRC to Mr. Stephen A Byrne, Senior Vice President, Nuclear Operations, Virgil C. Summer Nuclear Station – Second 10-Year Inservice Inspection, request for Relief R-II-20, RR-II-20 Addenda, RR-II-21 (TAC No. MCO108).

VII. Implementation Schedule

The relief is requested for the last period of the Third Inservice Inspection Interval.

Attachment 1

**Case N-695
Qualification Requirements for Dissimilar Metal
Piping Welds
Section XI, Division 1**

Inquiry: What alternative to the requirements of Appendix VIII, Supplement 10, may be used for qualification requirements for dissimilar metal piping welds?

Reply: It is the opinion of the Committee that as an alternative to the requirements of Appendix VIII, Supplement 10, the following requirements may be used.

1 SCOPE

This Case is applicable to dissimilar metal piping welds examined from either the inside or outside surface. This Case is not applicable to piping welds containing supplemental corrosion resistant clad (CRC) applied to mitigate intergranular stress corrosion cracking (IGSCC).

2 SPECIMEN REQUIREMENTS

Qualification test specimens shall meet the requirements listed herein, unless a set of specimens is designed to accommodate specific limitations stated in the scope of the examination procedure (e.g., pipe size, weld joint configuration, access limitations). The same specimens may be used to demonstrate both detection and sizing qualification.

2.1 General

The specimen set shall conform to the following requirements:

(a) The minimum number of flaws in a specimen set shall be ten.

(b) Specimens shall have sufficient volume to minimize spurious reflections that may interfere with the interpretation process.

(c) The specimen set shall include the minimum and maximum pipe diameters and thicknesses for which the examination procedure is applicable. Pipe diameters within 1/2 in. (13 mm) of the nominal diameter shall be considered equivalent. Pipe diameters larger than 24 in. (610 mm) shall be considered to be flat. When a range of thicknesses is to be examined, a thickness tolerance of + 25% is acceptable.

(c) The specimen set shall include examples of the following fabrication conditions:

(1) geometric and material conditions that normally require discrimination from flaws (e.g. counterbore or weld root conditions, cladding, weld buttering, remnants of previous welds, adjacent welds in close proximity, weld repair areas);

(2) typical limited scanning surface conditions shall be included as follows:

(a) for outside surface examination, weld crowns, diametrical shrink, single-side access due to nozzle and safe end external tapers;

(b) for inside surface examinations, internal tapers, exposed weld roots, and cladding conditions.

(e) Qualification requirements shall be satisfied separately for outside surface and inside surface examinations.

2.2 Flaw Location

At least 80% of the flaws shall be contained wholly in weld or buttering material. At least one and no more than 10% of the flaws shall be in ferritic base material. At least one and no more than 10% of the flaws shall be in austenitic base material.

2.3 Flaw Type

(a) At least 60% of the flaws shall be cracks, and the remainder shall be alternative flaws. Specimens with IGSCC shall be used when available. Alternative flaws shall meet the following requirements:

(1) Alternative flaws, if used, shall provide crack-like reflective characteristics and shall only be used when implantation of cracks would produce spurious reflectors that are uncharacteristic of service-induced flaws.

(2) Alternative flaws shall have a tip width no more than 0.002 in. (0.50 mm).

(b) At least 5O% of the flaws shall be coincident with areas described in 2.1(d).

2.4 Flaw Depth

All flaw depths shall be greater than 10% of the nominal pipe wall thickness. Flaw depths shall exceed the nominal clad thickness when placed in cladding. Flaws in the specimen set shall be distributed as follows:

Flaw Depth (% Wall Thickness)	Minimum Number of Flaws
10 - 30%	20%
31 - 60%	20%
61 - 100%	20%

At least 75% of the flaws shall be in the range of 10 to 60% of wall thickness.

2.5 Flaw Orientation

(a) For other than sizing specimens at least 30% and no more than 70% of the flaws, rounded to the next higher whole number, shall be oriented axially. The remainder of the flaws shall be oriented circumferentially.

(a) Sizing specimens shall meet the following requirements:

(1) Length-sizing flaws shall be oriented circumferentially.

(2) Depth-sizing flaws shall be oriented as in 2.5(a).

3 PERFORMANCE DEMONSTRATION

Personnel and procedure performance demonstration tests shall be conducted according to the following requirements:

(a) For qualifications from the outside surface, the specimen inside surface and specimen identification shall be concealed from the candidate. When qualifications are performed from the inside surface, the flaw location and specimen identification shall be obscured to maintain a "blind test." All examinations shall be completed prior to grading the results and presenting the results to the candidate. Divulgence of particular specimen results or candidate viewing of unmasked specimens after the performance demonstration is prohibited.

3.1 Detection Test

(a) The specimen set shall include detection specimens that meet the following requirements:

(1) Specimens shall be divided into grading units.

(a) Each grading unit shall include at least 3 in. (76 mm) of weld length.

(b) The end of each flaw shall be separated from an unflawed grading unit by at least 1 in. (25 mm) of unflawed material. A flaw may be less than 3 in. (76 mm) in length.

(c) The segment of weld length used in one grading unit shall not be used in another grading unit.

(d) Grading units need not be uniformly spaced around the pipe specimen.

(2) Personnel performance demonstration detection test sets shall be selected from Table 1. The number of unflawed grading units shall be at least 1-1/2 times the number of flawed grading units.

(3) Flawed and unflawed grading units shall be randomly mixed.

(b) Examination equipment and personnel are qualified for detection when personnel performance demonstrations satisfy the acceptance criteria of Table 1 for both detection and false calls.

3.2 Length-Sizing Test

(a) Each reported circumferential flaw in the detection test shall be length-sized.

(b) When the length-sizing test is conducted in conjunction with the detection test, and less than ten circumferential flaws are detected, additional specimens shall be provided to the candidate such that at least ten flaws are sized. The regions of each specimen containing a flaw to be sized may be identified to the candidate. The candidate shall determine the length of the flaw in each region.

(c) For a separate length-sizing test, the regions of each specimen containing a flaw to be sized may be identified to the candidate. The candidate shall determine the length of the flaw in each region.

(d) Examination procedures, equipment, and personnel are qualified for length-sizing when the RMS error of the flaw length measurements, as compared to the true flaw lengths, do not exceed 0.75 in. (19 mm).

TABLE 1
PERSONNEL PERFORMANCE DEMONSTRATION DETECTION TEST ACCEPTANCE CRITERIA

Detection Test Acceptance Criteria		False Call Acceptance Criteria	
No. of Flawed Grading Units	Minimum Detection Criteria	No. of Unflawed Grading Units	Maximum No. of False Calls
10	8	15	2
11	9	17	3
12	9	18	3
13	10	20	3
14	10	21	3
15	11	23	3
I6	12	24	4
17	12	26	4
18	13	27	4
19	13	29	4
20	14	30	5

3.3 Depth-Sizing Test

(a) The depth-sizing test may be conducted separately or in conjunction with the detection test. For a separate depth-sizing test, the regions of each specimen containing a flaw to be sized may be identified to the candidate. The candidate shall determine the maximum depth of the flaw in each region.

(b) When the depth-sizing test is conducted in conjunction with the detection test, and less than ten flaws are detected, additional specimens shall be provided to the candidate such that at least ten flaws are sized. The regions of each specimen containing a flaw to be sized may be identified to the candidate. The candidate shall determine the maximum depth of the flaw in each region.

(c) Examination procedures, equipment, and personnel are qualified for depth-sizing when the RMS error of the flaw depth measurements, as compared to the true flaw depths, do not exceed 0.125 in. (3 mm).

4 PROCEDURE QUALIFICATION

Procedure qualification shall include the following additional requirements:

(a) The specimen set shall include the equivalent of at least three personnel performance demonstration test sets. Successful personnel performance demonstrations may be combined to satisfy these requirements.

(b) Detectability of all flaws in the procedure qualification test set that are within the scope of the procedure shall be demonstrated. Length and depth sizing shall meet the requirements of 3.1, 3.2, and 3.3.

(c) At least one successful personnel performance demonstration shall be performed.

(d) To qualify new values of essential variables, at least one personnel performance demonstration test set is required. The acceptance criteria of 4(b) shall be met.