Calvert Cliffs Nuclear Power Plant

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Lusby, Maryland 20657

CENG
a joint venture of
Constellation Energy EDF

CALVERT CLIFFS
NUCLEAR POWER PLANT

June 7, 2012

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit No. 2; Docket No. 50-318
Relief Request for Unit 2 Dissimilar Metal Butt Welds Baseline Examinations (RR-ISI-04-07A)

Calvert Cliffs Nuclear Power Plant, LLC, (Calvert Cliffs) hereby requests Nuclear Regulatory Commission approval for use of an alternative to the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Code Case N-770-1 as conditioned in 10 CFR 50.55a. This relief request for Calvert Cliffs Unit 2 (RR-ISI-04-07A) is provided in Attachment (1) and is submitted pursuant to 10 CFR 50.55a(a)(3)(ii) as compliance with all the requirements of American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Code Case N-770-1 would pose a hardship without a compensating increase in the level of quality and safety.

Approval of this relief request is needed in support of Calvert Cliffs Unit 2 2013 refueling outage. As such, approval is therefore requested by January 4, 2013. This relief request is effective for Calvert Cliffs Fourth Ten-Year Inservice Inspection Interval.

Should you have questions regarding this matter, please contact Mr. Douglas E. Lauver at (410) 495-5219.

Very truly yours,

James J. Stanley
Manager – Engineering Services

JJS/KLG/bjd

Attachment: (1) Relief Request for Calvert Cliffs Unit 2 Dissimilar Metal Butt Weld Examinations (RR-ISI-04-07A)
Enclosure: 1. Unit 2 Examination Coverage Plots

A047
NRR

cc: N. S. Morgan, NRC
W. M. Dean, NRC
Resident Inspector, NRC
S. Gray, DNR

ATTACHMENT (1)

RELIEF REQUEST FOR CALVERT CLIFFS UNIT 2 DISSIMILAR METAL BUTT WELD EXAMINATIONS (RR-ISI-04-07A)

Calvert Cliffs Nuclear Power Plant, LLC
June 7, 2012

ATTACHMENT (1)

RELIEF REQUEST FOR CALVERT CLIFFS UNIT 2 DISSIMILAR METAL BUTT WELD EXAMINATIONS (RR-ISI-04-07A)

1. ASME Code Component(s) Affected

Code Class 1 PWR Pressure Retaining Dissimilar Metal Piping and Vessel Nozzle Butt Welds Containing Alloy 82/182. American Society of Mechanical Engineers (ASME) Code Case N-770-1, Table 1, Examinations Categories.

Inspection Item B - Unmitigated Butt Welds at Cold Leg Operating Temperature

2. Applicable Code Edition and Addenda

ASME Boiler and Pressure Vessel Code, Section XI, 2004 Edition, no Addenda - Code Case N-770-1 subject to conditions specified in 10 CFR 50.55a(g)(6)(ii)(F).

3. Applicable Code Requirement

With the issuance of a revised 10 CFR 50.55a in June 2011, the Nuclear Regulatory Commission (NRC) incorporated by reference ASME Code Case N-770-1, "Alternative Examination Requirements and Acceptance Standards for Class 1 PWR Piping and Vessel Nozzle Butt Welds Fabricated with UNS N06082 or UNS W86182 Weld Filler Material With or Without Application of Listed Mitigation Activities, Section XI, Division 1" (ASME Approval Date: December 25, 2009). Specific implementing requirements are documented in 10 CFR 50.55a(g)(6)(ii)(F) and are listed below.

(1) Licensees of existing, operating pressurized-water reactors as of July 21, 2011 shall implement the requirements of ASME Code Case N–770–1, subject to the conditions specified in paragraphs (g)(6)(ii)(F)(2) through (g)(6)(ii)(F)(10) of this section, by the first refueling outage after August 22, 2011.

(2) Full structural weld overlays authorized by the NRC staff may be categorized as Inspection Items C or F, as appropriate; welds that have been mitigated by the Mechanical Stress Improvement Process (MSIP™) may be categorized as Inspection Items D or E, as appropriate, provided the criteria in Appendix I of the code case have been met; for inservice inspection (ISI) frequencies, all other butt welds that rely on Alloy 82/182 for structural integrity shall be categorized as Inspection Items A–1, A–2, or B until the NRC staff has reviewed the mitigation and authorized an alternative code case Inspection Item for the mitigated weld, or until an alternative code case Inspection Item is used based on conformance with an ASME mitigation code case endorsed in Regulatory Guide 1.147 with conditions, if applicable, and incorporated in this section.

(3) Baseline examinations for welds in Table 1, Inspection Items A–1, A–2, and B, shall be completed by the end of the next refueling outage after January 20, 2012. Previous examinations of these welds can be credited for baseline examinations if they were performed within the re-inspection period for the weld item in ASME Code Case N-770-1, Table 1 using Section XI, Appendix VIII requirements and met the Code required examination volume of essentially 100 percent. Other previous examinations that do not meet these requirements can be used to meet the baseline examination requirement, provided NRC approval of alternative inspection requirements in accordance with paragraphs (a)(3)(i) or (a)(3)(ii) of this section is granted prior to the end of the next refueling outage after January 20, 2012.

(4) The axial examination coverage requirements of –2500(c) may not be considered to be satisfied unless essentially 100 percent coverage is achieved.

Items (5) through (9) of 10 CFR 50.55a(g)(6)(ii)(F) address future inspections beyond the baseline examination and are therefore not discussed in this relief request. Item (10) of 10 CFR 50.55a(g)(6)(ii)(F) addresses a mitigation that Calvert Cliffs does not have and is therefore not discussed in this relief request.

4. Reason for the Request

The relevant conditions for this relief request are ASME Code Case N-770-1, paragraph 2500 (b) as it pertains to dissimilar metal (DM) welds with cast stainless steel safe ends, and as subject to items (3) and (4) of 10 CFR 50.55a(g)(6)(ii)(F). Item (3) addresses performing the required baseline examination for that Inspection Item, while item (4) addresses the required examination coverage.

Item (3) of 10 CFR 50.55a(g)(6)(ii)(F) requires that all Inspection Items A-1, A-2, and B receive a baseline examination by the end of the first refueling outage after January 20, 2012. The Class 1 pressure retaining DM welds $\geq$ 2 inch nominal pipe size (NPS) were examined during the 2011 refueling outage to the full extent practicable. Specifics on the examination procedure and examination coverage is described below and credit for these exams as baseline examinations is sought where full ASME Code Case N-770-1 examination cannot be achieved.

Whereas MRP-139 (Reference 1) and ASME Code Case N-770-1 made allowances for limitations in circumferential scanning for axial flaw examination coverage of DM welds, the NRC has stated in item (4) that essentially 100 percent coverage is required. This applies to meeting the baseline requirements for Item (3) above.

5. Component/Weld Scope

The five welds shown in Table A below are the applicable welds $\geq$ 2 inch NPS covered by the requirements contained in ASME Code Case N-770-1, Section -1000. These welds have been categorized in accordance with Table 1 from ASME Code Case N-770-1. The examination volume coverage achieved during the 2011 refueling outage is also included in the table in three columns, representing different coverage determination criteria.

Examination coverage plots are included in Enclosure 1 for those welds where essentially 100 percent coverage was unable to be obtained using either ASME Code Case N-770-1 coverage determination, or for which 100 percent coverage was not achieved for the susceptible material examination volume.

TABLE A - UNIT 2 DM WELD POPULATION

DM Weld Designator / ID	Location	NPS	Inspection Item Category		N-770-1 Based Coverage[1][2]			N-770-1 Coverage including CASS[1][3]			Susceptible Material Coverage[4]		
			MRP-139	N-770-1	Axial Scan (%)	Circ Scan (%)	Total (%)	Axial Scan (%)	Circ Scan (%)	Total (%)	Axial Scan (%)	Circ Scan (%)	Total (%)
109280 / 30-RC-21A-7	21A RCP Inlet	30"	E	B	74	74	74	100	77	88	100	100	100
109310 / 30-RC-21A-10	21A RCP Outlet	30"	E	B	66	70	68	96	100	98	97	100	99
110310 / 30-RC-21B-10	21B RCP Outlet	30"	E	B	65	71	68	94	100	97	93	100	97
111280 / 30-RC-22A-7	22A RCP Inlet	30"	E	B	67	67	67	100	79	90	100	100	100
111310 / 30-RC-22A-10	22A RCP Outlet	30"	E	B	76	58	67	100	83	91	100	91	96

Notes:

(1) The examination volume is based on Figure 1 from ASME Code Case N-770-1.

(2) Coverage has been calculated based on the limitations contained in the Section XI, Appendix VIII-qualified examination procedure, SI-UT-130 R3, which is not qualified for examinations performed from the cast austenitic stainless steel (CASS) material side of the component.

(3) Calculated coverage values include the CASS material that was interrogated by the examination technique.

(4) Examination coverage of the susceptible material located in the lower 1/3 thickness region of the base material has been estimated based on original design drawings.

6. Burden Caused by Compliance

In accordance with 10 CFR 50.55a(a)(3)(ii), relief is requested for the components listed in Table A above on the basis that the required examination coverage of "essentially 100 percent" or "100 percent of the susceptible material volume" for cast stainless steel items is unattainable due to physical obstructions and the limitations imposed by design, geometry, and materials of construction. Calvert Cliffs used examination techniques qualified to meet the requirements of ASME Section XI, Appendix VIII, as required in 10 CFR 50.55a(g)(6), that achieved the maximum practical amount of coverage obtainable within the limitations imposed by the design, geometry and materials of construction for the components and examination techniques listed.

Based on the design configuration of the components and available examinations techniques, Calvert Cliffs was not able to achieve 100 percent coverage of the susceptible material examination volume and/or essentially 100 percent code coverage of the required examination volume for five welds without major modifications to the components. Plots of the ultrasonic testing (UT) coverage of the examination volume of those five welds are provided. Although essentially 100 percent code coverage was not obtained, every effort was made to obtain the maximum practical coverage. The combination of coverage amount combined with the examination techniques discussed below, contributed to maintaining a high level of quality and safety.

7. Proposed Alternative and Basis for Use

Dissimilar metal weld examinations performed at Calvert Cliffs during the 2011 refueling outage employed phased array (PA) UT technology. Utilizing PA UT technology not only improves the overall effectiveness of the UT examination but also provides significant performance improvements when compared to conventional examination methodologies.

The DM welds were examined utilizing Structural Integrity's proprietary manual PA procedure, SI-UT-130 R3. This procedure has been qualified in accordance with the requirements of Section XI, Appendix VIII, Supplement 10 for the manual PA UT examination technique. This technique has been Performance Demonstration Initiative-qualified to detect and characterize (length and depth size) service-induced damage in the form of Primary Water Stress Corrosion Cracking (PWSCC). The SI-UT-130 R3 procedure is also qualified to scan DM welds with single-sided access. This single-sided access qualification allows for full interrogation of DM welds that have cast stainless steel safe ends, or restrict scanning conditions from the opposite side. The application of Structural Integrity's PA UT technology allows for a reduction in the number of required examination scans across the surface of the component, while matching or exceeding the maximum achievable coverage of the Code-required weld and adjacent base material volume of any currently qualified ultrasonic technique. The capability of PA to provide increased examination coverage is inherently evident when applied to limited-access scanning surfaces.

Using the PA technique, examination coverage is greater than conventional techniques for constrained configurations. This is because the procedure employs a large number of discrete examination angles (including credit for a low angle of 30-degrees), which, in addition to increased examination coverage, provides superior material insonification by utilizing many different angular sound paths, thereby optimizing penetration into highly attenuative materials. The technique also includes a 10 degree electronic skew for circumferential scanning beam angles, which significantly improves examination coverage. Where improvement of coverage could be realized, Calvert Cliffs performed additional surface preparation.

The major limitation to achieving essentially 100 percent coverage and/or 100 percent coverage of the susceptible examination volume is the presence of cast stainless steel. All DM welds ≥ 12 inches contain cast stainless steel safe ends. For these welds containing cast stainless steel items, no component qualification supplement is available in Section XI, Appendix VIII. Therefore, the required examination volume was examined by Section XI, Appendix VIII, Supplement 10-qualified procedures to the maximum extent practical including 100 percent of the susceptible material volume (non-stainless steel volume).

As specified in IWA-2232 (ASME Section XI, 2004), the ultrasonic examination of piping welds is required to be performed in accordance with Appendix I. Appendix I requires that ultrasonic examination procedures, equipment, and personnel are to be qualified by Performance Demonstration in accordance with Section XI, Appendix VIII. Since requirements within Section XI, Appendix VIII for examination of cast austenitic component types are in the course of preparation, VIII-3110(c) requires the use of Appendix III. Subsequently, the requirements for Appendix III, paragraph III-1100 apply. Paragraph III-1100(c) allows alternative examination techniques, calibration block designs, and materials as provided in IWA-2240, except when the requirements of paragraph III-3430 apply. Paragraph III-3430 allows an alternate calibration block layout, provided similar beam paths are utilized, and allows additional reflectors provided they do not interfere with establishing the primary reference. Supplement 1 of Appendix III describes additional requirements for examination of austenitic and DM welds which are in combination with cast materials. Supplement 1(b)(4) cautions that cast austenitic materials may preclude meaningful examinations because of geometry and attenuation variables.

Dissimilar metal welds with cast austenitic material were examined using procedures, equipment, and personnel which were qualified on blind samples containing real cracks, realistic configurations, and cast austenitic materials. The qualified examination process applied includes calibration requirements with similar ultrasonic beam paths, scanning sensitivity based on the maximum allowable within the materials, and an array of angles from 30 to 70 degrees. These examination processes are superior to the requirements of Appendix III which does not require qualification on blind samples containing real cracks or realistic configurations.

This examination process meets IWA-2240 because the application of PA techniques qualified under the rules of Section XI, Appendix VIII provides a superior examination with newly developed techniques that have been reviewed and demonstrated to the Authorized Nuclear Inservice Inspector.

All of the unmitigated welds are found in lower temperature regions of the reactor coolant system (at temperatures near T_{cold}). Therefore, there is a lower probability of crack initiation and a slower crack growth rate. These welds are also highly flaw tolerant, as demonstrated in MRP-109 (Reference 2). As shown in this reference, continued operation without repair can be demonstrated for substantial flaw sizes.

Where appropriate, contouring has already been completed on the examination surface. Further actions are limited by the design minimum wall calculations for the piping. Additional axial flaw coverage would require a weld build up of the DM weld followed by additional contouring and a Construction Code required radiography examination. These additional steps to improve axial coverage constitute a hardship that does not result in an increase to health and safety of the public.

Additionally, bare metal visual examinations in accordance with ASME Code Case N-722 were performed on the subject components of the reactor coolant pressure boundary during the 2011

refueling outage. Those examinations identified no evidence of leakage for these components. During refueling outages, qualified examiners walk down Class 1 systems at pressurized conditions and cold shutdown conditions. These walkdowns are performed to satisfy ASME Code pressure testing requirements and the Boric Acid Corrosion Control Program. Adverse conditions are addressed by the station's corrective action program.

Therefore, the UT examination coverages, which include a large percentage of the susceptible material for the circumferential and axial flaws, combined with the periodic system pressure tests and outage walk downs, provide an acceptable level of quality and safety for identifying degradation from PWSCC prior to the development of a safety significant flaw.

8. Conclusion

The NRC incorporated ASME Code Case N-770-1 into 10 CFR 50.55a by reference. Specific implementing requirements are documented in 10 CFR 50.55a(g)(6)(ii)(F). The relevant examination coverage of five DM welds applicable to Calvert Cliffs Unit 2 are shown in Table A.

Item (3) of 10 CFR 50.55a(g)(6)(ii)(F) requires that baseline examinations for the welds in Table 1 of ASME Code Case N-770-1 be completed by the end of the next refueling outage after January 20, 2012. Previous examinations may be credited if they have met the following criteria:

1. Examinations were performed using a procedure that meets the requirements of ASME Code Section XI, Appendix VIII and;
2. The Code required examination volume of essentially 100 percent coverage has been obtained.

If the previous examinations do not meet these requirements, they can still be used to meet the baseline examination requirements, provided that NRC approval of alternative inspection requirements is granted prior to the end of the next refueling outage after January 20, 2012.

All examinations were performed in accordance with MRP-139 (Reference 1) requirements. Results from the examinations were documented in the ISI refueling outage report. However, with the conditions imposed by 10 CFR 50.55a(g)(6)(ii)(F)(3) and (4) all welds with cast safe end material currently require regulatory approval. Therefore, reasonable assurance of quality and safety is based on the achieved coverage and the ASME Code Case N-722 visual examinations performed.

9. Duration of Proposed Alternative

Relief is requested to accept the baseline examinations performed in 2011 for the Fourth Ten-year Interval of the Inservice Inspection Program for Calvert Cliffs which was effective from October 2009, ending on June 30, 2019 for Unit 2.

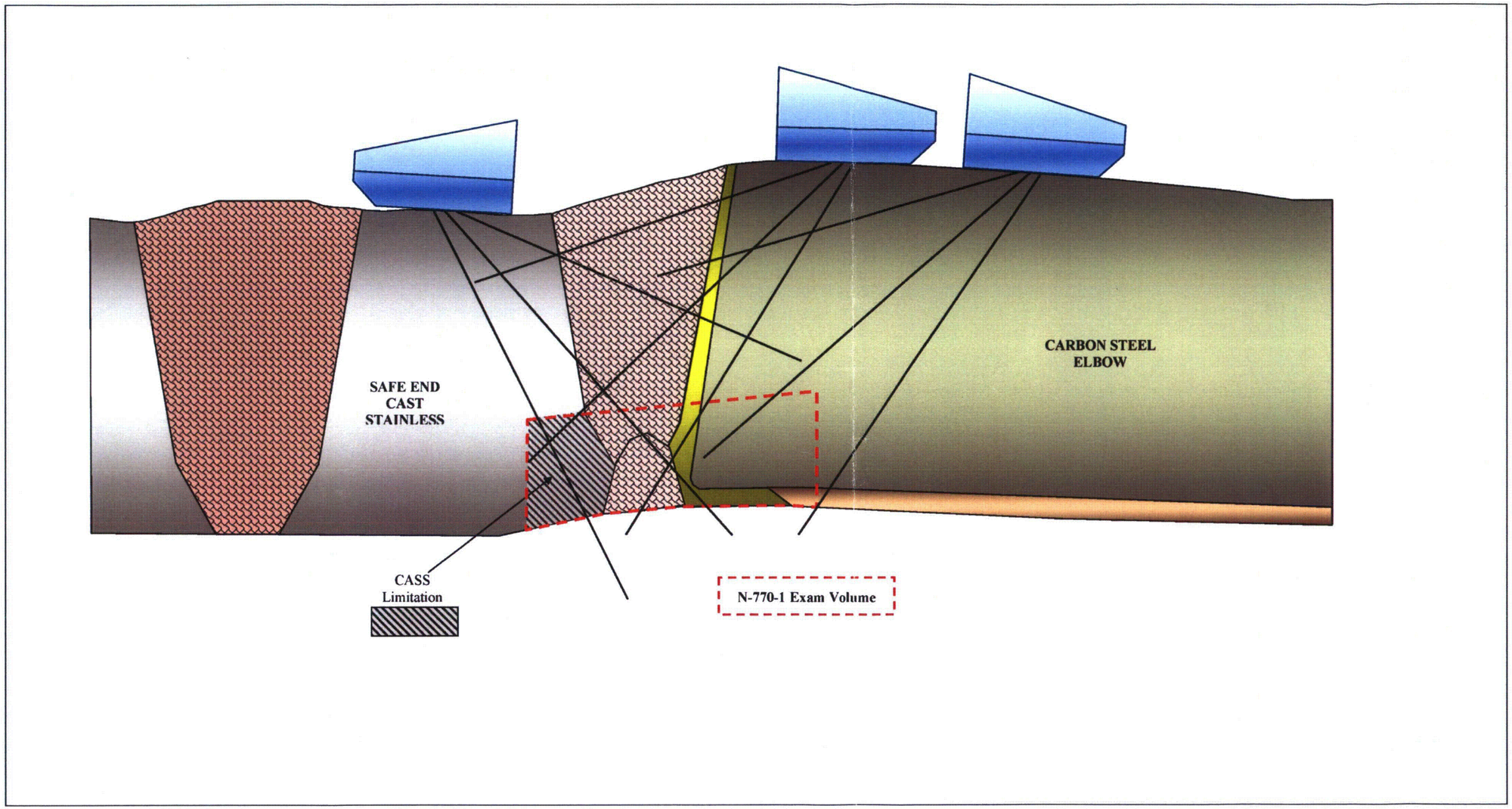
10. References

1. EPRI MRP-139, Revision 1, Material Reliability Program: Primary System Piping Butt Weld Inspection and Evaluation Guideline, December 2009, Electric Power Research Institute
2. EPRI MRP-109, Revision 0, Materials Reliability Program Alloy 82/182 Pipe Butt Weld Safety Assessment for U. S. PWR Plant Designs, April 2005, Electric Power Research Institute

ENCLOSURE 1

Unit 2 Examination Coverage Plots

CCNPP U2 LTP # 109280 / 30-RC-21A-7
Examination Coverage



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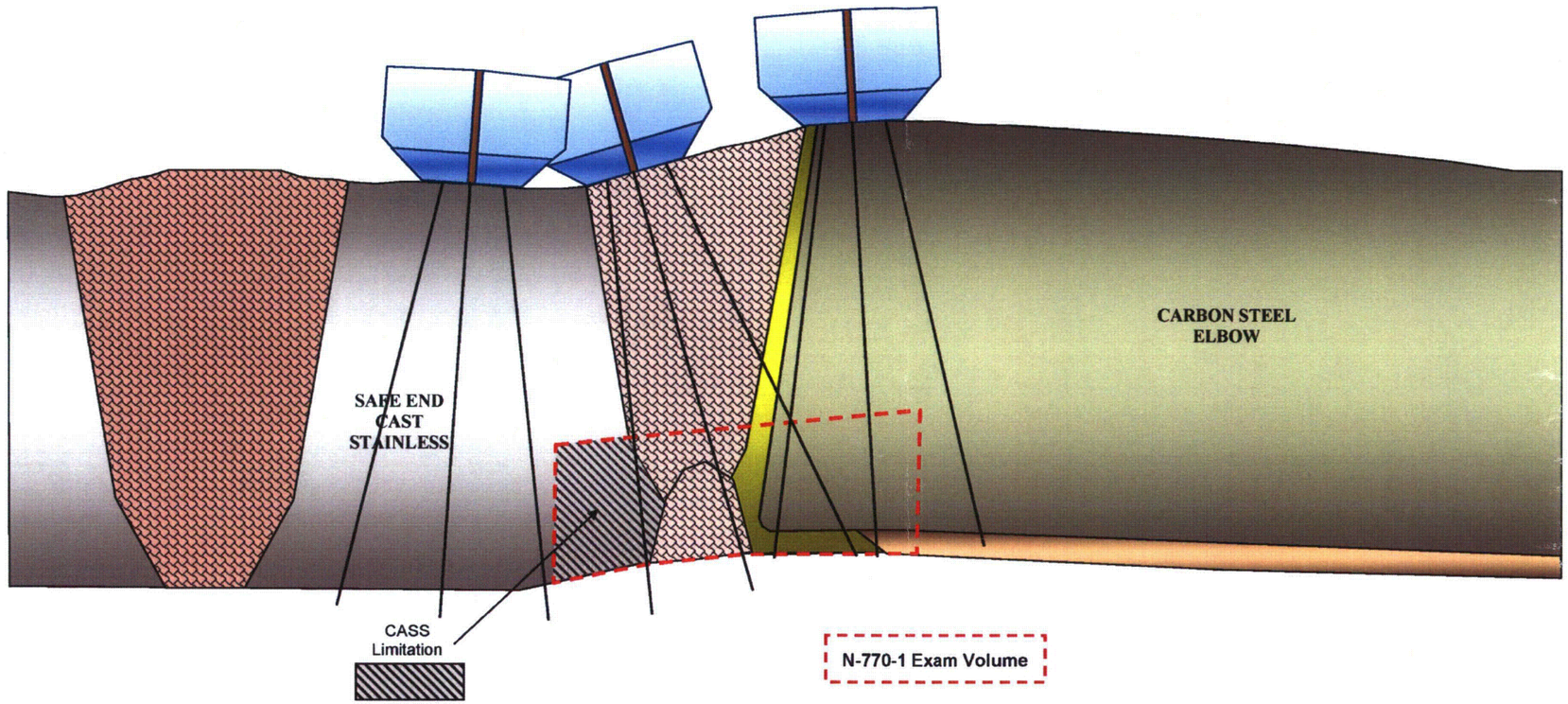

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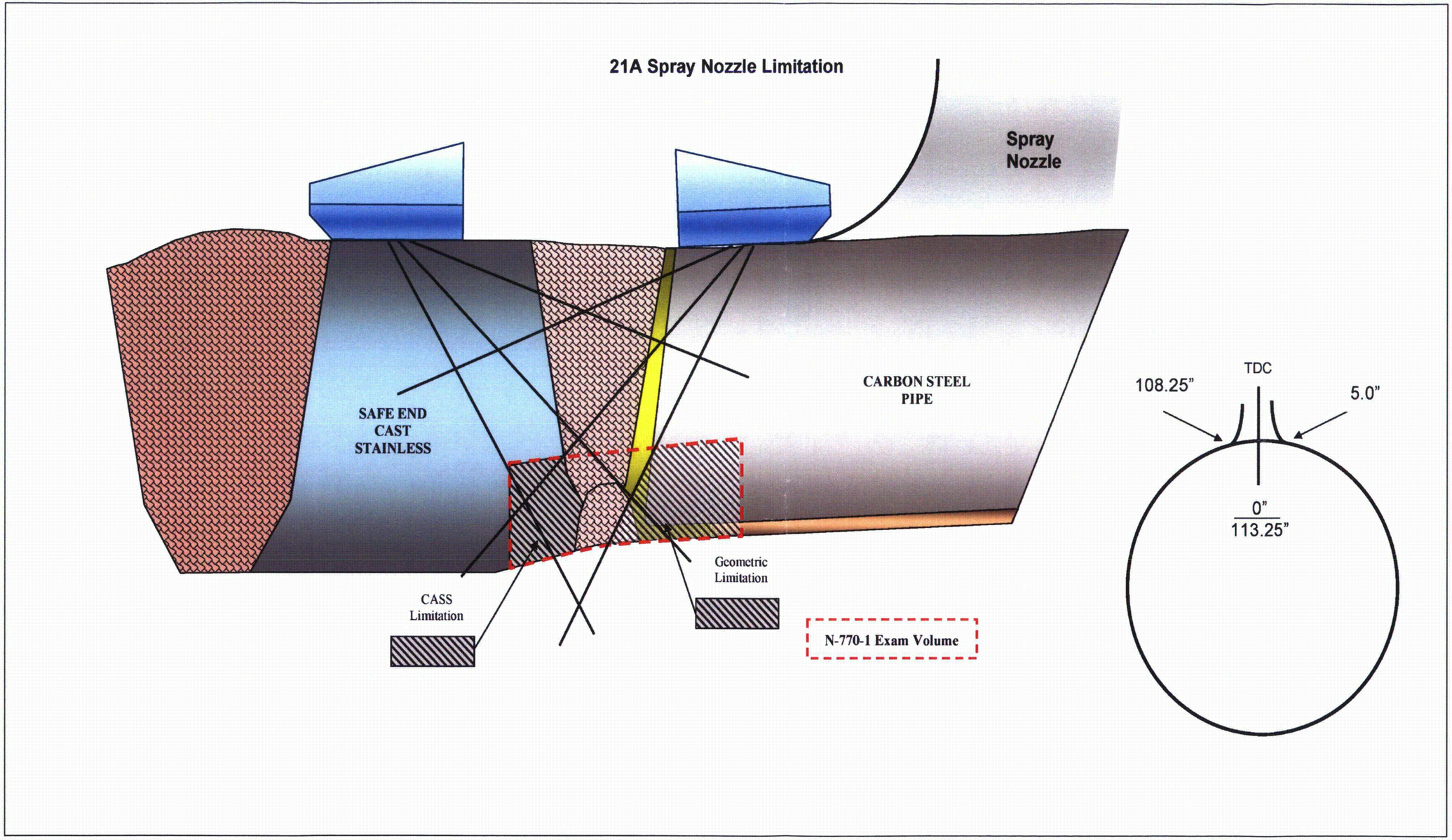

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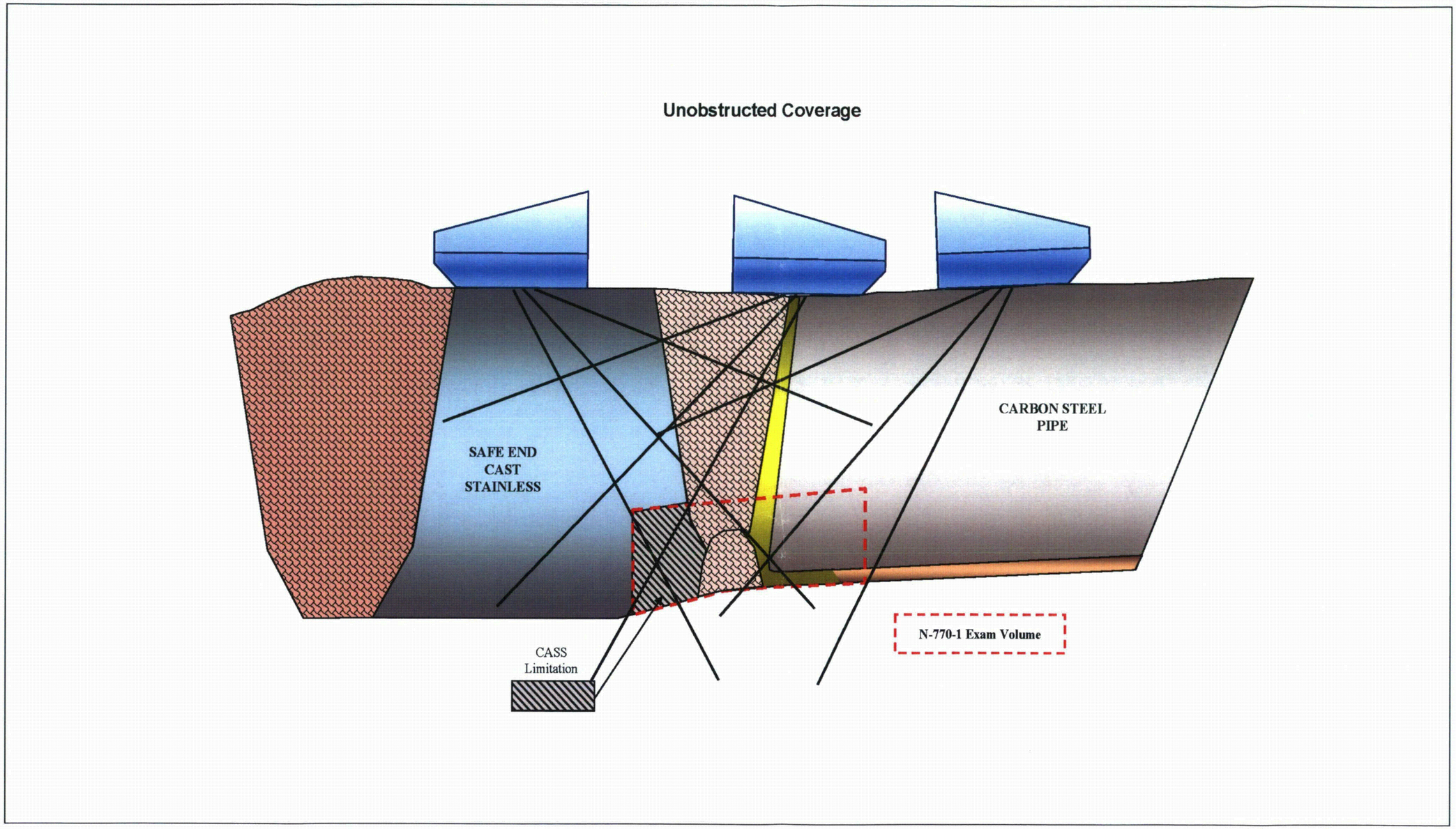

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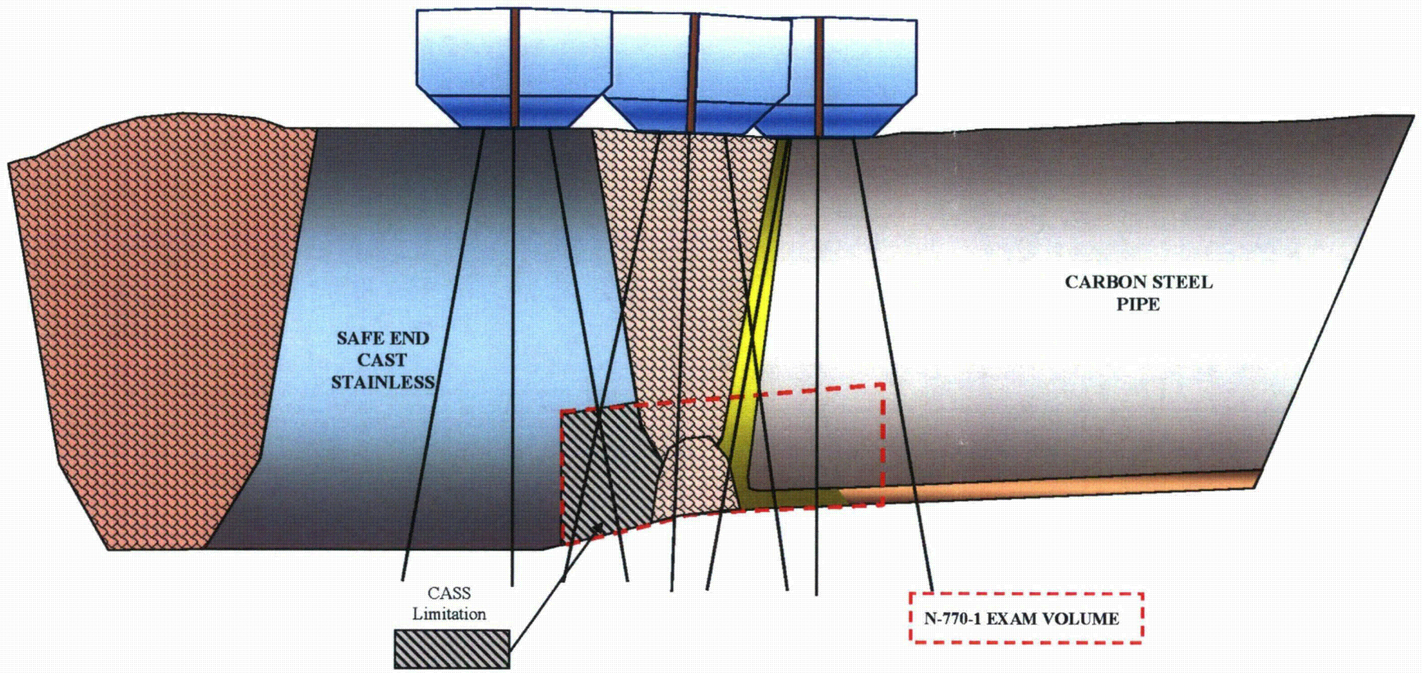

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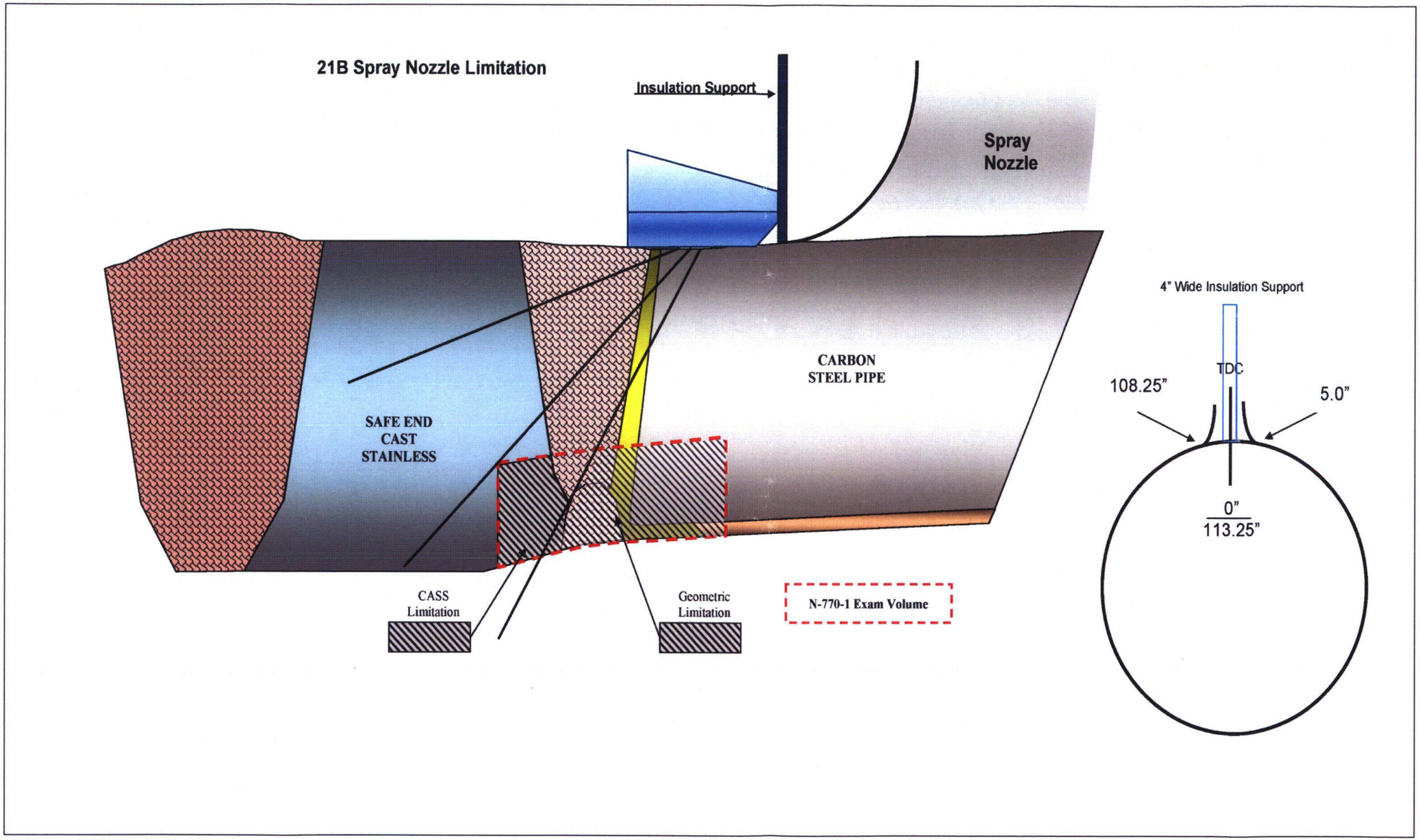

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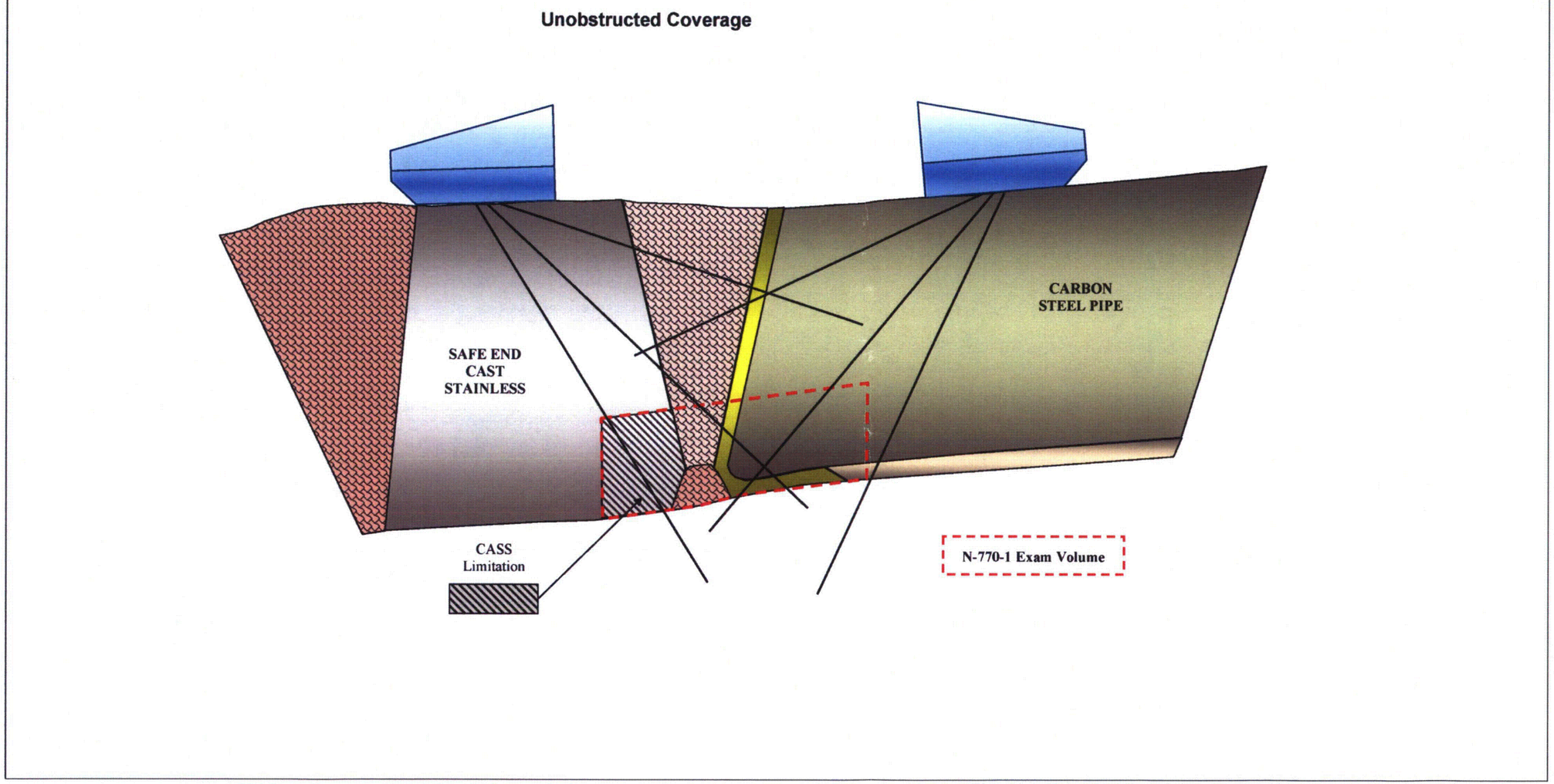

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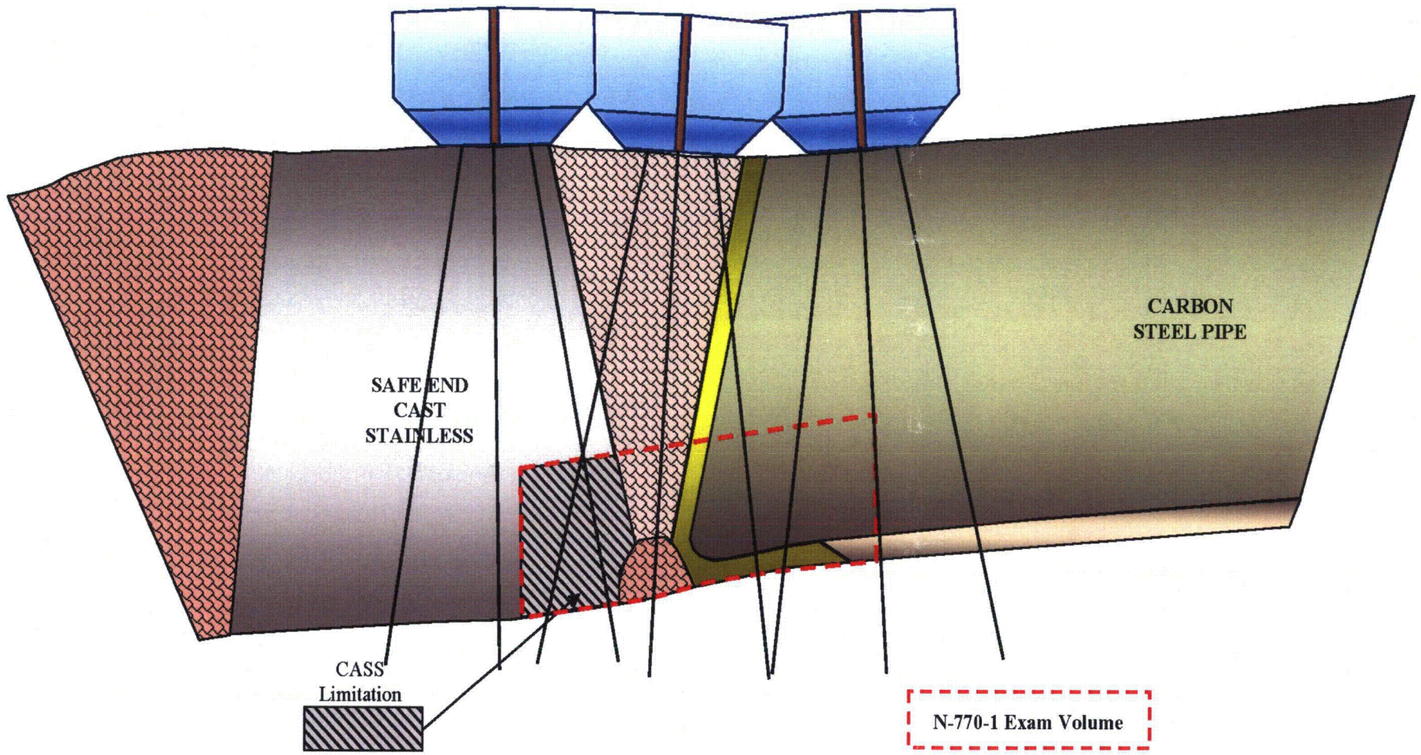

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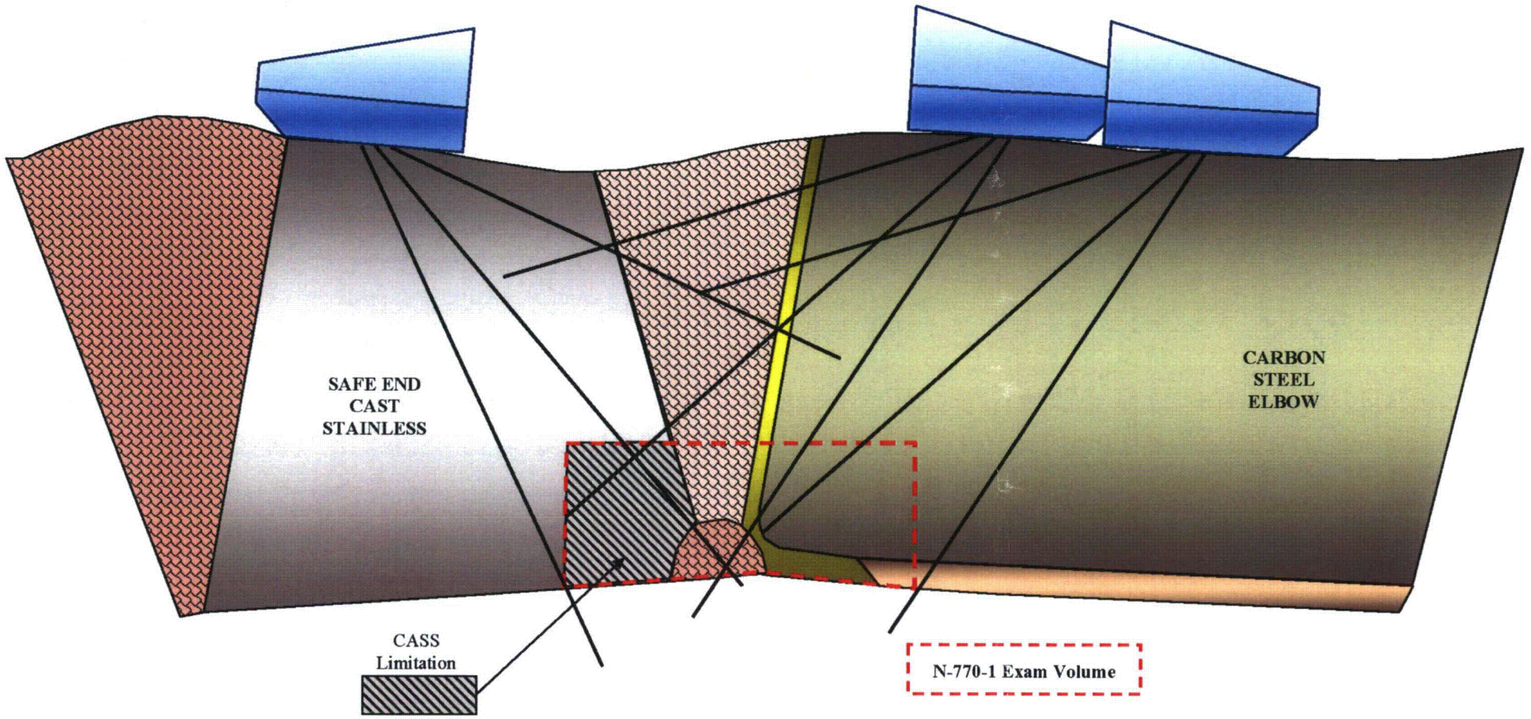

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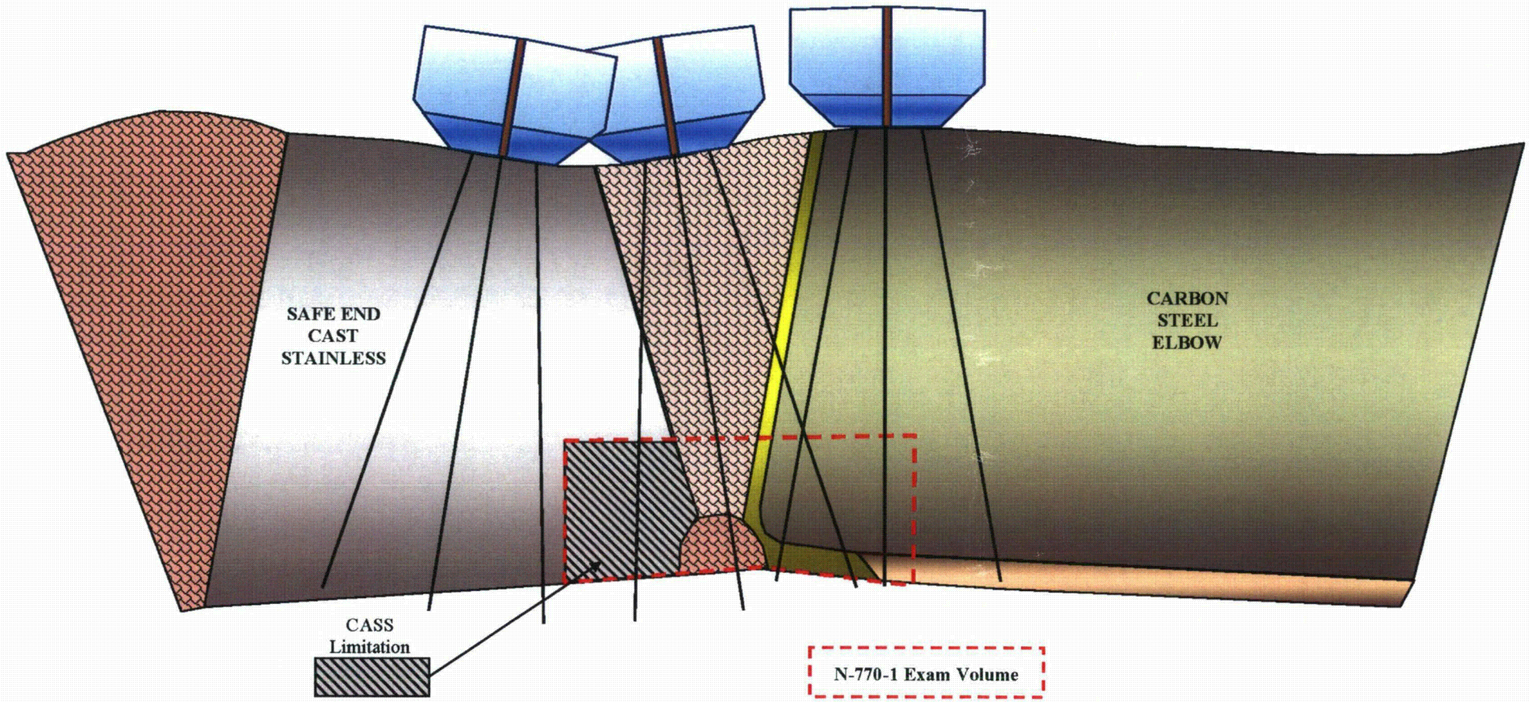

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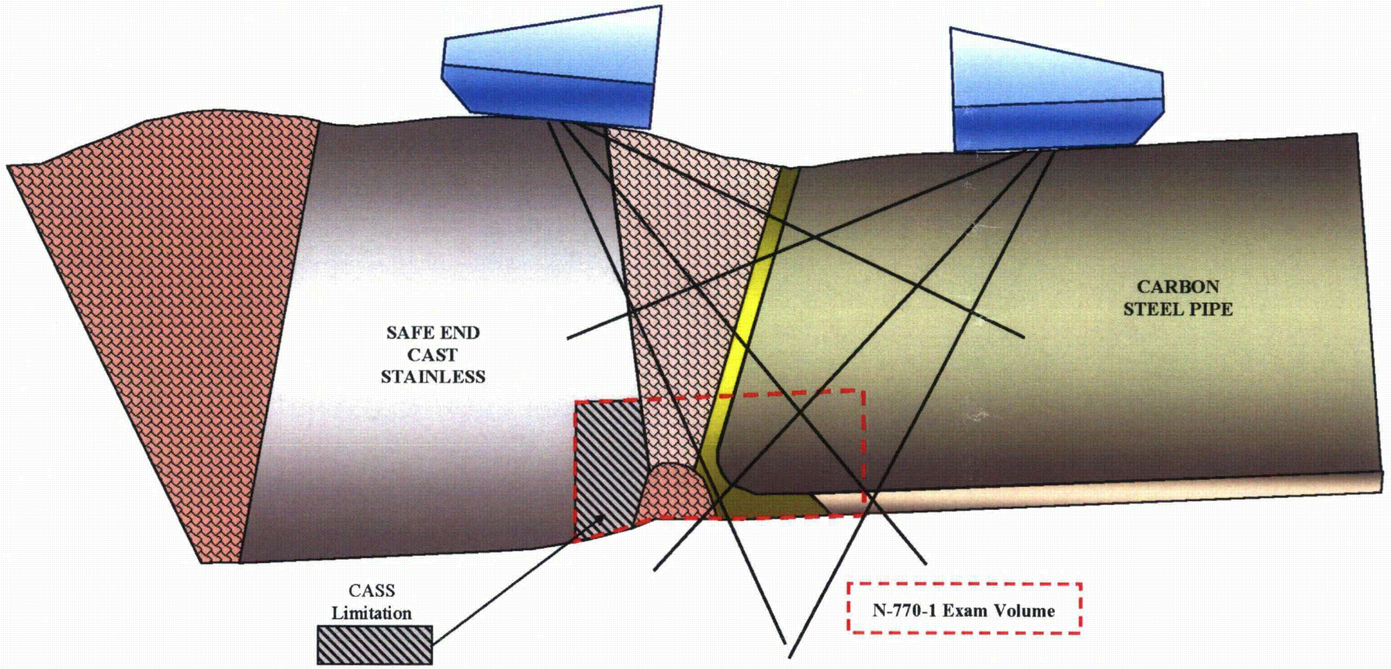

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