WOLF CREEK
NUCLEAR OPERATING CORPORATION

Terry J. Garrett
Vice President, Engineering

November 17, 2006

ET 06-0055

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

Reference:
1) Letter ET 06-0044, dated October 2, 2006, from T. J. Garrett, WCNOC, to USNRC
2) Letter ET 06-0042, dated September 27, 2006, from T. J. Garrett, WCNOC, to USNRC
3) Letter ET 06-0031, dated August 4, 2006, from T. J. Garrett, WCNOC, to USNRC
4) Letter ET 06-0021, dated May 19, 2006, from T. J. Garrett, WCNOC, to USNRC

Subject: Docket No. 50-482: Results of the Ultrasonic Examinations of the Full Structural Weld Overlays on the Pressurizer Nozzle Welds

Gentlemen:

During Refueling Outage 15, Wolf Creek Nuclear Operating Corporation (WCNOC) performed full structural weld overlays on the Wolf Creek Generating Station (WCGS) Pressurizer safety, relief, spray and surge line nozzle welds. This submittal provides the results of the ultrasonic examinations of the full structural weld overlays on the Pressurizer nozzle welds as committed to in Reference 1.

Reference 4 provided Wolf Creek Nuclear Operating Corporation (WCNOC) 10 CFR 50.55a Request I3R-05, which requested alternatives to the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (BPV) Code, Section XI for the installation and examination of full structural weld overlays for repairing/mitigating Pressurizer nozzle-to-safe end dissimilar metal (DM) and safe end-to-piping stainless steel (SS) butt welds. Reference 3 provided WCNOC's responses to a July 6, 2006 Nuclear Regulatory Commission (NRC) request for additional information (RAI) regarding the WCNOC 10 CFR 50.55a Request I3R-05 and provided Revision 1 to I3R-05 to address two WCNOC responses to the RAI.

A047

Reference 2 provided WCNOC's responses to RAIs provided electronically on September 20, 2006. Reference 1 revised the regulatory commitments to include information relevant to subsequent inservice examinations and footnotes that reiterate information found in the Performance Demonstration Initiative qualified ultrasonic examination procedures.

This letter contains no commitments. If you have any questions concerning this matter, please contact me at (620) 364-4084, or Mr. Kevin Moles at (620) 364-4126.

Very truly yours,

Terry J. Garrett

TJG/rlt

Attachment
Enclosures:
I - Relief Nozzle Indication Evaluation
II - "C" Safety Nozzle Pre-Repair Indication Evaluation
III - "C" Safety Nozzle Post-Repair Indication Evaluation
IV - Spray Nozzle Pre-Repair Indication Evaluation
V - Spray Nozzle Post-Repair Indication Evaluation

cc: J. N. Donohew (NRC); w/a, w/e
B. S. Mallett (NRC); w/a, w/e
G. B. Miller (NRC); w/a, w/e
Senior Resident Inspector (NRC); w/a, w/e

Results of Ultrasonic Examinations of Full Structural Weld Overlays of the Wolf Creek Generating Station Pressurizer Nozzle Welds

The results of the ultrasonic (UT) examinations of the weld overlays of the Wolf Creek Generating Station (WCGS) Pressurizer nozzle welds and related repairs are provided below and in the noted enclosures.

Surge nozzle weld overlay and "A" and "B" safety nozzle weld overlays. No recordable indications were identified. However, prior to final examinations, an in-process excavation and repair was performed on an upper portion of the surge nozzle weld overlay due to machine welding travel speed adjustment problems. No repairs were performed on the "A" safety and "B" safety nozzle weld overlays.

Relief nozzle weld overlay. Two recordable indications (one laminar and one planar) were identified and were acceptable. See Enclosure I for the evaluation/disposition of the indications. No repairs were performed on the weld overlay.

"C" Safety nozzle weld overlay. Two recordable indications (one laminar and one planar) were identified. See Enclosure II for the evaluation/disposition of the indications. As documented in Enclosure II, indication #2 (planar indication) was unacceptable per Table IWB-3514-2, requiring repair. This repair was performed by excavating the unacceptable indication. In the process of removing the unacceptable planar indication, the laminar indication was also removed. The excavated area was repaired by welding. The repair area was reexamined and one recordable (but acceptable) indication (laminar) was found in this area. See Enclosure III for the evaluation/disposition of this acceptable indication

Spray nozzle weld overlay. An in-process repair was performed on the first layer of the Spray nozzle weld overlay prior to installing the subsequent weld layers due to lack of bond indications. This resulted in removal of some base metal and reinstallation of the first layer of weld overlay. After completion of welding, an informational UT exam was conducted during the ASME Code Case N-638-1 required 48 hour hold time. Two recordable indications (both laminar) were identified. See Enclosure IV for the evaluation/disposition of the indications. Indication #1 location, as shown in Enclosure IV, is actually at the base metal to weld overlay interface after performing the in-process repair of the first layer, as discussed above. As documented in Enclosure IV, indication #2 was unacceptable per Table IWB-3514-3, requiring repair. The unacceptable indication was excavated and repaired by welding. After repair, the final UT examinations of the required volumes were performed. One recordable indication (laminar) was found and was acceptable. See Enclosure V for the evaluation/disposition of this indication.

All of the laminar indications noted above appear to be the result of a lack of bond indications between the base metal and the overlay. All of the planar indications noted above appear to be the result of inter-bead lack of fusion indications stacking up on the weld beads. No flaws were found in base materials that required repair.

ENCLOSURE I

RELIEF NOZZLE INDICATION EVALUATION

FLAW INDICATION EVALUATION SUMMARY FOR: PORV NOZZLE		
Appendix Q Criteria	**Acceptance Standard**	**Summary of Results**
Evaluation: Laminar Flaw Indications [Ref. 9.1 of Evaluation Worksheet]	ASME Section XI, 1998 Edition 2000 Addenda, Table IWB-3514-3	ACCEPTABLE CONDITION: The single laminar flaw indication is acceptable with an area of 1.5 sq. in. compared with the 7.5 sq. in. allowable.
Evaluation: Reduction in Coverage in the PSI/ISI Base Material Examination Volume Due to Laminar Flaw Indications [Ref. 9.2 of Evaluation Worksheet]	<10% Reduction in Coverage	ACCEPTABLE CONDITION: For the SS weld examination volume, the reduction in coverage (RiC) for circumferential beams is 0.8%, and the RiC for axial beams is 1.41%. For the DM weld examination volume, there is no RiC.
Evaluation: Consideration of the Largest Radial Planar Flaw (Axial and Circumferential) That Could Exist in Any Uninspectable Volume Within the Weld Overlay Examination Volume [Ref. 9.3 of Evaluation Worksheet]	ASME Section XI, 1998 Edition 2000 Addenda, Table IWB-3514-2 Inservice Examination Standards	ACCEPTABLE CONDITION: The assumed axial planar flaw due to the laminar flaw indication has an actual a/t of 5.6% versus the allowable a/t of 12.8%. The assumed circumferential planar flaw due to the laminar flaw indication has an actual a/t of 6.2% versus the allowable a/t of 17.1%.
Evaluation: Planar Flaw Indications in PSI/ISI Base Material and Weld Overlay Examination Volumes [Ref. 9.4 of Evaluation Worksheet]	ASME Section XI, 1998 Edition 2000 Addenda, Table IWB-3514-2 Preservice Examination Standards	ACCEPTABLE CONDITION: The single planar flaw indication has no measurable through-wall dimension.
Evaluation: Flaw Indications in PSI/ISI Base Material Examination Volume and Within Outer 25% of Underlying Weld and Base Metal Must Satisfy Design Requirements of the Weld Overlay [Ref. 9.5 of Evaluation Worksheet]	Design Requirements of the Weld Overlay	ACCEPTABLE CONDITION: No planar flaw indications were detected in the outer 25% of the underlying weld and base metal.

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Preparer:

Date: Oct. 26, 2006

WesDyne Level III Review:

Date: 10/27/06

ATTACHED FLAW INDICATION EVALUATION SHEETS:
Evaluation
Indication Plots
Reduction in Coverage Plots
Assumed Planar Flaw Plots
Layout of Indications

FLAW INDICATION PLOTS DESCRIBING THE LOCATION AND MEASURED DIMENSIONS OF THE FLAW INDICATIONS ARE ATTACHED.

Summary of Flaw Indications: (information taken from attached indication plots and referenced UT indication reports)

Indication #	Indication Type	Measured Width at Overlay OD Surface (in)	Measured Length at Overlay OD Surface (in)	Average Radial Position of Indication in Exam Volume (in)	Measured Circumference of Overlay Surface @ Indication (in)	Estimated Outer Radius of Weld Overlay @ Indication (in)	Corrected Length @ Indication (in)	Tswol @ Indication (in) [Note 1]	Measured Through-wall Dimension of Planar Flaw Indications (in)	
1	Laminar	0.30	6.25	3.34	26.00	4.14	5.04	0.88	N/A	
2	Planar	0.00	2.00	3.25	26.00	4.14	1.57	0.88	N/A	not measurable
Combined Laminar Indications										
						0.00	#DIV/0!			
						0.00	#DIV/0!			

NOTE 1: Tswol is measured from the weld overlay OD surface perpendicular to the pipe axis to the weld overlay/base metal interface using the nearest cross-section profile. For combined inidications, the Tswol is an average.

REFERENCES:
1. WesDyne Procedure WDI-STD-1007, Revision 0
2. WesDyne Overlay Ultrasonic Indication Report Sheet for PORV

Evaluation of Structural Weld Overlay Inspection Indications in Accordance with ASME Code Section XI, Appendix Q (2004 Ed., 2005 Addenda):

Acceptance Criteria:

9.1 Laminar flaws in the weld overlay examination volume shall meet the acceptance standards of Table IWB-3514-3. [Ref. Appendix Q, Q-4100 (c)(1)]:

Individual Indication Evaluation per Table IWB-3514-3:

Indication #	Measured Area (Measured Width x Corrected Length) (sq	Allowable Laminar Flaw per Table IWB-3514-3 (sq. in)	Acceptable or Unacceptable
1	1.5	7.5	Acceptable

9.2 The reduction of coverage to the PSI/ISI examination volume, as defined in PDI-UT-8, due to laminar flaws is to be less than 10%
The dimensions of the uninspectable volume are dependent on the coverage achieved with the angle beam examination of the weld overlay.
[Ref. Appendix Q, Q-4100 (c)(2)]

FLAW INDICATION PLOTS INDICATING THE REDUCTION IN COVERAGE IN THE PSI/ISI EXAMINATION VOLUME DUE TO LAMINAR FLAW INDICATIONS ARE ATTACHED.

Total PSI/ISI Examination Volumes: (averaged using on 0-degree cross-section):

	Calculated Cross-Sectional Area by Drawing Package (in^2)	Average Radius of Exam Volume (in)	Average Circumference of Exam Volume (in)	Total Exam Volume (in^3)
Total PSI/ISI Exam Volume of Nozzle/Safe End (DM) Weld:	2.90	4.08	25.64	74.34
Total PSI/ISI Exam Volume of Safe End/Pipe (SS) Weld:	2.20	3.74	23.50	51.70

PSI/ISI Examination Volume Nozzle/Safe End (DM) Weld Reduction in Coverage (RIC) from flaw indications based on Angle Beam (Circ Scan Direction):

	Calculated Circumferential Cross-Sectional Area of RIC by Drawing Package (in^2)	UT Measured Width of Laminar Flaw Indication (in)	RIC Volume for Each Indication (in^3)
NONE			0.00
Total RIC Volume in PSI/ISI Nozzle/Safe End (DM) Weld Exam Volume from Flaw Indications based on Angle Beam (Circ Scan Direction):			0.00

PSI/ISI Examination Volume Nozzle/Safe End (DM) Weld Reduction in Coverage (RIC) from flaw indications based on Angle Beam (Axial Scan Direction):

	Calculated Cross-Sectional Area of RIC by Drawing Package (in^2)	Average Radius of RIC Cross-Section (in)	Weld Overlay OD Surface Radius at Indication (in)	Measured Length of Indication at Weld Overlay OD Surface (in)	Corrected Length of Indication at Average RIC Cross-Section (in)	RIC Volume for Each Indication (in^3)
NONE					#DIV/0!	0.00

Total RIC Volume in PSI/ISI Nozzle/Safe End (DM) Weld Exam Volume from Flaw Indications based on Angle Beam (Axial Scan Direction): 0.00

PSI/ISI Examination Volume Safe End/Pipe (SS) Weld Reduction in Coverage (RIC) from flaw indications based on Angle Beam (Circ Scan Direction):

	Calculated Circumferential Cross-Sectional Area of RIC by Drawing Package (in^2)	UT Measured Width of Laminar Flaw Indication (in)	RIC Volume for Each Indication (in^3)
Indication #1	1.38	0.30	0.41

Total RIC Volume in PSI/ISI Safe End/Pipe (SS) Weld Exam Volume from Flaw Indications based on Angle Beam (Circ Scan Direction): 0.41

PSI/ISI Examination Volume Safe End/Pipe (SS) Weld Reduction in Coverage (RIC) from flaw indications based on Angle Beam (Axial Scan Direction):

	Calculated Cross-Sectional Area of RIC by Drawing Package (in^2)	Average Radius of RIC Cross-Section (in)	Weld Overlay OD Surface Radius at Indication (in)	Measured Length of Indication at Weld Overlay OD Surface (in)	Corrected Length of Indication at Average RIC Cross-Section (in)	RIC Volume for Each Indication (in^3)
Indication #1	0.15	3.20	4.13	6.25	4.84	0.73

Total RIC Volume in PSI/ISI Safe End/Pipe (SS) Weld Exam Volume from Flaw Indications based on Angle Beam (Axial Scan Direction): 0.73

COVERAGE ESTIMATE ASSUMPTION: PSI/ISI volume must be examined in two axial and two circumferential directions to obtain full 100% coverage credit [Ref. PDI-UT-8, Para. 8.8.3]; No averaging applied.

	Total Exam Volume (in^3)	Total RIC Volume (in^3)	% RIC	Status
Percentage of PSI/ISI Examination Volume Nozzle/Safe End (DM) Weld Not Covered (Circ Scan Direction):	74.34	0.00	0.00%	ACCEPTABLE
Percentage of PSI/ISI Examination Volume Nozzle/Safe End (DM) Weld Not Covered (Axial Scan Direction):	74.34	0.00	0.00%	ACCEPTABLE

	Total Exam Volume (in^3)	RIC Volume	% RIC	Status
Percentage of PSI/ISI Examination Volume Safe End/Pipe (SS) Weld Not Covered (Circ Scan Direction):	51.70	0.41	0.80%	ACCEPTABLE
Percentage of PSI/ISI Examination Volume Safe End/Pipe (SS) Weld Not Covered (Axial Scan Direction):	51.70	0.73	1.41%	ACCEPTABLE

9.3 Any uninspectable volume in the weld overlay is to be assumed to contain the largest radial flaw that could exist in that volume. This assumed flaw is to meet the inservice examination standards of Table IWB-3514-2. Both axial and circumferential planar flaws are to be assumed. [Ref. Appendix Q, Q-4100 (c)(3)]

Largest Axial Planar Flaw in Uninspectable Volume:

Indication #1:

S=	0.79	in.	
2a=	0.10	in.	
a=	0.050	in.	
l=	5.04	in.	corrected length
Tswol=	0.89	in.	Note 1

Flaw indication is SUBSURFACE Note 2

a=	0.050	in.	
a/t=	0.01		
a/t=	12.6	Y %	
a/t=	12.6	%	allowable

Extrapolation of Table IWB-3514-2 Inservice Examination Standard

Aspect Ratio (low)	0.00	t=	0.312	a/t=	13.8	t=	1.0	a/t=	12.6
Aspect Ratio (high)	0.05	t=	0.312	a/t=	14.4	t=	1.0	a/t=	13

a/t=	5.6	%	actual	Aspect Ratio (act)	0.01	t=	0.312	a/t=	13.9	t=	1.0	a/t=	12.7
				Y actual =	15.8								
ACCEPTABLE				Y=	1.0								

Largest Circumferential Planar Flaw in Uninspectable Volume:

Indication #1:

S=	0.79	in.	
2a=	0.11	in.	
a=	0.055	in.	
l=	0.3	in.	
Tswol=	0.89	in.	Note 1

Flaw indication is SUBSURFACE Note 2

a=	0.055	in.	
a/l=	0.18		
a/t=	17.1	Y %	
a/t=	17.1	%	allowable
a/t=	6.2	%	actual
ACCEPTABLE			

Extrapolation of Table IWB-3514-2 Inservice Examination Standard

Aspect Ratio (low)	0.15	t=	0.312	a/t=	17.2	t=	1.0	a/t=	15.7
Aspect Ratio (high)	0.20	t=	0.312	a/t=	17.2	t=	1.0	a/t=	17.7
Aspect Ratio (act)	0.18	t=	0.312	a/t=	17.2	t=	1.0	a/t=	17.0
Y actual =	14.4								
Y=	1.0								

NOTE 1: ASME Section XI, Appendix Q does not explicitly state which nominal wall thickness is to be used. As such the guidelines of ASME Section XI Code Case N-740 are applied; the nominal wall thickness is the thickness of the weld overlay.
NOTE 2: The weld overlay OD surface is considered the only surface for establishing the proximity of each flaw indication to a surface.

9.4 Planar flaw indications found in the PSI/ISI or weld overlay examination volumes, as defined in PDI-UT-8, are to meet the preservice examination acceptance standards of Table IWB-3514-2. [Ref. Appendix Q, Q-4200 (b) and Q-4100 (c)]

Indication #2:

S=	0.88	in.	
2a=	N/A	in.	not measurable
a=	#VALUE!	in.	
l=	1.57	in.	corrected length
Tswol=	0.88	in.	Note 1

Flaw indication is #VALUE! Note 2

a=	#VALUE!	in.	
a/l=	#VALUE!		
a/t=	#VALUE!	### %	
a/t=	#VALUE!	%	allowable
a/t=	#VALUE!	%	actual
ACCEPTABLE			

Extrapolation of Table IWB-3514-2 Pre-service Examination Standard

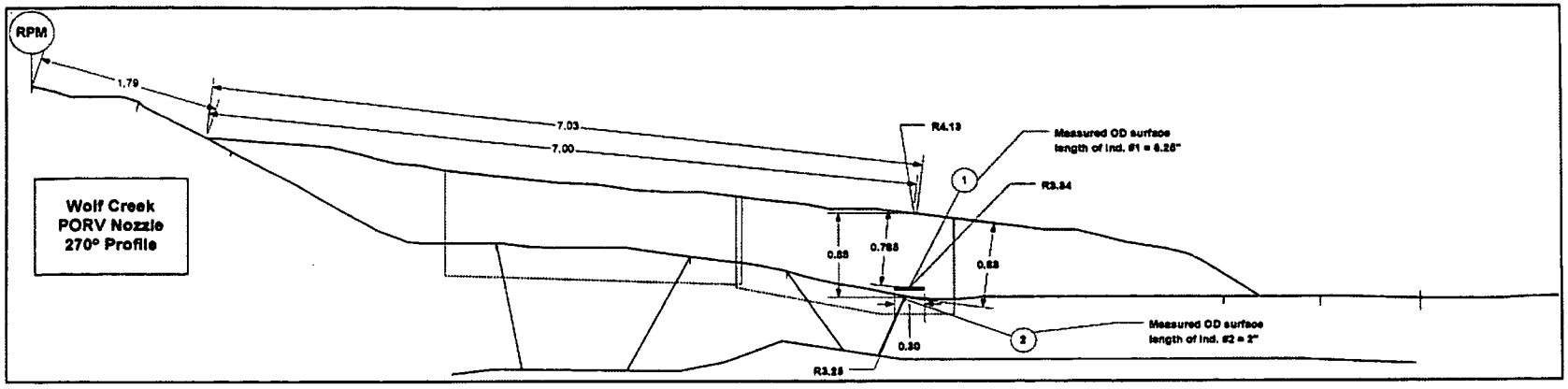
Aspect Ratio (low)	0.05	t=	0.312	a/t=	9.6	t=	1.0	a/t=	8.7
Aspect Ratio (high)	0.10	t=	0.312	a/t=	10.4	t=	1.0	a/t=	9.5
Aspect Ratio (act)	#VALUE!	t=	0.312	a/t=	#VALUE!	t=	1.0	a/t=	#VALUE!
Y actual =	#VALUE!								
Y=	#VALUE!								

NOTE 1: ASME Section XI, Appendix Q does not explicitly state which nominal wall thickness is to be used. As such the guidelines of ASME Section XI Code Case N-740 are applied; the nominal wall thickness is the thickness of the weld overlay.
NOTE 2: The weld overlay OD surface is considered the only surface for establishing the proximity of each flaw indication to a surface.

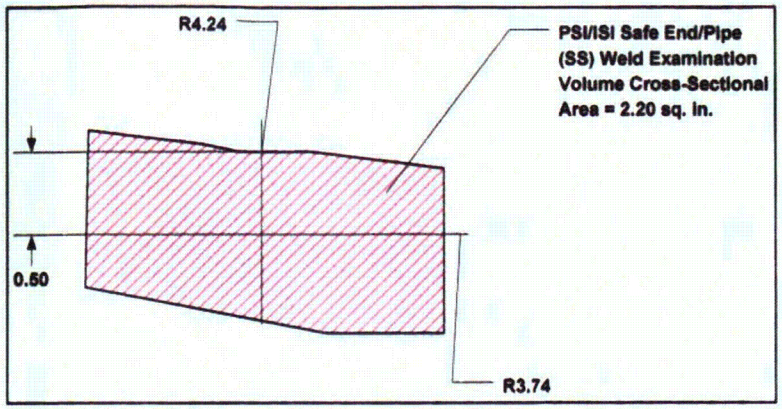
9.5 Flaw indications found in the PSI/ISI examination volume, as defined in PDI-UT-8, and within the outer 25% of the underlying weld and base metal are to satisfy the design analysis requirements of the weld overlay. [Ref. Appendix Q, Q-4200 (b)]

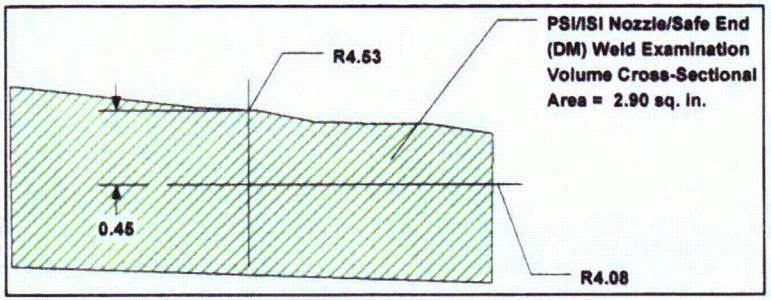
NO PLANAR FLAW INDICATIONS FOUND IN THE OUTER 25% OF THE UNDERLYING WELD AND BASE METAL.

FLAW INDICATION PLOTS

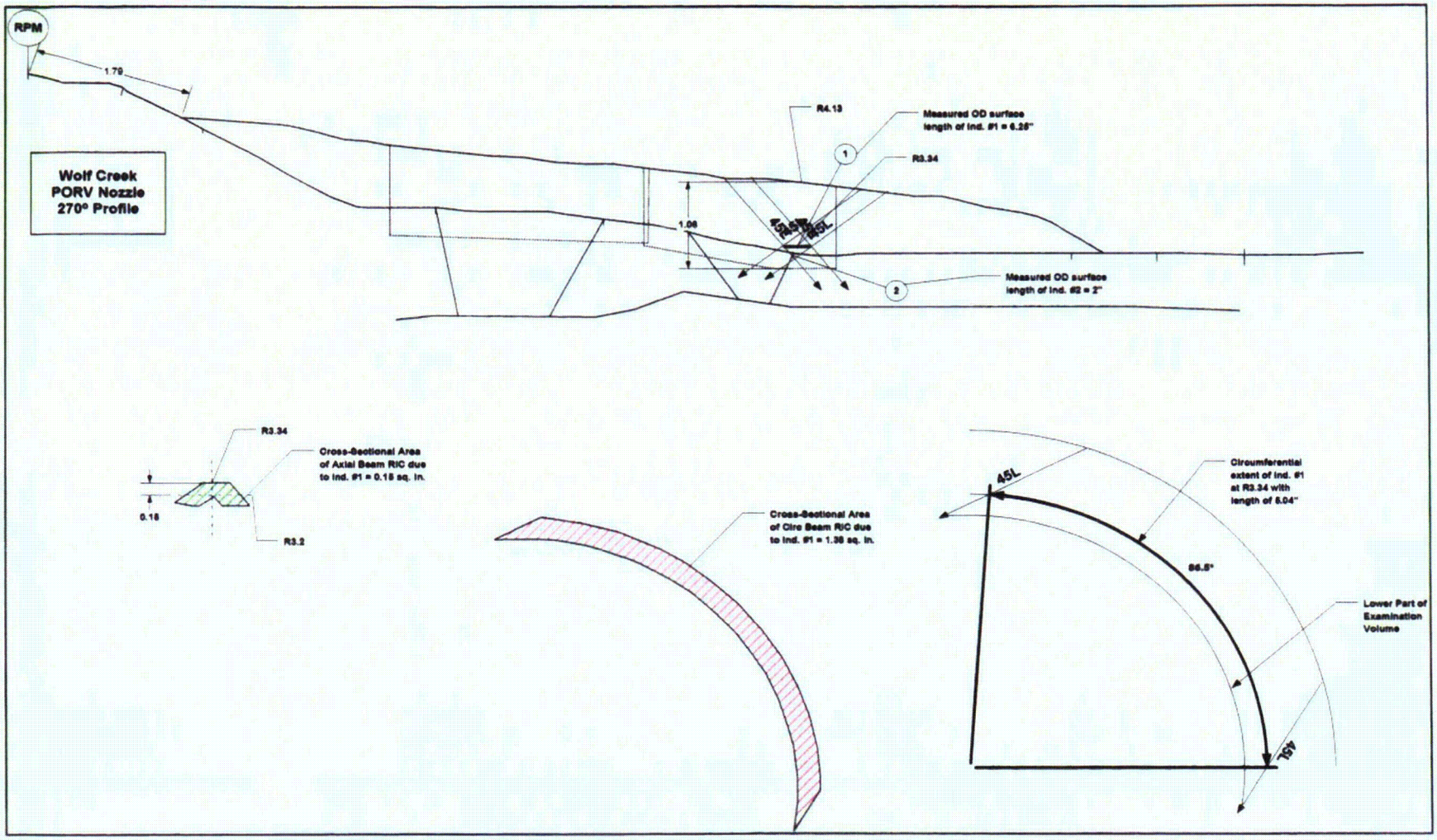


REDUCTION IN COVERAGE PLOTS

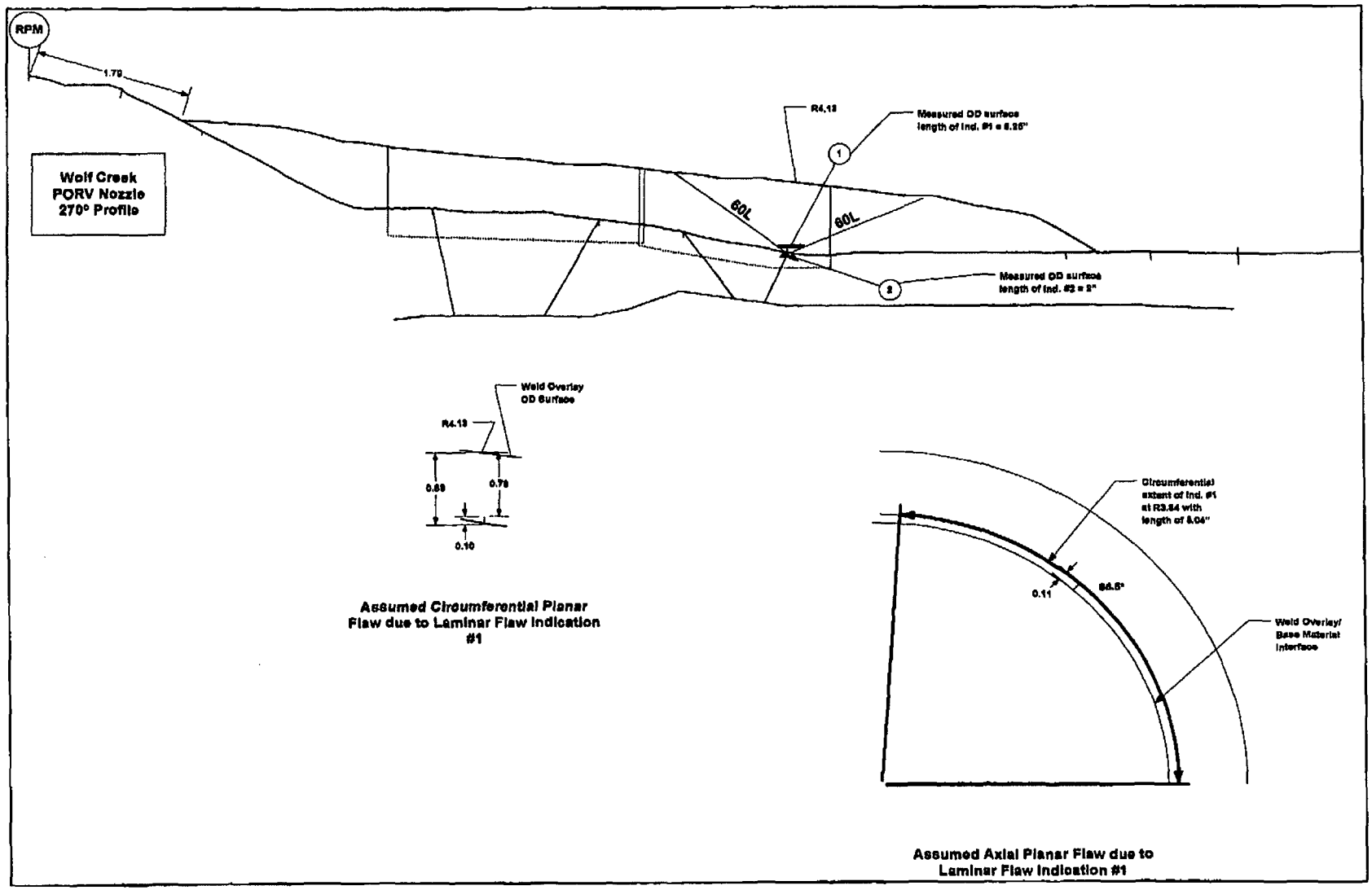




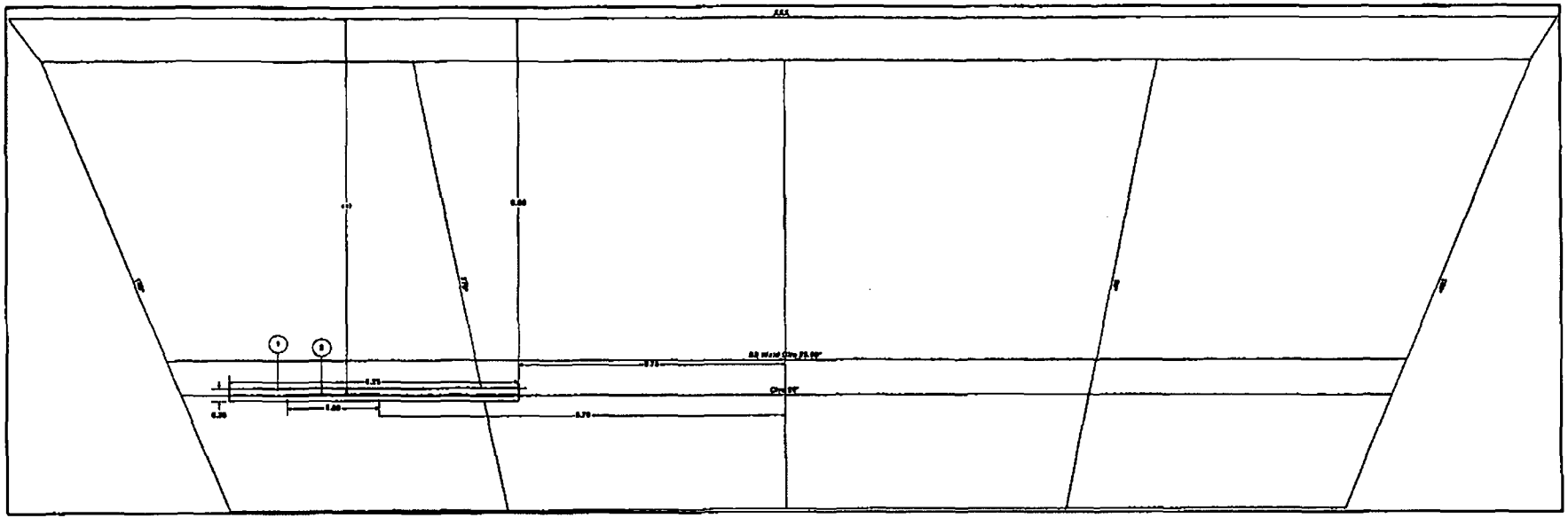
REDUCTION IN COVERAGE PLOTS



ASSUMED LARGEST PLANAR FLAW IN ANY UNINSPECTABLE VOLUME PLOTS



LAYOUT OF INDICATIONS



ENCLOSURE II

"C" SAFETY NOZZLE PRE-REPAIR INDICATION EVALUATION

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FLAW INDICATION EVALUATION SUMMARY FOR: WOLF CREEK SAFETY NOZZLE C		
Appendix Q Criteria	**Acceptance Standard**	**Summary of Results**
Evaluation: Laminar Flaw Indications [Ref. 9.1 of Evaluation Worksheet]	ASME Section XI, 1998 Edition 2000 Addenda, Table IWB-3514-3	ACCEPTABLE CONDITION: The single laminar flaw indication is acceptable with an area of 3.4 sq. in. versus the allowable of 7.5 sq. in.
Evaluation: Reduction in Coverage in the PSI/ISI Base Material Examination Volume Due to Laminar Flaw Indications [Ref. 9.2 of Evaluation Worksheet]	<10% Reduction in Coverage	ACCEPTABLE CONDITION: For the DM Weld, the reduction in coverage (RiC) due to the laminar flaw indication for axial beams is 1.18%; the RiC for circumferential beams is 0.94%. For the SS Weld, there is no RiC due to laminar flaw indications..
Evaluation: Consideration of the Largest Radial Planar Flaw (Axial and Circumferential) That Could Exist in Any Uninspectable Volume Within the Weld Overlay Examination Volume [Ref. 9.3 of Evaluation Worksheet]	ASME Section XI, 1998 Edition 2000 Addenda, Table IWB-3514-2 Inservice Examination Standards	ACCEPTABLE CONDITION: The laminar flaw indication lies primarily at the weld overlay/base metal interface. A planar flaw indication has been detected at same location as laminar flaw indication.
Evaluation: Planar Flaw Indications in PSI/ISI Base Material and Weld Overlay Examination Volumes [Ref. 9.4 of Evaluation Worksheet]	ASME Section XI, 1998 Edition 2000 Addenda, Table IWB-3514-2 Preservice Examination Standards	**UNACCEPTABLE CONDITION: The single planar flaw indication results in an actual a/t of 29.4% versus an allowable a/t of 9.5%.**
Evaluation: Flaw indications in PSI/ISI Base Material Examination Volume and Within Outer 25% of Underlying Weld and Base Metal Must Satisfy Design Requirements of the Weld Overlay [Ref. 9.5 of Evaluation Worksheet]	Design Requirements of the Weld Overlay	ACCEPTABLE CONDITION: No planar flaw indications were detected in the outer 25% of the underlying weld and base metal.

Preparer:	Rick Rishel
Date:	27-Oct-2006
WesDyne Level III Review:	Norm Siniaho
Date:	

ATTACHED FLAW INDICATION EVALUATION SHEETS:
Evaluation
Indication Plots
Reduction in Coverage Plots
Assumed Planar Flaw Plots
Layout of Indications

FLAW INDICATION PLOTS DESCRIBING THE LOCATION AND MEASURED DIMENSIONS OF THE FLAW INDICATIONS ARE ATTACHED.

Summary of Flaw Indications: (information taken from attached indication plots and referenced UT indication reports)

Indication #	Indication Type	Measured Width at Overlay OD Surface (in)	Measured Length at Overlay OD Surface (in)	Average Radial Position of Indication in Exam Volume (in)	Measured Circumference of Overlay Surface @ Indication (in)	Estimated Outer Radius of Weld Overlay @ Indication (in)	Corrected Length @ Indication (in)	Tswol @ Indication (in) [Note 1]	Measured Through-wall Dimension of Planar Flaw Indications (in)	
1	Laminar	1.30	3.00	3.99	28.90	4.60	2.60	0.63	N/A	laminar flaw indication has variable depth from 0.3" to 0.69"
2	Planar	0.00	3.00	3.99	28.90	4.60	2.60	0.63	0.37	

NOTE 1: Tswol is measured from the weld overlay OD surface perpendicular to the pipe axis to the weld overlay/base metal interface using the nearest cross-section profile. For combined inidications, the Tswol is an average.

REFERENCES:
1. WesDyne Procedure WDI-STD-1007, Revision 0
2. WesDyne Overlay Ultrasonic Indication Report Sheet for Safety C (Data Package #WC-UT-001)

Evaluation of Structural Weld Overlay Inspection Indications in Accordance with ASME Code Section XI, Appendix Q (2004 Ed., 2005 Addenda):

Acceptance Criteria:

9.1 Laminar flaws in the weld overlay examination volume shall meet the acceptance standards of Table IWB-3514-3. [Ref. Appendix Q, Q-4100 (c)(1)]:

Individual Indication Evaluation per Table IWB-3514-3:

Indication #	Measured Area (Measured Width x Corrected Length) (sq	Allowable Laminar Flaw per Table IWB-3514-3 (sq. in)	Acceptable or Unacceptable
1	3.4	7.5	Acceptable

9.2 The reduction of coverage to the PSI/ISI examination volume, as defined in PDI-UT-8, due to laminar flaws is to be less than 10%
The dimensions of the uninspectable volume are dependent on the coverage achieved with the angle beam examination of the weld overlay.
[Ref. Appendix Q, Q-4100 (c)(2)]

FLAW INDICATION PLOTS INDICATING THE REDUCTION IN COVERAGE IN THE PSI/ISI EXAMINATION VOLUME DUE TO LAMINAR FLAW INDICATIONS ARE ATTACHED.

Total PSI/ISI Examination Volumes: (averaged using on 0-degree cross-section):

	Calculated Cross-Sectional Area by Drawing Package (in^2)	Average Radius of Exam Volume (in)	Average Circumference of Exam Volume (in)	Total Exam Volume (in^3)
Total PSI/ISI Exam Volume of Nozzle/Safe End (DM) Weld:	2.66	4.00	25.13	66.85
Total PSI/ISI Exam Volume of Safe End/Pipe (SS) Weld:	2.29	3.70	23.25	53.24

PSI/ISI Examination Volume Nozzle/Safe End (DM) Weld Reduction in Coverage (RIC) from flaw indications based on Angle Beam (Circ Scan Direction):

	Calculated Circumferential Cross-Sectional Area of RIC by Drawing Package (in^2)	UT Measured Width of Laminar Flaw Indication (in)	RIC Volume for Each Indication (in^3)
Indication #1	2.520	0.25	0.63
Total RIC Volume in PSI/ISI Nozzle/Safe End (DM) Weld Exam Volume from Flaw Indications based on Angle Beam (Circ Scan Direction):			0.63

PSI/ISI Examination Volume Nozzle/Safe End (DM) Weld Reduction in Coverage (RIC) from flaw indications based on Angle Beam (Axial Scan Direction):

	Calculated Cross-Sectional Area of RIC by Drawing Package (in^2)	Average Radius of RIC Cross-Section (in)	Weld Overlay OD Surface Radius at Indication (in)	Measured Length of Indication at Weld Overlay OD Surface (in)	Corrected Length of Indication at Average RIC Cross-Section (in)	RIC Volume for Each Indication (in^3)
Indication #1	0.300	3.97	4.52	3.00	2.63	0.79

Total RIC Volume in PSI/ISI Nozzle/Safe End (DM) Weld Exam Volume from Flaw Indications based on Angle Beam (Axial Scan Direction): 0.79

PSI/ISI Examination Volume Safe End/Pipe (SS) Weld Reduction in Coverage (RIC) from flaw indications based on Angle Beam (Circ Scan Direction):

	Calculated Circumferential Cross-Sectional Area of RIC by Drawing Package (in^2)	UT Measured Width of Laminar Flaw Indication (in)	RIC Volume for Each Indication (in^3)
NONE			0.00

Total RIC Volume in PSI/ISI Safe End/Pipe (SS) Weld Exam Volume from Flaw Indications based on Angle Beam (Circ Scan Direction): 0.00

PSI/ISI Examination Volume Safe End/Pipe (SS) Weld Reduction in Coverage (RIC) from flaw indications based on Angle Beam (Axial Scan Direction):

	Calculated Cross-Sectional Area of RIC by Drawing Package (in^2)	Average Radius of RIC Cross-Section (in)	Weld Overlay OD Surface Radius at Indication (in)	Measured Length of Indication at Weld Overlay OD Surface (in)	Corrected Length of Indication at Average RIC Cross-Section (in)	RIC Volume for Each Indication (in^3)
NONE					#DIV/0!	0.00

Total RIC Volume in PSI/ISI Safe End/Pipe (SS) Weld Exam Volume from Flaw Indications based on Angle Beam (Axial Scan Direction): 0.00

COVERAGE ESTIMATE ASSUMPTION: PSI/ISI volume must be examined in two axial and two circumferential directions to obtain full 100% coverage credit [Ref. PDI-UT-8, Para. 8.8.3]; No averaging applied.

	Total Exam Volume (in^3)	Total RIC Volume (in^3)	% RIC	Status
Percentage of PSI/ISI Examination Volume Nozzle/Safe End (DM) Weld Not Covered (Circ Scan Direction):	66.85	0.63	0.94%	ACCEPTABLE
Percentage of PSI/ISI Examination Volume Nozzle/Safe End (DM) Weld Not Covered (Axial Scan Direction):	66.85	0.79	1.18%	ACCEPTABLE

	Total Exam Volume (in^3)	RIC Volume	% RIC	Status
Percentage of PSI/ISI Examination Volume Safe End/Pipe (SS) Weld Not Covered (Circ Scan Direction):	53.24	0.00	0.00%	ACCEPTABLE
Percentage of PSI/ISI Examination Volume Safe End/Pipe (SS) Weld Not Covered (Axial Scan Direction):	53.24	0.00	0.00%	ACCEPTABLE

9.3 Any uninspectable volume in the weld overlay is to be assumed to contain the largest radial flaw that could exist in that volume. This assumed flaw is to meet the inservice examination standards of Table IWB-3514-2. Both axial and circumferential planar flaws are to be assumed. [Ref. Appendix Q, Q-4100 (c)(3)]

LAMINAR FLAW INDICATION #1 LIES AT WELD OVERLAY/BASE METAL INTERFACE.
A PLANAR FLAW INDICATION (IND. 2) HAS BEEN DETECTED FROM SAME REFLECTOR (SEE 9.4 EVALUATION).

9.4 **Planar flaw indications found in the PSI/ISI or weld overlay examination volumes, as defined in PDI-UT-8, are to meet the preservice examination acceptance standards of Table IWB-3514-2. [Ref. Appendix Q, Q-4200 (b) and Q-4100 (c)]**

Indication #2:

S=	0.39	in.	
2a=	0.37	in.	
a=	0.185	in.	
l=	2.6	in.	corrected length
Tswol=	0.63	in.	Note 1

Flaw indication is SUBSURFACE Note 2

a=	0.185	in.	
a/t=	0.07		
a/t=	9.5 Y	%	
a/t=	9.5	%	allowable
a/t=	29.4	%	actual

UNACCEPTABLE

Extrapolation of Table IWB-3514-2 Pre-service Examination Standard

Aspect Ratio (low)	0.05	t=	0.312	a/t=	9.6	t=	1.0	a/t=	8.7
Aspect Ratio (high)	0.10	t=	0.312	a/t=	10.4	t=	1.0	a/t=	9.5
Aspect Ratio (act)	0.07	t=	0.312	a/t=	9.9	t=	1.0	a/t=	9.0

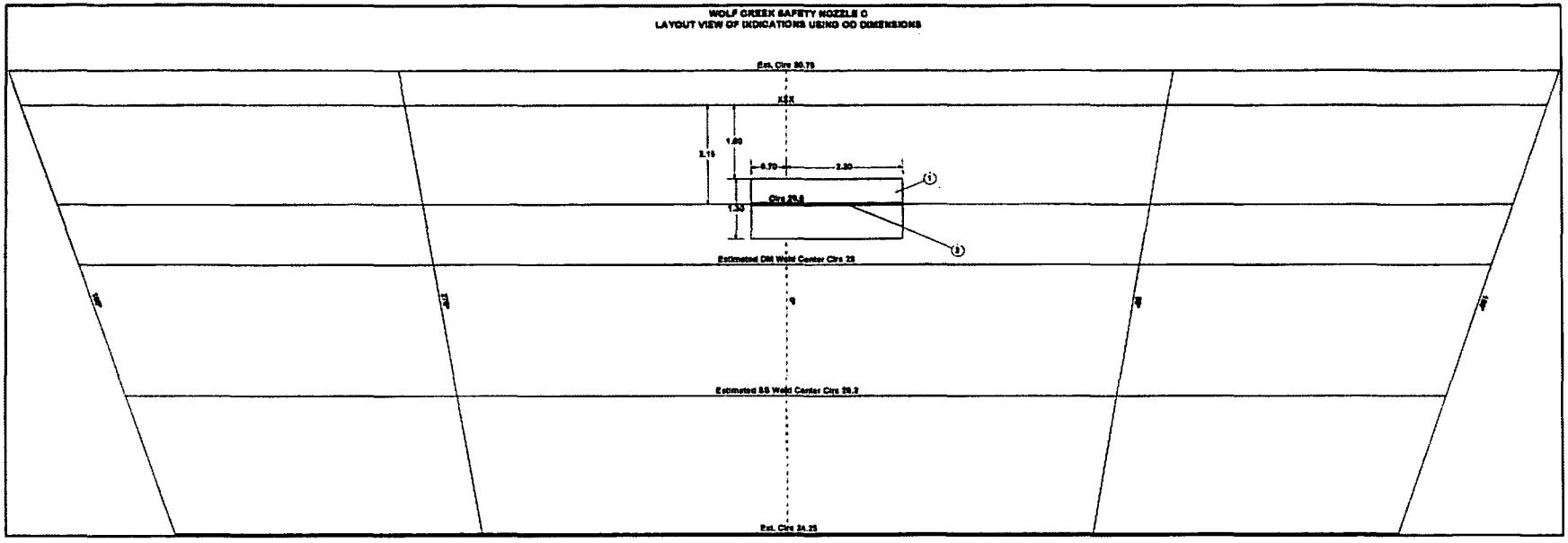
Y actual =	2.1
Y=	1.0

NOTE 1: ASME Section XI, Appendix Q does not explicitly state which nominal wall thickness is to be used. As such the guidelines of ASME Section XI Code Case N-740 are applied; the nominal wall thickness is the thickness of the weld overlay.
NOTE 2: The weld overlay OD surface is considered the only surface for establishing the proximity of each flaw indication to a surface.

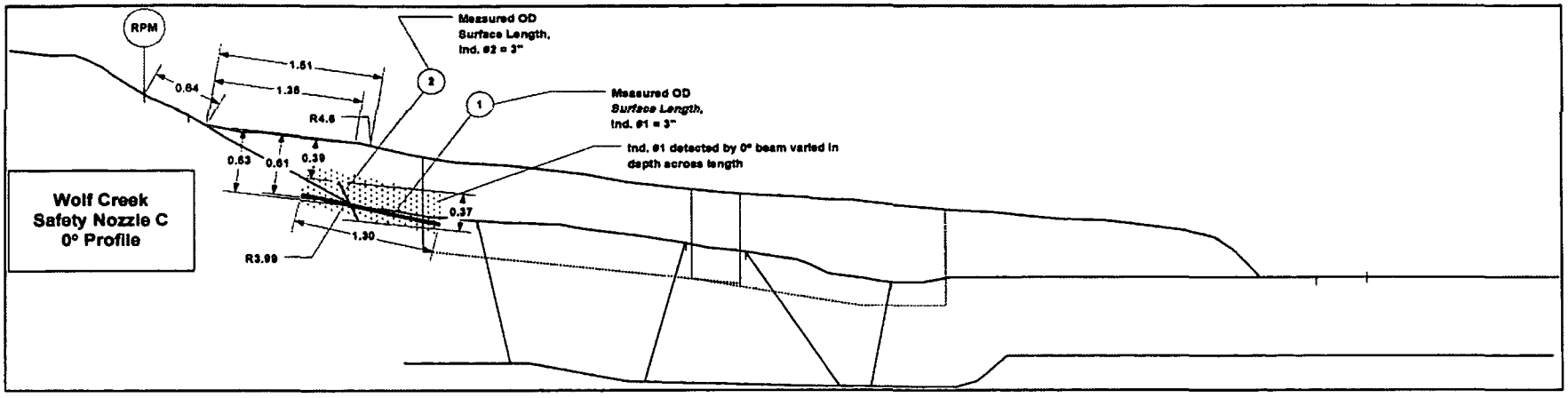
9.5 **Flaw indications found in the PSI/ISI examination volume, as defined in PDI-UT-8, and within the outer 25% of the underlying weld and base metal are to satisfy the design analysis requirements of the weld overlay. [Ref. Appendix Q, Q-4200 (b)]**

NO PLANAR FLAW INDICATIONS FOUND IN THE OUTER 25% OF THE UNDERLYING WELD AND BASE METAL.

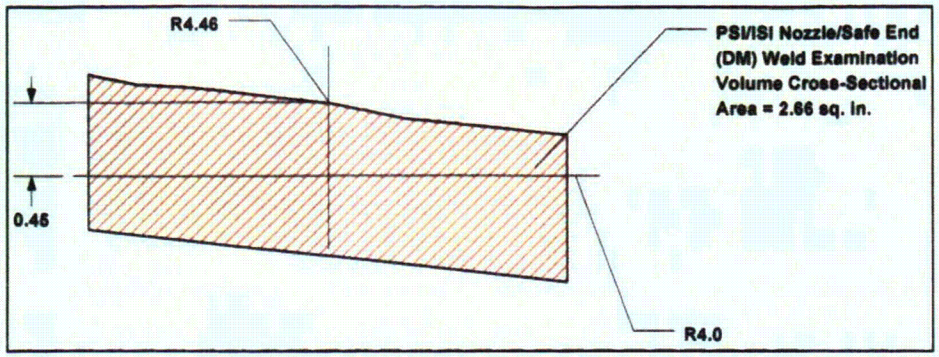
LAYOUT OF INDICATIONS

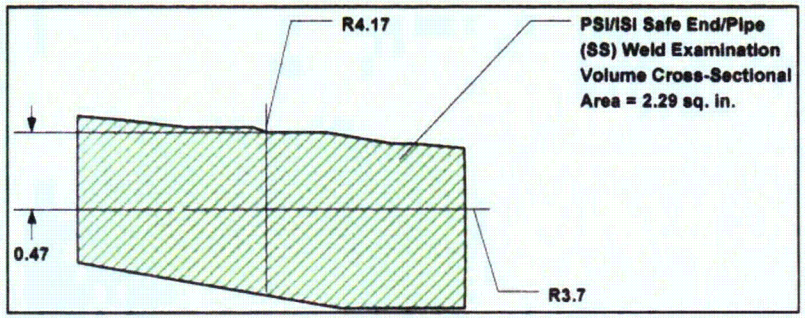


FLAW INDICATION PLOTS



REDUCTION IN COVERAGE PLOTS





REDUCTION IN COVERAGE PLOTS

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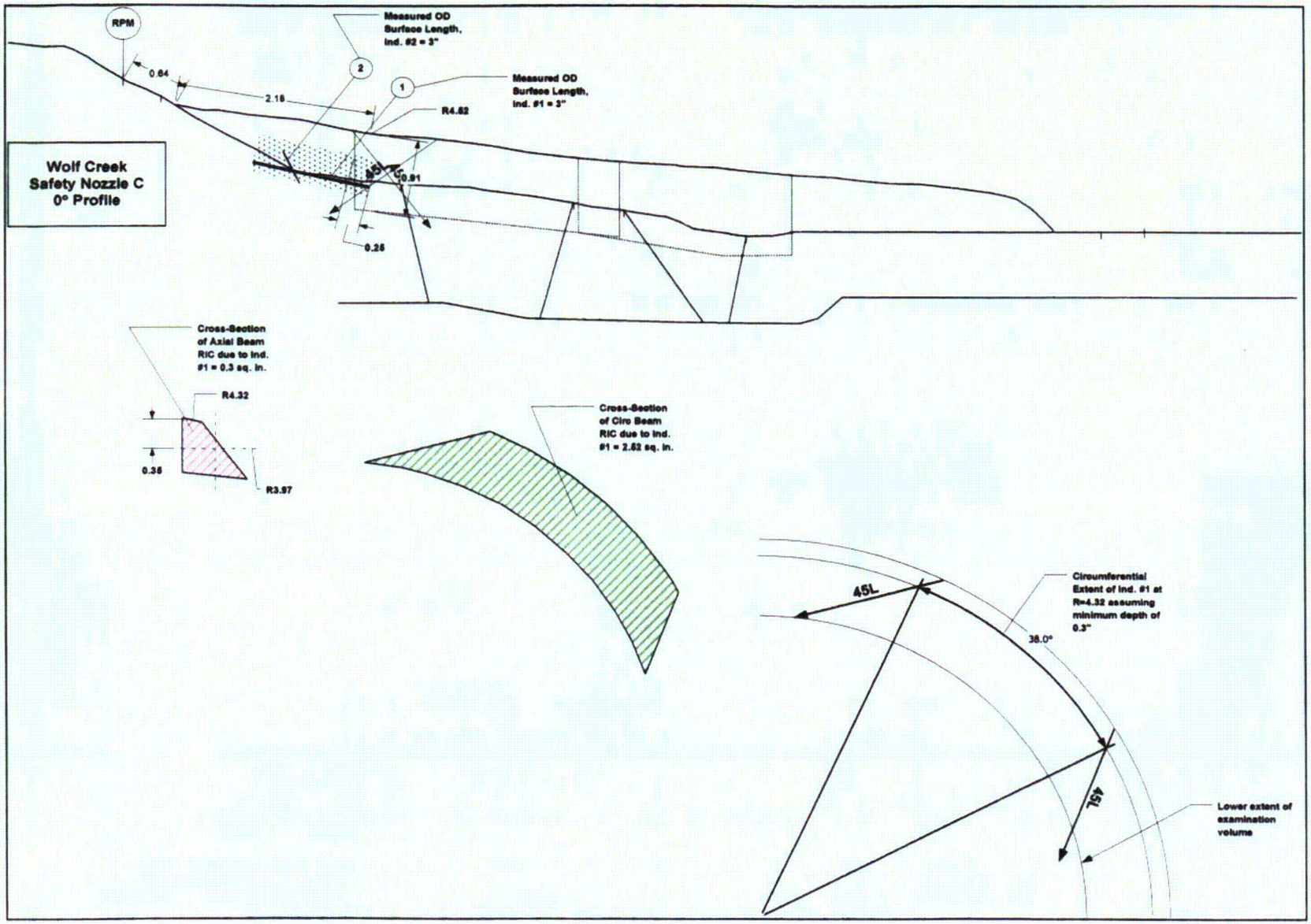


LAMINAR FLAW INDICATION #1 LIES AT WELD OVERLAY/BASE METAL INTERFACE.
A PLANAR FLAW INDICATION HAS BEEN DETECTED FROM SAME REFLECTOR.
NO ASSUMED PLANAR FLAWS ARE CONSIDERED.

ENCLOSURE III

"C" SAFETY NOZZLE POST-REPAIR INDICATION EVALUATION

FLAW INDICATION EVALUATION SUMMARY FOR:		
WOLF CREEK SAFETY NOZZLE C (POST-REPAIR)		
Appendix Q Criteria	**Acceptance Standard**	**Summary of Results**
Evaluation: Laminar Flaw Indications [Ref. 9.1 of Evaluation Worksheet]	ASME Section XI, 1998 Edition 2000 Addenda, Table IWB-3514-3	ACCEPTABLE CONDITION: The single laminar flaw indication is acceptable with an area of 0.2 sq. in. versus the allowable of 7.5 sq. in.
Evaluation: Reduction in Coverage in the PSI/ISI Base Material Examination Volume Due to Laminar Flaw Indications [Ref. 9.2 of Evaluation Worksheet]	<10% Reduction in Coverage	ACCEPTABLE CONDITION: For the DM Weld, the reduction in coverage (RiC) due to the laminar flaw indication for axial beams is 0.1%; the RiC for circumferential beams is 0.08%. For the SS Weld, there is no RiC due to laminar flaw indications..
Evaluation: Consideration of the Largest Radial Planar Flaw (Axial and Circumferential) That Could Exist in Any Uninspectable Volume Within the Weld Overlay Examination Volume [Ref. 9.3 of Evaluation Worksheet]	ASME Section XI, 1998 Edition 2000 Addenda, Table IWB-3514-2 Inservice Examination Standards	ACCEPTABLE CONDITION: The laminar flaw indication lies primarily at the weld overlay repair/base metal interface; as such there is no uninspectable volume.
Evaluation: Planar Flaw Indications in PSI/ISI Base Material and Weld Overlay Examination Volumes [Ref. 9.4 of Evaluation Worksheet]	ASME Section XI, 1998 Edition 2000 Addenda, Table IWB-3514-2 Preservice Examination Standards	ACCEPTABLE CONDITION: A planar flaw indication associated with the laminar flaw indication was detected only at increased gain and has no measurable through-wall dimension.
Evaluation: Flaw indications in PSI/ISI Base Material Examination Volume and Within Outer 25% of Underlying Weld and Base Metal Must Satisfy Design Requirements of the Weld Overlay [Ref. 9.5 of Evaluation Worksheet]	Design Requirements of the Weld Overlay	ACCEPTABLE CONDITION: No planar flaw indications were detected in the outer 25% of the underlying weld and base metal.

Preparer:	Rick Rishel	
Date:	3-Nov-2006	
WesDyne Level III Review:	Norm Siniaho	
Date:	4Nov 2006	

ATTACHED FLAW INDICATION EVALUATION SHEETS:
Evaluation
Indication Plots
Reduction in Coverage Plots
Assumed Planar Flaw Plots
Layout of Indications

FLAW INDICATION PLOTS DESCRIBING THE LOCATION AND MEASURED DIMENSIONS OF THE FLAW INDICATIONS ARE ATTACHED.

Summary of Flaw Indications: (information taken from attached indication plots and referenced UT indication reports)

Indication #	Indication Type	Measured Width at Overlay OD Surface (in)	Measured Length at Overlay OD Surface (in)	Average Radial Position of Indication in Exam Volume (in)	Measured Circumference of Overlay Surface @ Indication (in)	Estimated Outer Radius of Weld Overlay @ Indication (in)	Corrected Length @ Indication (in)	Tswol @ Indication (in) [Note 1]	Measured Through-wall Dimension of Planar Flaw Indications (in)	
1	Laminar	0.30	0.90	3.74	28.20	4.49	0.75	*	N/A	* Indication in repair cavity

NOTE 1: Tswol is measured from the weld overlay OD surface perpendicular to the pipe axis to the weld overlay/base metal interface using the nearest cross-section profile. For combined inidications, the Tswol is an average.

REFERENCES:
1. WesDyne Procedure WDI-STD-1007, Revision 0
2. WesDyne Overlay Ultrasonic Indication Report Sheet for Safety C (Post Repair)

Evaluation of Structural Weld Overlay Inspection Indications in Accordance with ASME Code Section XI, Appendix Q (2004 Ed., 2005 Addenda):

Acceptance Criteria:

9.1 Laminar flaws in the weld overlay examination volume shall meet the acceptance standards of Table IWB-3514-3. [Ref. Appendix Q, Q-4100 (c)(1)]:

Individual Indication Evaluation per Table IWB-3514-3:

Indication #	Measured Area (Measured Width x Corrected Length) (sq	Allowable Laminar Flaw per Table IWB-3514-3 (sq. in)	Acceptable or Unacceptable
1	0.2	7.5	Acceptable

**9.2 The reduction of coverage to the PSI/ISI examination volume, as defined in PDI-UT-8, due to laminar flaws is to be less than 10%
The dimensions of the uninspectable volume are dependent on the coverage achieved with the angle beam examination of the weld overlay.
[Ref. Appendix Q, Q-4100 (c)(2)]**

FLAW INDICATION PLOTS INDICATING THE REDUCTION IN COVERAGE IN THE PSI/ISI EXAMINATION VOLUME DUE TO LAMINAR FLAW INDICATIONS ARE ATTACHED.

Total PSI/ISI Examination Volumes: (averaged using on 0-degree cross-section):

	Calculated Cross-Sectional Area by Drawing Package (in^2)	Average Radius of Exam Volume (in)	Average Circumference of Exam Volume (in)	Total Exam Volume (in^3)
Total PSI/ISI Exam Volume of Nozzle/Safe End (DM) Weld:	2.66	4.00	25.13	66.85
Total PSI/ISI Exam Volume of Safe End/Pipe (SS) Weld:	2.29	3.70	23.25	53.24

PSI/ISI Examination Volume Nozzle/Safe End (DM) Weld Reduction in Coverage (RIC) from flaw indications based on Angle Beam (Circ Scan Direction):

	Calculated Circumferential Cross-Sectional Area of RIC by Drawing Package (in^2)	UT Measured Width of Laminar Flaw Indication (in)	RIC Volume for Each Indication (in^3)
Indication #1	0.175	0.30	0.05
Total RIC Volume in PSI/ISI Nozzle/Safe End (DM) Weld Exam Volume from Flaw Indications based on Angle Beam (Circ Scan Direction):			0.05

PSI/ISI Examination Volume Nozzle/Safe End (DM) Weld Reduction in Coverage (RIC) from flaw indications based on Angle Beam (Axial Scan Direction):

	Calculated Cross-Sectional Area of RIC by Drawing Package (in^2)	Average Radius of RIC Cross-Section (in)	Weld Overlay OD Surface Radius at Indication (in)	Measured Length of Indication at Weld Overlay OD Surface (in)	Corrected Length of Indication at Average RIC Cross-Section (in)	RIC Volume for Each Indication (in^3)
Indication #1	0.090	3.64	4.49	0.90	0.73	0.07

Total RIC Volume in PSI/ISI Nozzle/Safe End (DM) Weld Exam Volume from Flaw Indications based on Angle Beam (Axial Scan Direction): 0.07

PSI/ISI Examination Volume Safe End/Pipe (SS) Weld Reduction in Coverage (RIC) from flaw indications based on Angle Beam (Circ Scan Direction):

	Calculated Circumferential Cross-Sectional Area of RIC by Drawing Package (in^2)	UT Measured Width of Laminar Flaw Indication (in)	RIC Volume for Each Indication (in^3)
NONE			0.00

Total RIC Volume in PSI/ISI Safe End/Pipe (SS) Weld Exam Volume from Flaw Indications based on Angle Beam (Circ Scan Direction): 0.00

PSI/ISI Examination Volume Safe End/Pipe (SS) Weld Reduction in Coverage (RIC) from flaw indications based on Angle Beam (Axial Scan Direction):

	Calculated Cross-Sectional Area of RIC by Drawing Package (in^2)	Average Radius of RIC Cross-Section (in)	Weld Overlay OD Surface Radius at Indication (in)	Measured Length of Indication at Weld Overlay OD Surface (in)	Corrected Length of Indication at Average RIC Cross-Section (in)	RIC Volume for Each Indication (in^3)
NONE					#DIV/0!	0.00

Total RIC Volume in PSI/ISI Safe End/Pipe (SS) Weld Exam Volume from Flaw Indications based on Angle Beam (Axial Scan Direction): 0.00

COVERAGE ESTIMATE ASSUMPTION: PSI/ISI volume must be examined in two axial and two circumferential directions to obtain full 100% coverage credit [Ref. PDI-UT-8, Para. 8.8.3]; No averaging applied.

	Total Exam Volume (in^3)	Total RIC Volume (in^3)	% RIC	Status
Percentage of PSI/ISI Examination Volume Nozzle/Safe End (DM) Weld Not Covered (Circ Scan Direction):	66.85	0.05	0.08%	ACCEPTABLE
Percentage of PSI/ISI Examination Volume Nozzle/Safe End (DM) Weld Not Covered (Axial Scan Direction):	66.85	0.07	0.10%	ACCEPTABLE

	Total Exam Volume (in^3)	RIC Volume	% RIC	Status
Percentage of PSI/ISI Examination Volume Safe End/Pipe (SS) Weld Not Covered (Circ Scan Direction):	53.24	0.00	0.00%	ACCEPTABLE
Percentage of PSI/ISI Examination Volume Safe End/Pipe (SS) Weld Not Covered (Axial Scan Direction):	53.24	0.00	0.00%	ACCEPTABLE

9.3 Any uninspectable volume in the weld overlay is to be assumed to contain the largest radial flaw that could exist in that volume. This assumed flaw is to meet the inservice examination standards of Table IWB-3514-2. Both axial and circumferential planar flaws are to be assumed. [Ref. Appendix Q, Q-4100 (c)(3)]

LAMINAR FLAW INDICATION #1 LIES AT WELD OVERLAY REPAIR/BASE METAL INTERFACE.
NO UNINSPECTABLE VOLUME IN WELD OVERLAY.

9.4 Planar flaw indications found in the PSI/ISI or weld overlay examination volumes, as defined in PDI-UT-8, are to meet the preservice examination acceptance standards of Table IWB-3514-2.

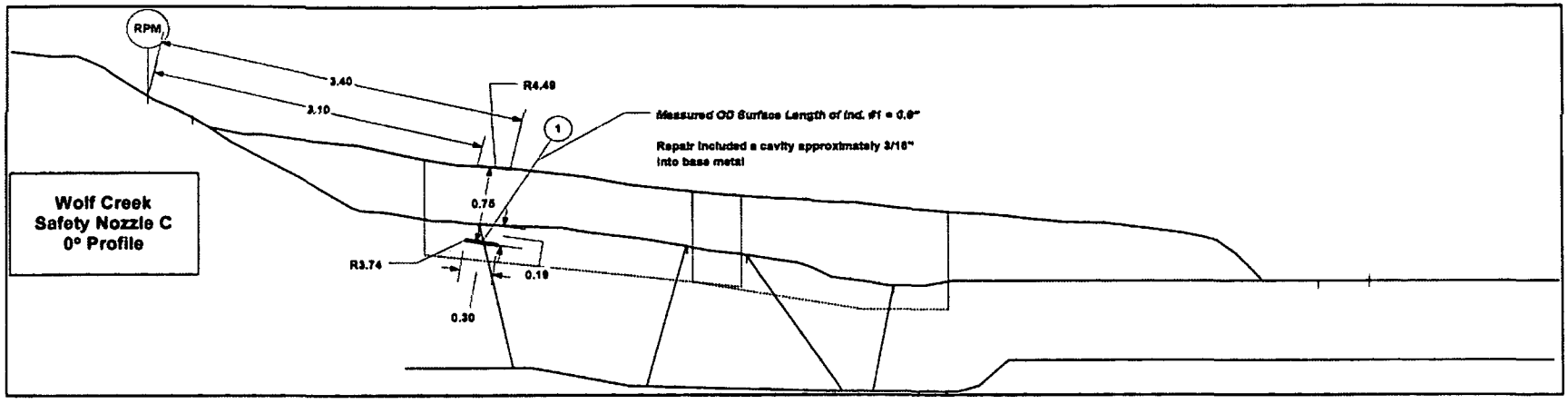
[Ref. Appendix Q, Q-4200 (b) and Q-4100 (c)]

A PLANAR FLAW INDICATION ASSOCIATED WITH LAMINAR FLAW IND. #1 HAS NO MEASURABLE THROUGHWALL AT INCREASED GAIN. PLANAR FLAW IS ACCEPTABLE.

9.5 Flaw indications found in the PSI/ISI examination volume, as defined in PDI-UT-8, and within the outer 25% of the underlying weld and base metal are to satisfy the design analysis requirements of the weld overlay.
[Ref. Appendix Q, Q-4200 (b)]

NO PLANAR FLAW INDICATIONS FOUND IN THE OUTER 25% OF THE UNDERLYING WELD AND BASE METAL.

FLAW INDICATION PLOTS



Note: The plot of this indication shows a location below the the interface. This is due to a removal depth of previous indication. The previous indication was removed after a final grind of 3/16" into base material.

REDUCTION IN COVERAGE PLOTS

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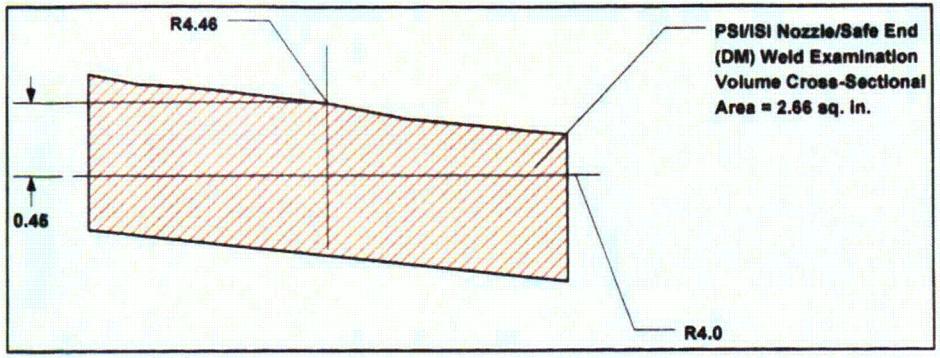

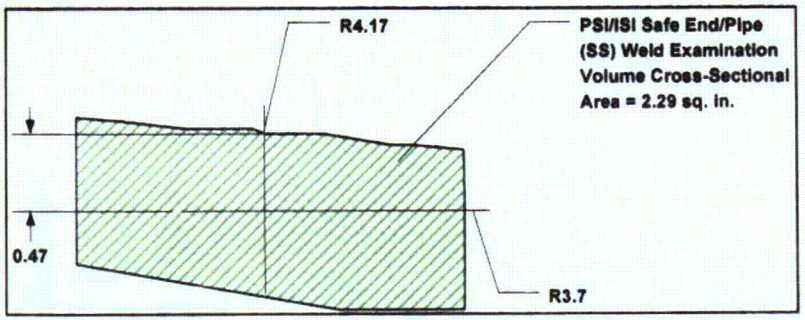

REDUCTION IN COVERAGE PLOTS

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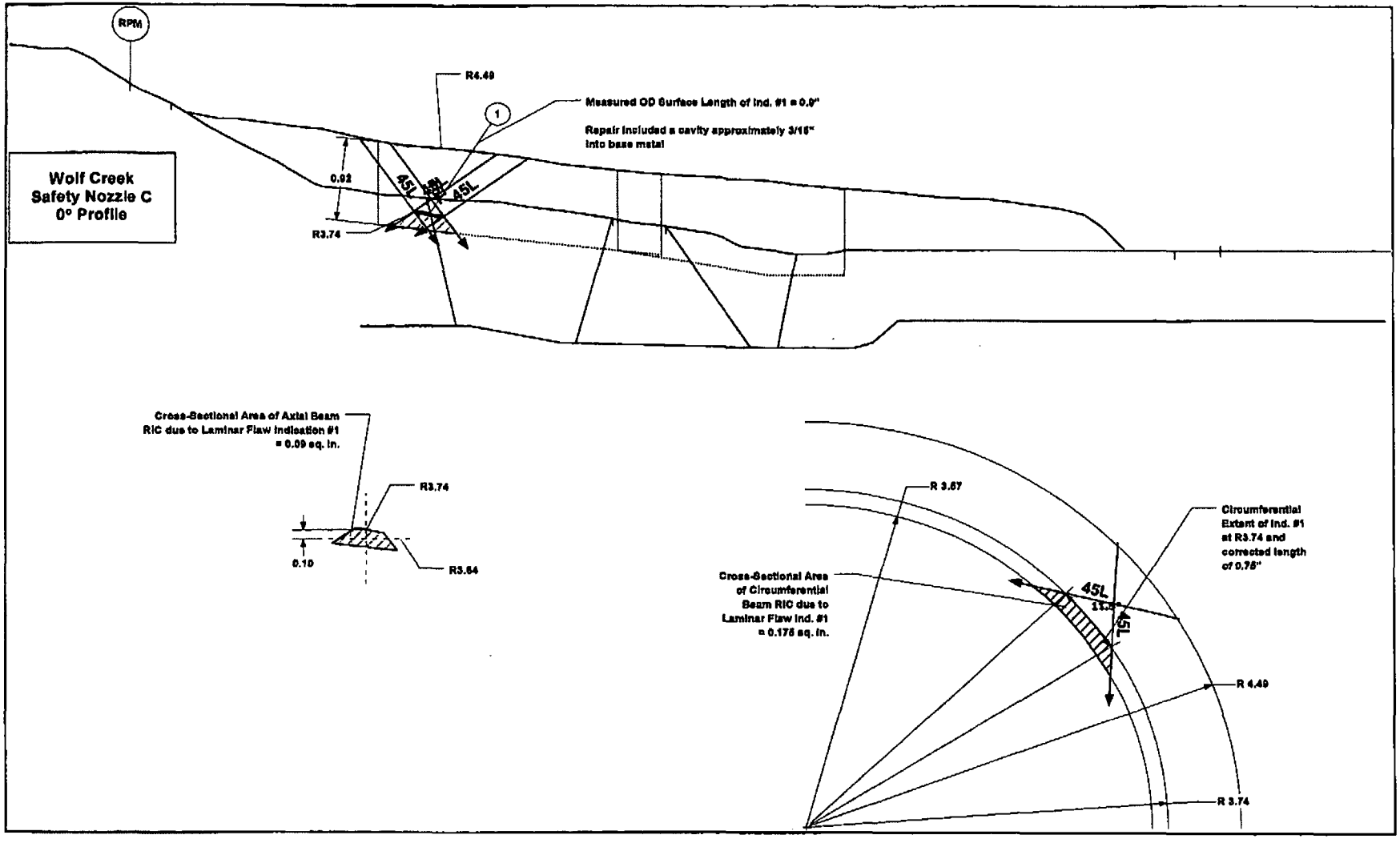
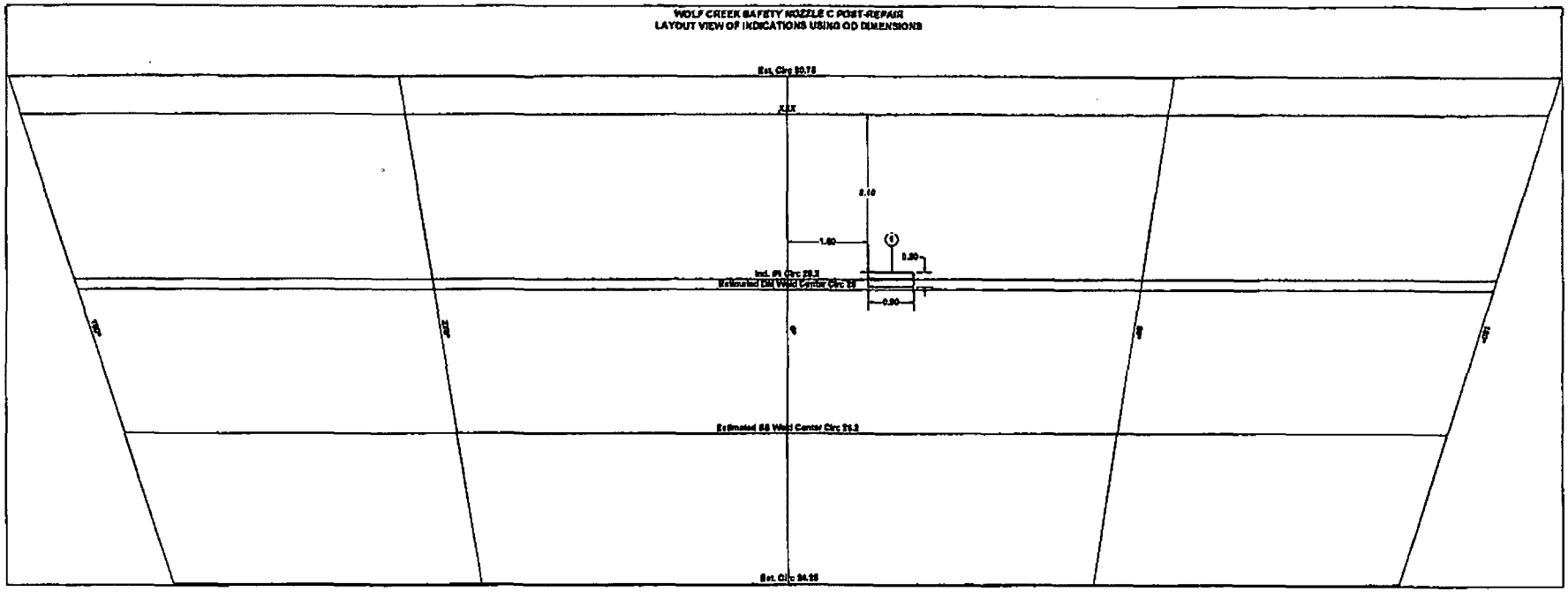


LAMINAR FLAW INDICATION #1 LIES AT WELD OVERLAY REPAIR/BASE METAL INTERFACE. THERE IS NO UNINSPECTABLE VOLUME.


WOLF CREEK SAFETY NOZZLE C POST-REPAIR
LAYOUT VIEW OF INDICATIONS USING OD DIMENSIONS
Est. Circ 30.75
X-X
8.10
1.60
1
0.80
Ind. #1 Circ 29.3
Estimated DM Weld Center Circ 28
0.90
Estimated SS Weld Center Circ 21.3
Est. Circ 94.25

ENCLOSURE IV

SPRAY NOZZLE PRE-REPAIR INDICATION EVALUATION

FLAW INDICATION EVALUATION SUMMARY FOR:		
Wolf Creek Spray Nozzle (Informational UT)		
Appendix Q Criteria	**Acceptance Standard**	**Summary of Results**
Evaluation: Laminar Flaw Indications [Ref. 9.1 of Evaluation Worksheet]	ASME Section XI, 2001 Edition 2003 Addenda, Table IWB-3514-3	UNACCEPTABLE CONDITION: Indications #1 and #2 have corrected areas of 5.3 sq. in. and 13.9 sq. in. compared to an acceptable area of 7.5 sq. in. Indication #2 exceeds this criteria.
Evaluation: Reduction in Coverage in the PSI/ISI Base Material Examination Volume Due to Laminar Flaw Indications [Ref. 9.2 of Evaluation Worksheet]	<10% Reduction in Coverage	UNACCEPTABLE CONDITION: For the DM weld, the axial beam reduction in coverage is 3.11%; the circumferential beam RiC is 3%. The DM weld evaluation assumes that the indication lies on the weld overlay/base metal interface with the full 25%T of the base metal thickness beneath it and using the original profile DM weld volume. For the SS weld, the axial beam RiC is 13.58%; the circumferential beam RiC is 11.55%.
Evaluation: Consideration of the Largest Radial Planar Flaw (Axial and Circumferential) That Could Exist in Any Uninspectable Volume Within the Weld Overlay Examination Volume [Ref. 9.3 of Evaluation Worksheet]	ASME Section XI, 2001 Edition 2003 Addenda, Table IWB-3514-2 Inservice Examination Standards	UNACCEPTABLE CONDITION: The largest assumed axial planar flaw has an actual a/t of 18.7% compared to an allowable of 11.4%. The largest assumed circumferential planar flaw has an actual a/t of 16.4% compared to an allowable of 11.1%.
Evaluation: Planar Flaw Indications in PSI/ISI Base Material and Weld Overlay Examination Volumes [Ref. 9.4 of Evaluation Worksheet]	ASME Section XI, 2001 Edition 2003 Addenda, Table IWB-3514-2 Preservice Examination Standards	ACCEPTABLE CONDITION: No planar flaw indications detected in this informational UT.

Informational UT

Evaluation: Flaw indications in PSI/ISI Base Material Examination Volume and Within Outer 25% of Underlying Weld and Base Metal Must Satisfy Design Requirements of the Weld Overlay [Ref. 9.5 of Evaluation Worksheet]	Design Requirements of the Weld Overlay	ACCEPTABLE CONDITION: No planar flaw indications detected in this informational UT.

Preparer: Rick Risher [illegible] for Risher

Date: 11/2/06

WesDyne Level III Review: Norm Siniato [illegible]

Date: 11/3/06

ATTACHED FLAW INDICATION EVALUATION SHEETS:
Evaluation
Indication Plots
Reduction in Coverage Plots
Assumed Planar Flaw Plots
Layout of Indications

FLAW INDICATION PLOTS DESCRIBING THE LOCATION AND MEASURED DIMENSIONS OF THE FLAW INDICATIONS ARE ATTACHED.

Summary of Flaw Indications: (information taken from attached indication plots and referenced UT indication reports)

Indication #	Indication Type	Measured Width at Overlay OD Surface (in)	Measured Length at Overlay OD Surface (in)	Average Radial Position of Indication in Exam Volume (in)	Measured Circumference of Overlay Surface @ Indication (in)	Estimated Outer Radius of Weld Overlay @ Indication (in)	Corrected Length @ Indication (in)	Tswol @ Indication (in) [Note 1]	Measured Through-wall Dimension of Planar Flaw Indications (in)	
1	Laminar	1.40	4.70	3.08	23.70	3.77	3.81	0.51	N/A	Tswol at approx. center of indication
2	Laminar	1.00	16.00	3.02	21.80	3.47	13.93	0.80	N/A	Tswol at approx. center of indication

NOTE 1: Tswol is measured from the weld overlay OD surface perpendicular to the pipe axis to the weld overlay/base metal interface using the nearest cross-section profile. For combined inidications, the Tswol is an average.

REFERENCES:
1. WesDyne Procedure WDI-STD-1007, Revision 0
2. Informational UT data

Evaluation of Structural Weld Overlay Inspection Indications in Accordance with ASME Code Section XI, Appendix Q (2004 Ed., 2005 Addenda):

Acceptance Criteria:

9.1 Laminar flaws in the weld overlay examination volume shall meet the acceptance standards of Table IWB-3514-3. [Ref. Appendix Q, Q-4100 (c)(1)]:

Check on Figure IWA-3360-1 Applicability for Combining Laminar Flaws:

Indication #	&	Indication #	Distance 'S' Between Indications (in)	Figure IWA-3360-1 Check
1		2	1.2	These indications are to be evaluated separately.

Individual Indication Evaluation per Table IWB-3514-3:

Indication #	Measured Area (Measured Width x Corrected Length) (sq	Allowable Laminar Flaw per Table IWB-3514-3 (sq. in)	Acceptable or Unacceptable
1	5.3	7.5	Acceptable
2	13.9	7.5	Unacceptable

9.2 The reduction of coverage to the PSI/ISI examination volume, as defined in PDI-UT-8, due to laminar flaws is to be less than 10%
The dimensions of the uninspectable volume are dependent on the coverage achieved with the angle beam examination of the weld overlay.
[Ref. Appendix Q, Q-4100 (c)(2)]

FLAW INDICATION PLOTS INDICATING THE REDUCTION IN COVERAGE IN THE PSI/ISI EXAMINATION VOLUME DUE TO LAMINAR FLAW INDICATIONS ARE ATTACHED.

Total PSI/ISI Examination Volumes: (averaged using on 0-degree cross-section):

	Calculated Cross-Sectional Area by Drawing Package (in^2)	Average Radius of Exam Volume (in)	Average Circumference of Exam Volume (in)	Total Exam Volume (in^3)	
Total PSI/ISI Exam Volume of Nozzle/Safe End (DM) Weld:	2.04	3.34	20.99	42.81	based on original 270-deg profile
Total PSI/ISI Exam Volume of Safe End/Pipe (SS) Weld:	2.02	2.79	17.53	35.41	based on original 90-deg profile

PSI/ISI Examination Volume Nozzle/Safe End (DM) Weld Reduction in Coverage (RIC) from flaw indications based on Angle Beam (Circ Scan Direction):

	Calculated Circumferential Cross-Sectional Area of RIC by Drawing Package (in^2)	UT Measured Width of Laminar Flaw Indication (in)	RIC Volume for Each Indication (in^3)
Indication #1	0.916	1.40	1.28

Total RIC Volume in PSI/ISI Nozzle/Safe End (DM) Weld Exam Volume from Flaw Indications based on Angle Beam (Circ Scan Direction): 1.28

PSI/ISI Examination Volume Nozzle/Safe End (DM) Weld Reduction in Coverage (RIC) from flaw indications based on Angle Beam (Axial Scan Direction):

	Calculated Cross-Sectional Area of RIC by Drawing Package (in^2)	Average Radius of RIC Cross-Section (in)	Weld Overlay OD Surface Radius at Indication (in)	Measured Length of Indication at Weld Overlay OD Surface (in)	Corrected Length of Indication at Average RIC Cross-Section (in)	RIC Volume for Each Indication (in^3)
Indication #1	0.361	2.96	3.77	4.70	3.69	1.33

Total RIC Volume in PSI/ISI Nozzle/Safe End (DM) Weld Exam Volume from Flaw Indications based on Angle Beam (Axial Scan Direction): 1.33

PSI/ISI Examination Volume Safe End/Pipe (SS) Weld Reduction in Coverage (RIC) from flaw indications based on Angle Beam (Circ Scan Direction):

	Calculated Circumferential Cross-Sectional Area of RIC by Drawing Package (in^2)	UT Measured Width of Laminar Flaw Indication (in)		RIC Volume for Each Indication (in^3)
Indication #2	9.09	0.45	in examination volume	4.09

Total RIC Volume in PSI/ISI Safe End/Pipe (SS) Weld Exam Volume from Flaw Indications based on Angle Beam (Circ Scan Direction): 4.09

PSI/ISI Examination Volume Safe End/Pipe (SS) Weld Reduction in Coverage (RIC) from flaw indications based on Angle Beam (Axial Scan Direction):

	Calculated Cross-Sectional Area of RIC by Drawing Package (in^2)	Average Radius of RIC Cross-Section (in)	Weld Overlay OD Surface Radius at Indication (in)	Measured Length of Indication at Weld Overlay OD Surface (in)	Corrected Length of Indication at Average RIC Cross-Section (in)	RIC Volume for Each Indication (in^3)
Indication #2	0.398	2.82	3.47	16.00	12.08	4.81

Total RIC Volume in PSI/ISI Safe End/Pipe (SS) Weld Exam Volume from Flaw Indications based on Angle Beam (Axial Scan Direction): 4.81

COVERAGE ESTIMATE ASSUMPTION: PSI/ISI volume must be examined in two axial and two circumferential directions to obtain full 100% coverage credit [Ref. PDI-UT-8, Para. 8.8.3]; No averaging applied.

	Total Exam Volume (in^3)	Total RIC Volume (in^3)	% RIC	Status
Percentage of PSI/ISI Examination Volume Nozzle/Safe End (DM) Weld Not Covered (Circ Scan Direction):	42.81	1.28	3.00%	ACCEPTABLE
Percentage of PSI/ISI Examination Volume Nozzle/Safe End (DM) Weld Not Covered (Axial Scan Direction):	42.81	1.33	3.11%	ACCEPTABLE

	Total Exam Volume (in^3)	RIC Volume	% RIC	Status
Percentage of PSI/ISI Examination Volume Safe End/Pipe (SS) Weld Not Covered (Circ Scan Direction):	35.41	4.09	11.55%	UNACCEPTABLE
Percentage of PSI/ISI Examination Volume Safe End/Pipe (SS) Weld Not Covered (Axial Scan Direction):	35.41	4.81	13.58%	UNACCEPTABLE

8.3 Any uninspectable volume in the weld overlay is to be assumed to contain the largest radial flaw that could exist in that volume. This assumed flaw is to meet the inservice examination standards of Table IWB-3514-2. Both axial and circumferential planar flaws are to be assumed.
[Ref. Appendix Q, Q-4100 (c)(3)]

FLAW INDICATION PLOTS INDICATING THE LARGEST RADIAL FLAWS THAT COULD EXIST IN ANY UNINSPECTABLE VOLUME WITHIN THE WELD OVERLAY EXAMINATION VOLUME DUE TO LAMINAR FLAW INDICATIONS ARE ATTACHED.
INDICATION #1 IS ASSUMED TO BE AT THE WELD OVERLAY/BASE METAL INTERFACE, I.E. NO UNINSPECTABLE VOLUME IN WELD OVERLAY

Largest Axial Planar Flaw in Uninspectable Volume:

Indication #2:

S=	0.46	in.
2a=	0.28	in.
a=	0.140	in.
l=	1	in.

Tswol=	0.75	in.	Note 1
Flaw indication is	SUBSURFACE		Note 2
a=	0.140	in.	
a/l=	0.14		
a/t=	11.4 Y	%	
a/t=	11.4	%	allowable
a/t=	18.7	%	actual
	UNACCEPTABLE		

Extrapolation of Table IWB-3514-2 Inservice Examination Standard

Aspect Ratio (low)	0.10	t=	0.312	a/t=	12.2	t=	1.0	a/t=	11
Aspect Ratio (high)	0.15	t=	0.312	a/t=	12.4	t=	1.0	a/t=	11.1
Aspect Ratio (act)	0.14	t=	0.312	a/t=	12.4	t=	1.0	a/t=	11.1

Y actual = 3.3
Y= 1.0

Largest Circumferential Planar Flaw in Uninspectable Volume:

Indication #2:

S=	0.48	in.	
2a=	0.23	in.	
a=	0.115	in.	
l=	13.93	in.	corrected length
Tswol=	0.7	in.	Note 1
Flaw indication is	SUBSURFACE		Note 2
a=	0.115	in.	
a/l=	0.01		
a/t=	11.1 Y	%	
a/t=	11.1	%	allowable
a/t=	16.4	%	actual
	UNACCEPTABLE		

Extrapolation of Table IWB-3514-2 Inservice Examination Standard

Aspect Ratio (low)	0.00	t=	0.312	a/t=	11.7	t=	1.0	a/t=	10.6
Aspect Ratio (high)	0.05	t=	0.312	a/t=	12	t=	1.0	a/t=	10.7
Aspect Ratio (act)	0.01	t=	0.312	a/t=	11.7	t=	1.0	a/t=	10.6

Y actual = 4.2
Y= 1.0

NOTE 1: ASME Section XI, Appendix Q does not explicitly state which nominal wall thickness is to be used. As such the guidelines of ASME Section XI Code Case N-740 are applied; the nominal wall thickness is the thickness of the weld overlay.
NOTE 2: The weld overlay OD surface is considered the only surface for establishing the proximity of each flaw indication to a surface.

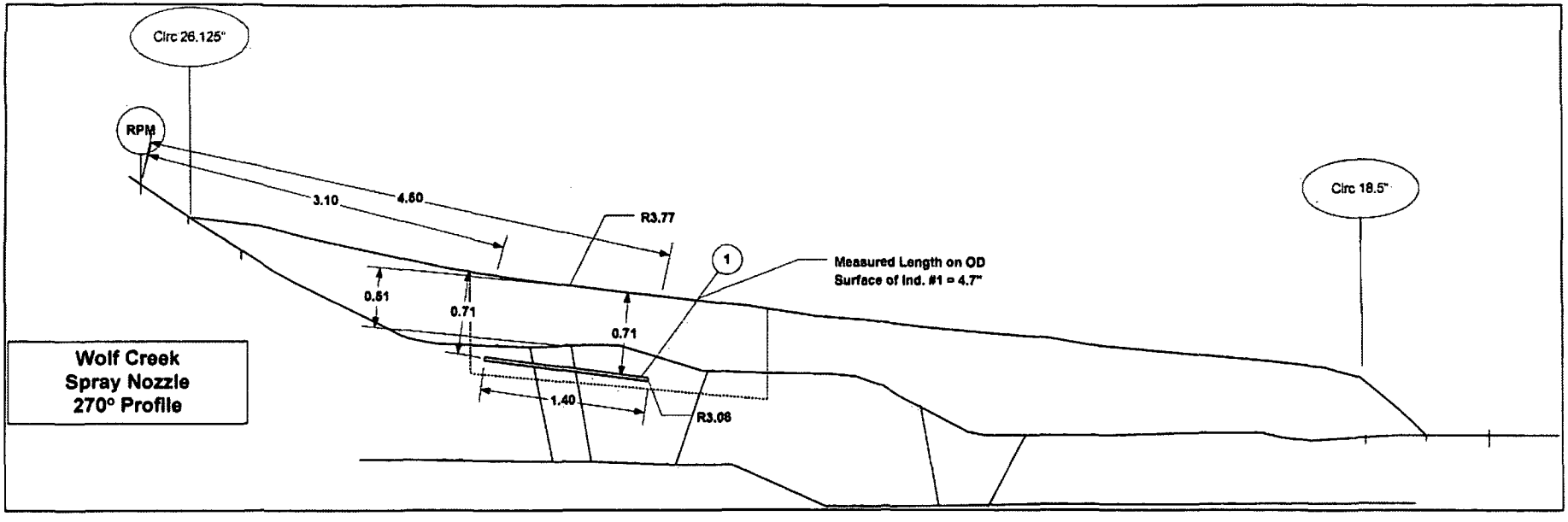
9.4 **Planar flaw indications found in the PSI/ISI or weld overlay examination volumes, as defined in PDI-UT-8, are to meet the preservice examination acceptance standards of Table IWB-3514-2. [Ref. Appendix Q, Q-4200 (b) and Q-4100 (e)]**

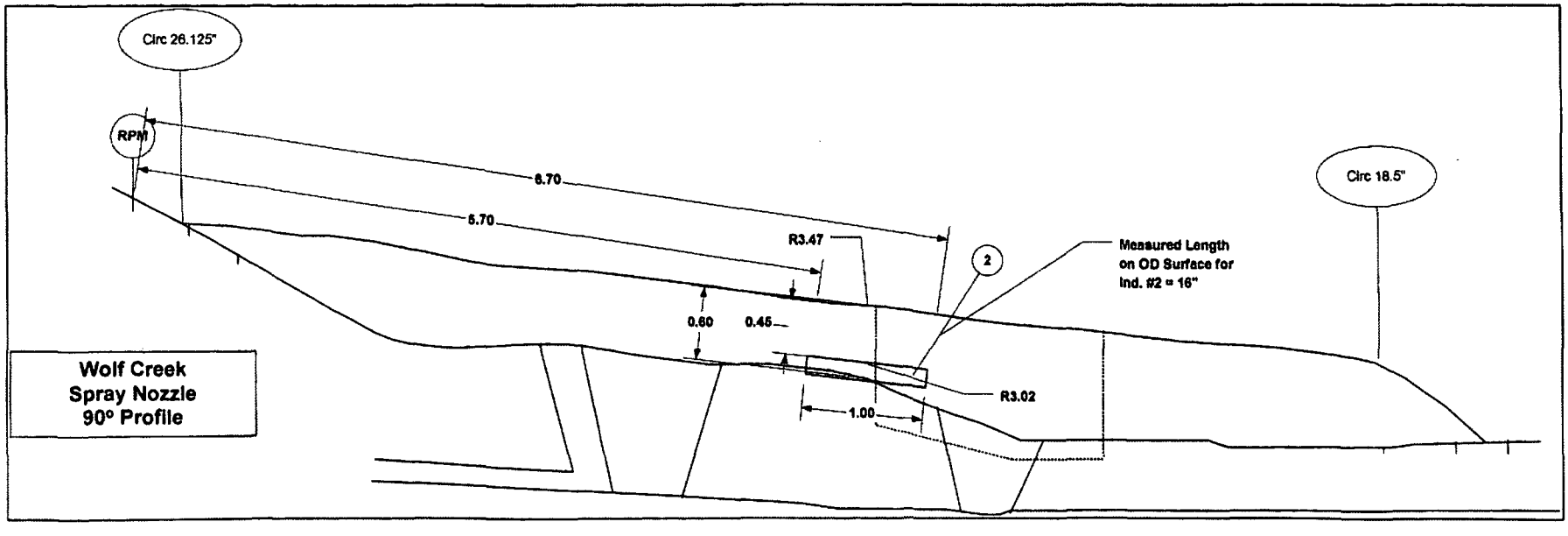
NO PLANAR FLAW INDICATIONS DETECTED IN THIS INFORMATIONAL UT

9.5 **Flaw indications found in the PSI/ISI examination volume, as defined in PDI-UT-8, and within the outer 25% of the underlying weld and base metal are to satisfy the design analysis requirements of the weld overlay. [Ref. Appendix Q, Q-4200 (b)]**

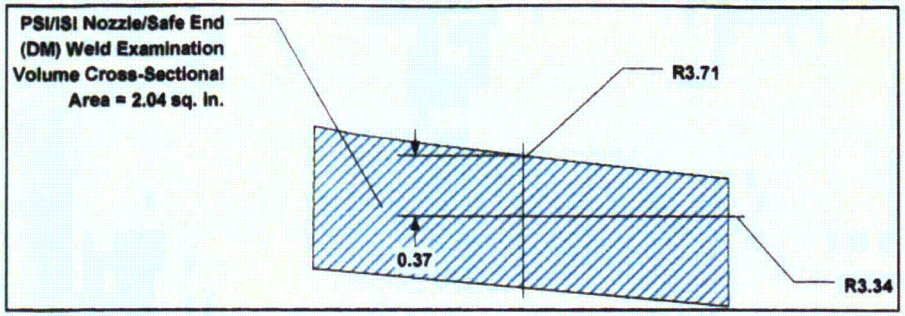
NO PLANAR FLAW INDICATIONS DETECTED IN THIS INFORMATIONAL UT

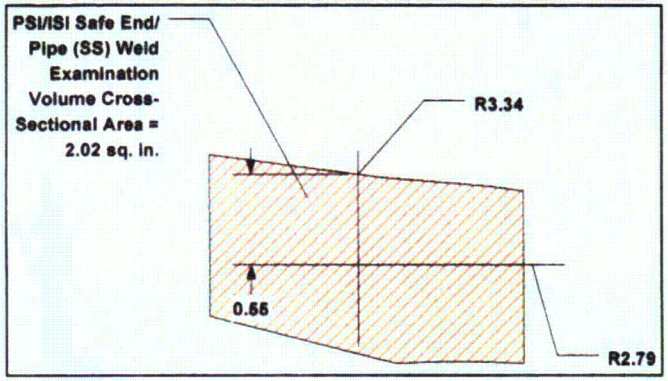
FLAW INDICATION PLOTS





REDUCTION IN COVERAGE PLOTS





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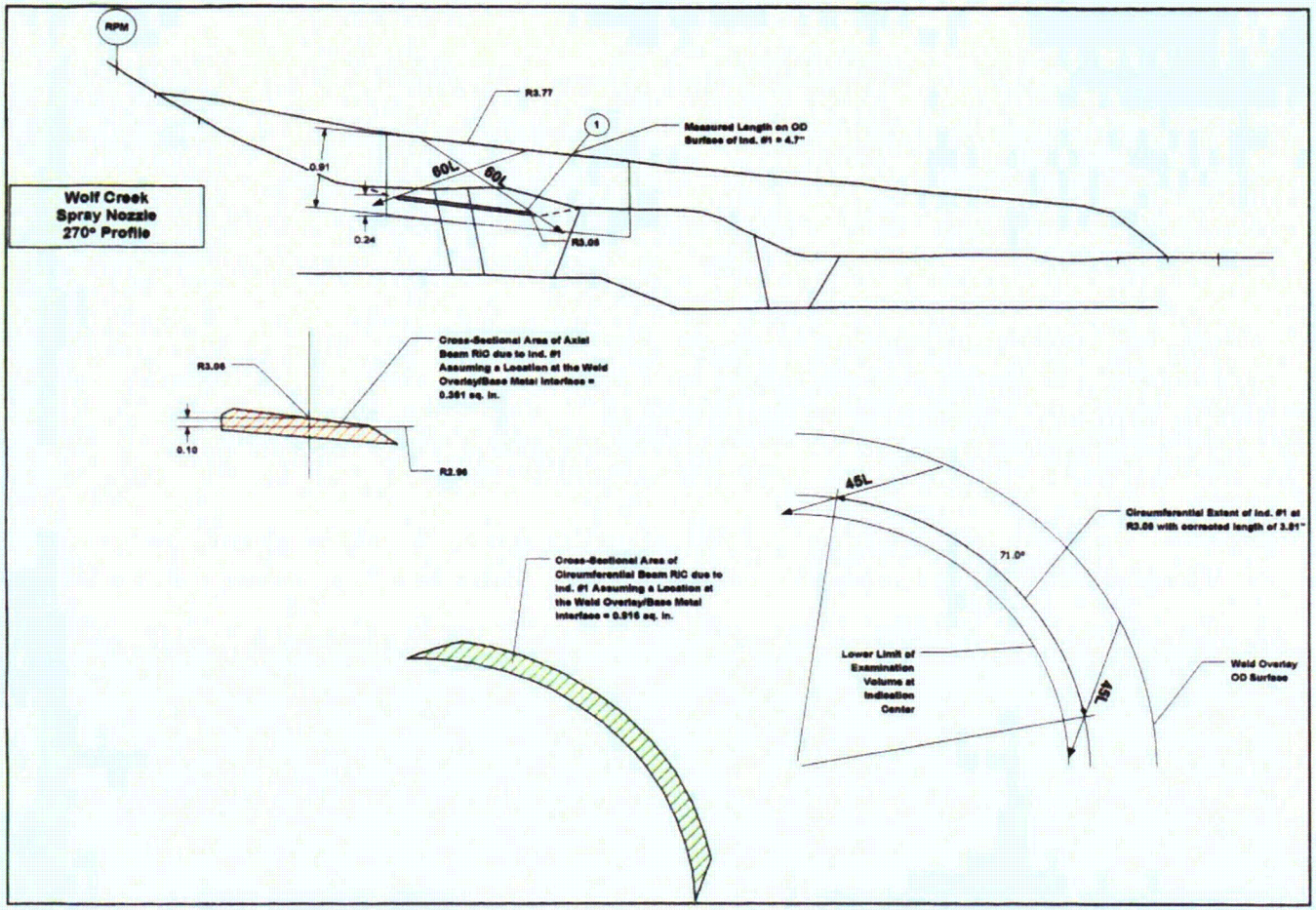
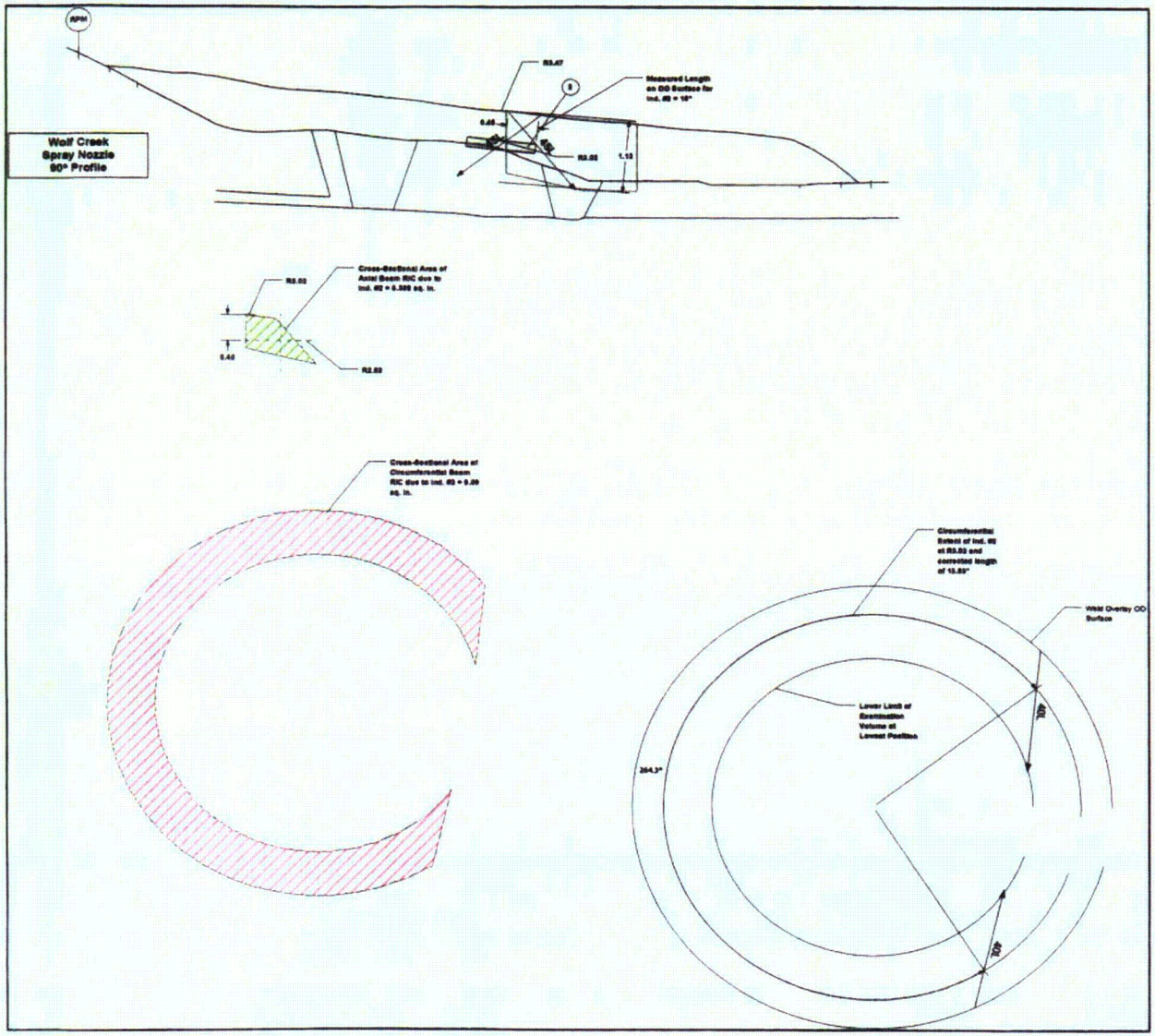
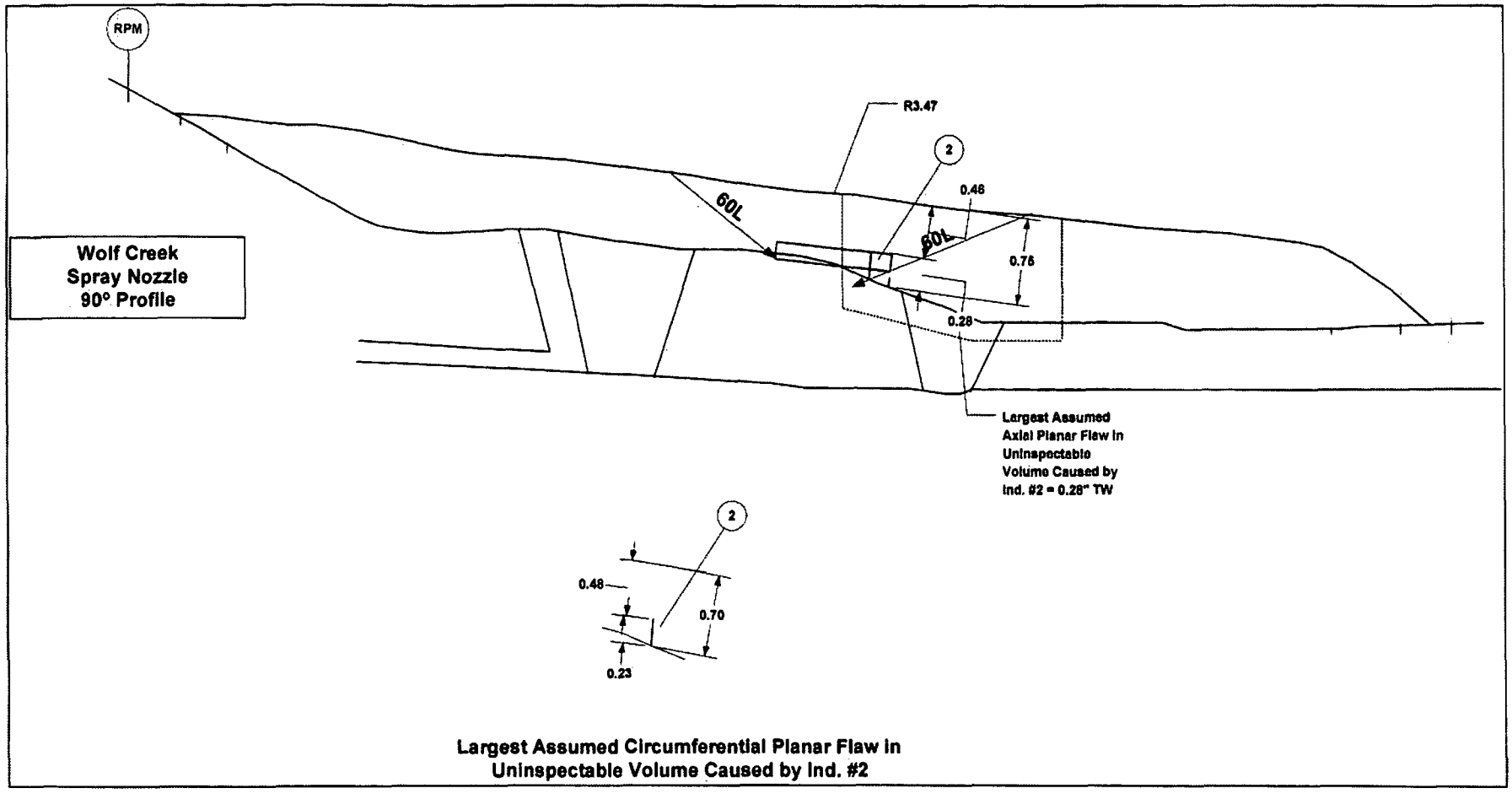


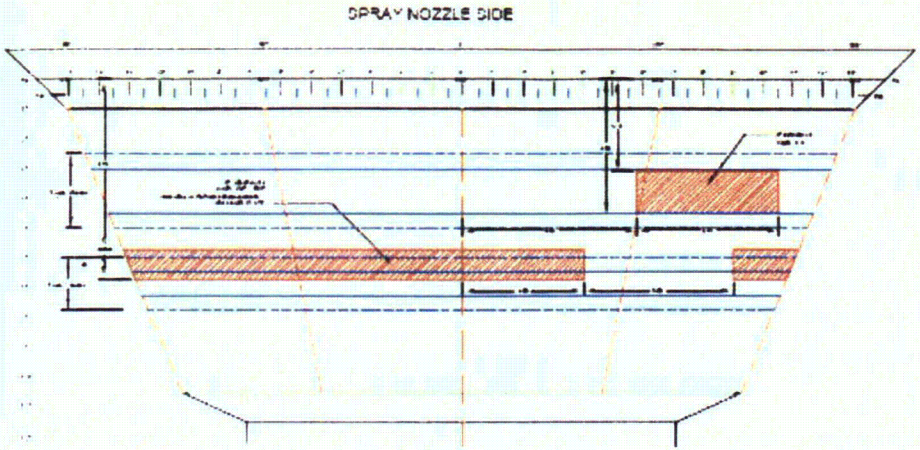
REDUCTION IN COVERAGE PLOTS





Largest Assumed Circumferential Planar Flaw in Uninspectable Volume Caused by Ind. #2

LAYOUT OF INDICATIONS



ENCLOSURE V

SPRAY NOZZLE POST-REPAIR INDICATION EVALUATION

FLAW INDICATION EVALUATION SUMMARY FOR:		
Wolf Creek Spray Nozzle (Post-Repair)		
Appendix Q Criteria	**Acceptance Standard**	**Summary of Results**
Evaluation: Laminar Flaw Indications [Ref. 9.1 of Evaluation Worksheet]	ASME Section XI, 2001 Edition 2003 Addenda, Table IWB-3514-3	ACCEPTABLE CONDITION: The single laminar flaw indication has an area of 1.8 sq. in. compared to the allowable of 7.5 sq. in.
Evaluation: Reduction in Coverage in the PSI/ISI Base Material Examination Volume Due to Laminar Flaw Indications [Ref. 9.2 of Evaluation Worksheet]	<10% Reduction in Coverage	ACCEPTABLE CONDITION: For the DM weld, the circumferential beam reduction in coverage (RiC) is 1.08%; the axial beam RiC is 1.3%. For the SS weld, there is no RiC.
Evaluation: Consideration of the Largest Radial Planar Flaw (Axial and Circumferential) That Could Exist in Any Uninspectable Volume Within the Weld Overlay Examination Volume [Ref. 9.3 of Evaluation Worksheet]	ASME Section XI, 2001 Edition 2003 Addenda, Table IWB-3514-2 Inservice Examination Standards	ACCEPTABLE CONDITION: The single laminar flaw indication is located at the weld overlay/base metal interface; thus there is no uninspectable volume in the weld overlay.
Evaluation: Planar Flaw Indications in PSI/ISI Base Material and Weld Overlay Examination Volumes [Ref. 9.4 of Evaluation Worksheet]	ASME Section XI, 2001 Edition 2003 Addenda, Table IWB-3514-2 Preservice Examination Standards	ACCEPTABLE CONDITION: No planar flaw indications detected.
Evaluation: Flaw indications in PSI/ISI Base Material Examination Volume and Within Outer 25% of Underlying Weld and Base Metal Must Satisfy Design Requirements of the Weld Overlay [Ref. 9.5 of Evaluation Worksheet]	Design Requirements of the Weld Overlay	ACCEPTABLE CONDITION: No planar flaw indications detected.

Preparer:	Rick Rishel	
Date:	Nov. 6, 2006	
WesDyne Level III Review:	Norm Siniaho	
Date:	Nov. 6, 2006	

ATTACHED FLAW INDICATION EVALUATION SHEETS:
Evaluation
Indication Plots
Reduction in Coverage Plots
Assumed Planar Flaw Plots
Layout of Indications

FLAW INDICATION PLOTS DESCRIBING THE LOCATION AND MEASURED DIMENSIONS OF THE FLAW INDICATIONS ARE ATTACHED.

Summary of Flaw Indications: (information taken from attached indication plots and referenced UT indication reports)

Indication #	Indication Type	Measured Width at Overlay OD Surface (in)	Measured Length at Overlay OD Surface (in)	Average Radial Position of Indication in Exam Volume (in)	Measured Circumference of Overlay Surface @ Indication (in)	Estimated Outer Radius of Weld Overlay @ Indication (in)	Corrected Length @ Indication (in)	Tswol @ Indication (in) [Note 1]	Measured Through-wall Dimension of Planar Flaw Indications (in)	
1	Laminar	0.70	3.20	3.06	23.70	3.77	2.49	0.71	N/A	indication at interface

NOTE 1: Tswol is measured from the weld overlay OD surface perpendicular to the pipe axis to the weld overlay/base metal interface using the nearest cross-section profile. For combined inidications, the Tswol is an average.

REFERENCES:
1. WesDyne Procedure WDI-STD-1007, Revision 0
2. WesDyne Overlay Ultrasonic Examination Indication Report Sheet (Spray Nozzle

Evaluation of Structural Weld Overlay Inspection Indications in Accordance with ASME Code Section XI, Appendix Q (2004 Ed., 2005 Addenda):

Acceptance Criteria:

9.1 Laminar flaws in the weld overlay examination volume shall meet the acceptance standards of Table IWB-3514-3. [Ref. Appendix Q, Q-4100 (c)(1)]:

Individual Indication Evaluation per Table IWB-3514-3:

Indication #	Measured Area (Measured Width x Corrected Length) (sq	Allowable Laminar Flaw per Table IWB-3514-3 (sq. in)	Acceptable or Unacceptable
1	1.8	7.5	Acceptable

**9.2 The reduction of coverage to the PSI/ISI examination volume, as defined in PDI-UT-8, due to laminar flaws is to be less than 10%
The dimensions of the uninspectable volume are dependent on the coverage achieved with the angle beam examination of the weld overlay.
[Ref. Appendix Q, Q-4100 (c)(2)]**

FLAW INDICATION PLOTS INDICATING THE REDUCTION IN COVERAGE IN THE PSI/ISI EXAMINATION VOLUME DUE TO LAMINAR FLAW INDICATIONS ARE ATTACHED.

Total PSI/ISI Examination Volumes: (averaged using on 0-degree cross-section):

	Calculated Cross-Sectional Area by Drawing Package (in^2)	Average Radius of Exam Volume (in)	Average Circumference of Exam Volume (in)	Total Exam Volume (in^3)	
Total PSI/ISI Exam Volume of Nozzle/Safe End (DM) Weld:	2.38	3.25	20.42	48.60	based on original 270-deg profile
Total PSI/ISI Exam Volume of Safe End/Pipe (SS) Weld:	1.87	2.89	18.16	33.96	based on original 270-deg profile

PSI/ISI Examination Volume Nozzle/Safe End (DM) Weld Reduction in Coverage (RIC) from flaw indications based on Angle Beam (Circ Scan Direction):

	Calculated Circumferential Cross-Sectional Area of RIC by Drawing Package (in^2)	UT Measured Width of Laminar Flaw Indication (in)	RIC Volume for Each Indication (in^3)
Indication #1	0.747	0.70	0.52
Total RIC Volume in PSI/ISI Nozzle/Safe End (DM) Weld Exam Volume from Flaw Indications based on Angle Beam (Circ Scan Direction):			0.52

PSI/ISI Examination Volume Nozzle/Safe End (DM) Weld Reduction in Coverage (RIC) from flaw indications based on Angle Beam (Axial Scan Direction):

	Calculated Cross-Sectional Area of RIC by Drawing Package (in^2)	Average Radius of RIC Cross-Section (in)	Weld Overlay OD Surface Radius at Indication (in)	Measured Length of Indication at Weld Overlay OD Surface (in)	Corrected Length of Indication at Average RIC Cross-Section (in)	RIC Volume for Each Indication (in^3)
Indication #1	0.254	2.93	3.77	3.20	2.49	0.63

Total RIC Volume in PSI/ISI Nozzle/Safe End (DM) Weld Exam Volume from Flaw Indications based on Angle Beam (Axial Scan Direction): 0.63

PSI/ISI Examination Volume Safe End/Pipe (SS) Weld Reduction in Coverage (RIC) from flaw indications based on Angle Beam (Circ Scan Direction):

	Calculated Circumferential Cross-Sectional Area of RIC by Drawing Package (in^3)	UT Measured Width of Laminar Flaw Indication (in)	RIC Volume for Each Indication (in^3)
NONE			0.00

Total RIC Volume in PSI/ISI Safe End/Pipe (SS) Weld Exam Volume from Flaw Indications based on Angle Beam (Circ Scan Direction): 0.00

PSI/ISI Examination Volume Safe End/Pipe (SS) Weld Reduction in Coverage (RIC) from flaw indications based on Angle Beam (Axial Scan Direction):

	Calculated Cross-Sectional Area of RIC by Drawing Package (in^3)	Average Radius of RIC Cross-Section (in)	Weld Overlay OD Surface Radius at Indication (in)	Measured Length of Indication at Weld Overlay OD Surface (in)	Corrected Length of Indication at Average RIC Cross-Section (in)	RIC Volume for Each Indication (in^3)
NONE					#DIV/0!	0.00

Total RIC Volume in PSI/ISI Safe End/Pipe (SS) Weld Exam Volume from Flaw Indications based on Angle Beam (Axial Scan Direction): 0.00

COVERAGE ESTIMATE ASSUMPTION: PSI/ISI volume must be examined in two axial and two circumferential directions to obtain full 100% coverage credit [Ref. PDI-UT-8, Para. 8.8.3]; No averaging applied.

	Total Exam Volume (in^3)	Total RIC Volume (in^3)	% RIC	Status
Percentage of PSI/ISI Examination Volume Nozzle/Safe End (DM) Weld Not Covered (Circ Scan Direction):	48.60	0.52	1.06%	ACCEPTABLE
Percentage of PSI/ISI Examination Volume Nozzle/Safe End (DM) Weld Not Covered (Axial Scan Direction):	48.60	0.63	1.30%	ACCEPTABLE

	Total Exam Volume (in^3)	RIC Volume	% RIC	Status
Percentage of PSI/ISI Examination Volume Safe End/Pipe (SS) Weld Not Covered (Circ Scan Direction):	33.96	0.00	0.00%	ACCEPTABLE
Percentage of PSI/ISI Examination Volume Safe End/Pipe (SS) Weld Not Covered (Axial Scan Direction):	33.96	0.00	0.00%	ACCEPTABLE

9.3 Any uninspectable volume in the weld overlay is to be assumed to contain the largest radial flaw that could exist in that volume. This assumed flaw is to meet the inservice examination standards of Table IWB-3514-2. Both axial and circumferential planar flaws are to be assumed.
[Ref. Appendix Q, Q-4100 (c)(3)]

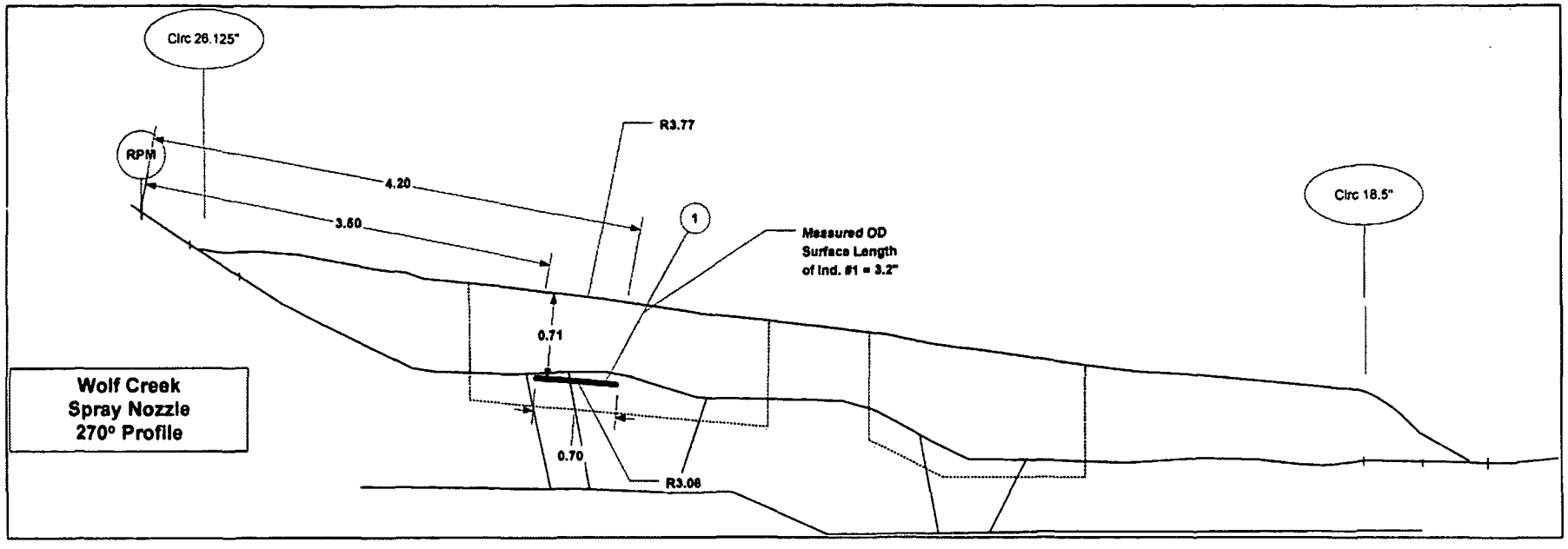
INDICATION #1 IS ASSUMED TO BE AT THE WELD OVERLAY/BASE METAL INTERFACE, I.E. NO UNINSPECTABLE VOLUME IN WELD OVERLAY

9.4 Planar flaw indications found in the PSI/ISI or weld overlay examination volumes, as defined in PDI-UT-8, are to meet the preservice examination acceptance standards of Table IWB-3514-2.
[Ref. Appendix Q, Q-4200 (b) and Q-4100 (c)]

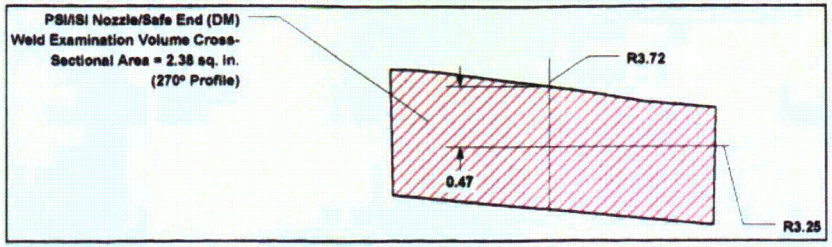
NO PLANAR FLAW INDICATIONS DETECTED.

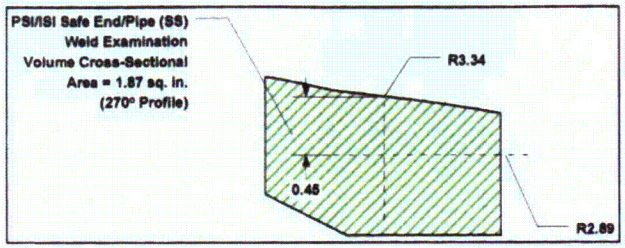
9.5 Flaw indications found in the PSI/ISI examination volume, as defined in PDI-UT-8, and within the outer 25% of the underlying weld and base metal are to satisfy the design analysis requirements of the weld overlay.
[Ref. Appendix Q, Q-4200 (b)]

NO PLANAR FLAW INDICATIONS DETECTED.

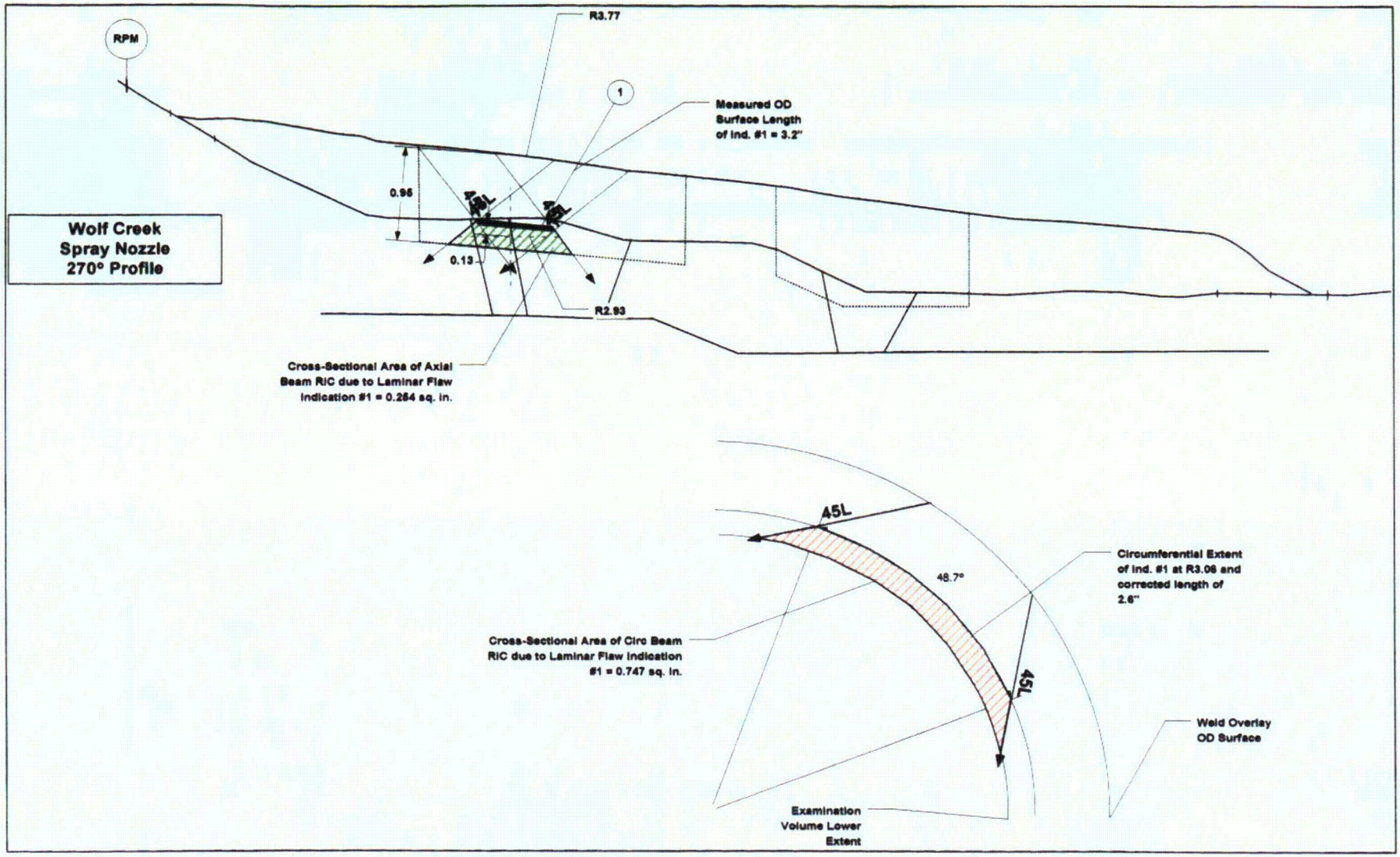

Circ 26.125"
RPM
4.20
3.50
R3.77
1
Measured OD
Surface Length
of Ind. #1 = 3.2"
Circ 18.5"
0.71
0.70
R3.08
Wolf Creek
Spray Nozzle
270° Profile

REDUCTION IN C[illegible]VERAGE PLOTS

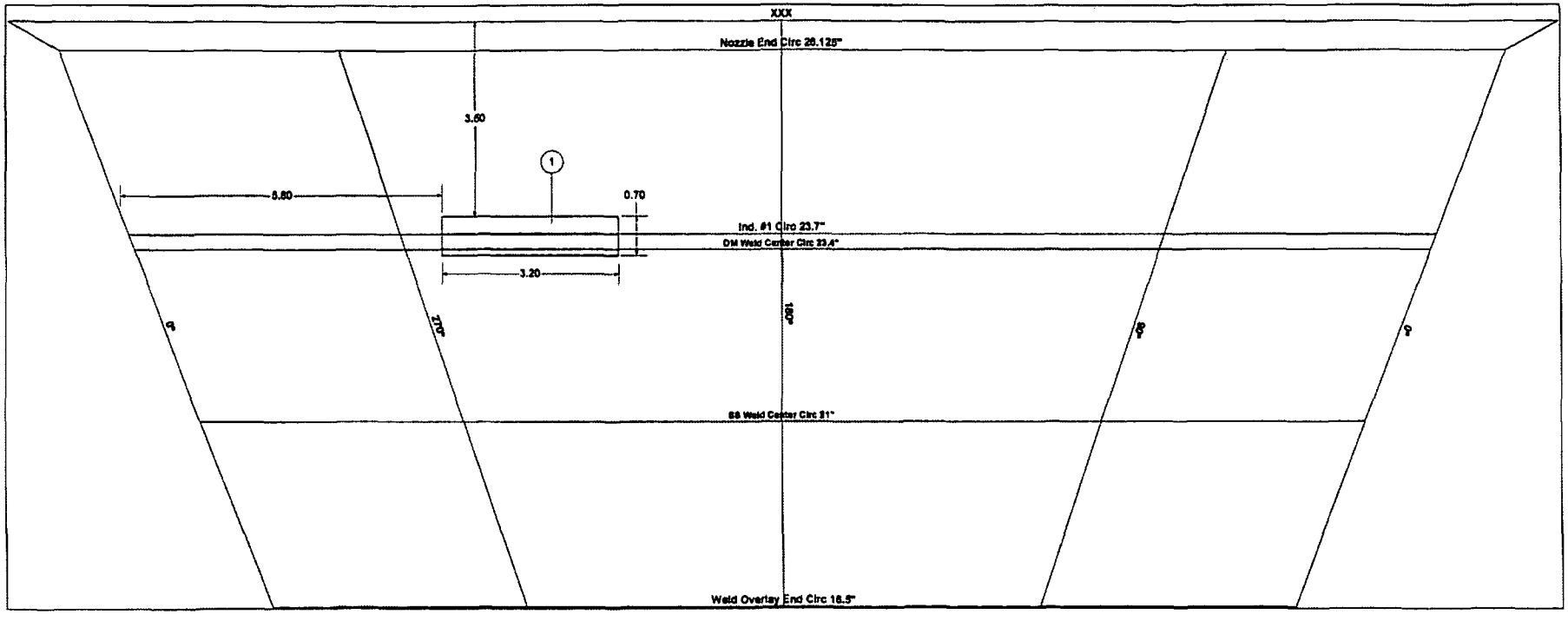




REDUCTION IN COVERAGE PLOTS



INDICATION #1 IS ASSUMED TO BE AT THE WELD OVERLAY/BASE METAL INTERFACE, I.E. NO UNINSPECTABLE VOLUME IN WELD OVERLAY


XXX
Nozzle End Circ 26.125"
3.60
1
5.80
0.70
Ind. #1 Circ 23.7"
DM Weld Center Circ 23.4"
3.20
0°
270°
180°
90°
0°
SS Weld Center Circ 21"
Weld Overlay End Circ 18.5"