### BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking on the Commission's Own Motion to Adopt New Safety and Reliability Regulations for Natural Gas Transmission and Distribution Pipelines and Related Ratemaking Mechanisms

R.11-02-019 (Filed February 24, 2011)

DECLARATION OF SUMEET SINGH SUPPLEMENTING THE VERIFIED STATEMENT OF PACIFIC GAS AND ELECTRIC COMPANY'S VICE PRESIDENT OF GAS TRANSMISSION MAINTENANCE AND CONSTRUCTION IN RESPONSE TO RULING OF ASSIGNED COMMISSIONER AND ASSIGNED ADMINISTRATIVE LAW JUDGE

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Dated: October 18, 2013

### BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

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### I, SUMEET SINGH, do declare:

- 1. I am the Senior Director of Integrity Management in Gas Operations for Pacific Gas and Electric Company (PG&E). Prior to that I was the Senior Director of Asset Knowledge Management in Gas Operations for PG&E.
- 2. I received a B.S. in civil engineering from the University of California, Berkeley, in 2000, and a Masters of Business Administration from the University of California, Los Angeles, in 2008. I have been employed by PG&E for a total of 11 years, spending approximately 9 years in gas operations.
- 3. I am providing this declaration as a supplement to the Verified Statement of M. Kirk Johnson submitted on August 30, 2013 based on the ongoing analysis of documentation and information on Line 147 conducted by David Harrison, a former PG&E pipeline engineer and now a technical consultant working on our maximum allowable operating pressure (MAOP) validation effort. The ongoing work conducted by Mr. Harrison and his team is discussed in paragraphs 39 through 48 of the Verified Statement. I am also providing copies of recent expert reports from Exponent and from Kiefner and Associates.
- 4. As discussed in the Verified Statement, in early 2013 Mr. Harrison and his team learned that portions of Segments 108 and 108.7 of Line 147 had been cut out as part of the 2011 hydrostatic testing process. Mr. Harrison was able to confirm from photographs of four sections

of pipe that had been cut out of Line 147 in connection with the strength tests that the long seam for two sections of the pipe was DSAW. Another was seamless, and the fourth was SSAW. Based on this, we updated the MAOP validation documentation for Segments 108 and 108.7 to show the SSAW seam type. Despite the fact that destructive testing confirmed a specified minimum yield strength (SMYS) value of 42,000 psi, we reduced the SMYS value of these segments to 33,000 psi in order to reflect a more conservative SMYS value based on the seam type and installation year.

- 5. At the time PG&E submitted the Verified Statement, our best available information indicated that while the updated SMYS value did affect the MAOP for the two segments (reduced from 525 psig to 412 psig), these segments were still commensurate with an MAOP of 365 psig. This was based upon, among other things, the conservative SMYS value of 33,000 psi, a wall thickness of 0.3125 inches, and a design factor of 0.5 for a class 3 location.
- 6. The wall thickness of 0.3125 inches was derived from a 1957 strength test pressure report, the bill of material for performing the hydrostatic testing in 2011, the drawing detail from the 2011 hydrostatic testing that corresponds to the bill of material, and the associated record of material removed form (chain of custody form). A copy of the 1957 strength test pressure report is attached as Exhibit A.
- 7. Prior to submitting the Verified Statement, we had an "H form" dated December 2, 2011, from a contractor involved with our pressure testing work. The H form was associated with mile point 1.89 that corresponded to segment 107.7 and identified 20 inch diameter pipe with a wall thickness between 0.261 inches and 0.275 inches. It also indicated that the seam type for this pipe was DSAW. A copy of this H form is attached as Exhibit B. Once we confirmed that segment 107.7 pipe was 24 inch diameter pipe and not 20 inch pipe as indicated on the H-form, we discounted this H form due to the inaccuracy and were uncertain of the location due to the incorrect mile point information. We continued to rely on the documentation of 0.3125 inches of wall thickness described in paragraph 6 above for segments 108 and 108.7, although we have also continued to analyze our records for Line 147 and for our entire system.

- 8. PG&E's review of its records and examination of pipe has been ongoing, and did not end while PG&E was preparing the Verified Statement. We have continued to gather, review and analyze additional information about Line 147. Attached as Exhibit C is a report prepared by PG&E's Applied Technology Services (ATS) Department dated August 29, 2013. ATS performed ultrasonic measurements of the wall thickness of the pipe cutout stored in our Modesto pipe storage yard. This test indicated a pipe wall thickness range of 0.25 inches (from 0.247 inches to 0.258 inches) for pipe believed to be for segment 108, rather than 0.3125 inches as was previously identified on the records. After receipt of this report, we double-checked to confirm that ATS had tested the correct pipe sample, which was confirmed last month.
- 9. In addition, on August 27, 2013, PG&E received a revised H form from the contractor for the pressure testing work. The revised H form changed the mile point, which now associated it with Segment 108, and also changed the seam type, but did not change its wall thickness measurements. Given the number of changes to the H form, PG&E conducted additional diligence to ensure the correct location and data accuracy by discussing these changes further with our pressure testing team. A copy of this revised H form is attached as Exhibit D. The updated seam type on this form shows A.O. Smith pipe. However, we believe the seam type is actually SSAW, based on a review performed by Michael Rosenfeld of Kiefner and Associates. Both A.O. Smith and SSAW pipe have a joint efficiency factor of 0.8, so this difference in the seam type does not affect the MAOP.
- 10. Given the updated information from two sources consisting of the ATS report (Exhibit C) and revised H form (Exhibit D), PG&E has applied a conservative representation for the entire length of segments 108 and 108.7 by using a wall thickness of 0.250 inches instead of 0.3125 inches and thus the MAOP for both of these segments would be 330 psig, not 412 psig as described in paragraphs 48 and 49 of the Verified Statement. The MAOP for the entire line remains at 330 psig.
- 11. On September 13, 2013, I submitted a Declaration supplementing the Verified Statement by submitting reports from Anamet, Inc. concerning the metallurgical evaluation of

the pipe where the leak that was found in October 2012 on Line 147, Segment 109. PG&E also retained Exponent to conduct an analysis to identify why the October 2012 leak on Line 147, Segment 109 was not detected during the hydrotest. Exponent conducted visual, metallographic, fractographic, and chemical analysis of the leak site. Exponent concluded that "[t]he subject leak was caused by cracking that occurred within a location on the pipe body that had been repaired using a weld-metal deposition ('weld repair'). This weld repair was not associated with either a girth or longitudinal seam weld." Moreover, Exponent found "no metallographic or fractographic evidence that any crack growth occurred following the repair weld. Specifically, there was no evidence of progressive crack growth due to fatigue, stress corrosion cracking (SCC) or ductile tearing[.]" The Exponent report is attached as Exhibit E.

- 12. PG&E also retained Kiefner and Associates to determine whether the hydrostatic pressure tests on Line 147 still established Line 147's fitness for service. Kiefner and Associates conclude that Line 147 is safe to operate. For convenience and clarity, I am quoting the conclusions of Kiefner and Associates in full below:
  - 1. PG&E has substantial knowledge of the type of pipe, construction features, and appurtenances present in Line 147. Data from metallurgical examination of a leak that occurred in 2012 suggests that the affected pipe was reconditioned first-generation A.O. Smith line pipe. Records indicate that such pipe was shipped to the site in 1957, although it is not listed in the PFL, confirming that the database is not perfect.
  - 2. The October 2011 hydrostatic pressure spike test confirmed the fitness for service of the pipeline for its MAOP without doubt. The concept of pressure testing to establish the ability of a pipeline to safely hold pressure at a lower pressure is an accepted practice that is logical and supported by industry experience and research. NTSB and PHMSA have recommended and required, respectively, hydrostatic pressure testing to revalidate pipeline operating pressures. The test was performed to a sufficient margin to assure the integrity of the pipeline well into the future assuming routine maintenance practices such as catholic protection monitoring and damage prevention programs continue to be implemented.
  - 3. A review of data concerning specific pipeline integrity threats provides no evidence that the integrity or fitness for service of Line 147 has degraded in the 2 years since the October 2011 hydrostatic tests were conducted.

In addition, Kiefner and Associates' letter states, "The fact that PG&E may not know all facts about every piece of pipe or component in Line 147 does not cause me particular concern considering that the pipeline in its current condition was successfully pressure tested to a level that supports a maximum allowable operating pressure (MAOP) of 400 psig." A copy of the Kiefner and Associates report is attached as Exhibit F.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct to the best of my knowledge and belief.

Executed this 18th day of October 2013, at San Ramon, California.

SUMEET SINGH, Senior Director

shows dings

**Integrity Management** 

PACIFIC GAS AND ELECTRIC COMPANY

## **EXHIBIT A**

### DEPARTMENT OF GAS OPERATIONS

### FIELD PRESSURE TEST REPORT (Per ASA B 31.1.8 - 1955 Code for Pressure Piping, Paragraph 841.4)

1.	Proj	ject Description: Relocat	o 24° Main 14	7; Brittan Avenu	e, San Carlos	
	-					
2.	Pipe	eline Data:	Size	Wall Thickness	Steel Specificat	ions
	(a)	Mainline		0.3125	API 5IX,Gr	<u>x 42</u>
	(b)	Design Operating Pressur	re, maximum		psi osi	
	(c)	Stress at Max. D.O.P.		; as % of yield ; " " " "	38.1	
	(d)	Location class 3	Type c	onstruction		
	(e)	Test pressure 750	psi; flu psi; "	id Vater	Period of test1	hour
	(f)	Stress at Test Pressure		si; as % of yieldsi; " " " "	i 5762	
3.	Test	, Data				
	(a)	Date and time started te	est 10.21.57	<u>];20 py</u> , flu	uid used	
	(b)	Date and time reached te				
	(c)	Date and time concluded	· · · · · · · · · · · · · · · · · · ·			e <u>:750 #</u>
	(d)	Date and time Purging st				
	(e)	Date and time Pipeline t		A Company of the Comp	∩∩ PW	
	(f)	Date and time Pipeline P		#4-10, y-5-1	· CO_PM	
	(g)	Name of FG&E Supervisor			A Company of the comment of the company of the comp	
	(h)	Who made test? _p_ C. &		central et de la companya del companya del companya de la companya del la companya de la company		
Div.	ision		XXX			
OOIL	orace	or (Indicate Name) -				

Division Manager concerned.

## **EXHIBIT B**



INSPECTION SERVICES
Pipeline Integrity Team
CWA # 2500461774
GEIS Job # LAPI0015

### **IN-FIELD SERVICES**

### **GEIS Pipeline Integrity Team NDE**

### Pacific Gas & Electric Company

Hydrostatic Test Dig from October 7, 2011 to November 5, 2011 T43A/B\_L147\_B \_MP-1.89

**Documents Contained Within:** 

H-Form Report T43A/B\_L147\_B MP-1.89 NDE Reports of T43A/B\_L147\_B MP-1.89 Photo Report of T43A/B\_L147\_B MP-1.89

Authors: H. Mayer & J. Hayes Date: December 2, 2011



Page 1 of 30

Form H: Dire	ct Examination Data S	heet - Page 1 of	10							
	DA/ILI Route Number:	L-147	Site	DA Designation:	T43A/B_B	3	ILI I	<u>ILI</u> .og Distance:	NA	
	Date of Excavation:	10/7/2011		N-Segment:	NA		RMP-11	Ref. Section:	Table 5.6	5.2
Evami	Mile Point: nation Performed By:	1.89 H. Mayer/J. Hay	vec	IMA Number:	NA			e Girth Weld: om Girth Weld:	NA NA	
	6&E Project Manager:	Donovan Fin	<del></del>	gion Number:	NA		Distance Fi	om Girui Weiu.	INA	
	Approved By:	Kenji Gailey	/ Sub	region # (ICDA):	NA					
	Order Number:	41497360		Stationing:	NA					
Excava	ation Priority:				Excavation I	Reason				
=	=	cheduled (For ILI -	1 Year  X Hydro Test	Other)	ECDA		_i	ecoat		
•	tical, take P/S or CIS read						NA			
Excavation De	tails: U/S Ditch Start of Northing: 37.4878 Easting: -122.27		(Uncorrected F	ield Measurement) PDOP: Acc~:	NA NA		Excavation Length Excavation Length		NA 21.0ft	
	Centerline G Northing: NA	SPS Coordinates	(Uncorrected F	ield Measurement)	NA_		GPS File N	ame:	Guida 148T4313	3
	Easting: NA	ind GPS Coordinate	as (Uncorrected F	Acc~:	NA					
	Northing: 37.4878 Easting: -122.27	3664944	o (oncorrected)	PDOP: Acc~:	NA NA					
1.0 Data Befo	ore Coating Removal									
1.1	Native Soil Type:	X	Clay X Rock	X Sand	Loam	Wet	Other		NA	
1.1	1.1A Backfill Material F		Silt	Slurry	Native	<b>-</b>	of Cover (Ft.):		6.00ft	
	Comments:		<b>—</b>	<b>—</b>	NA NA					
1.2	· · · · · · · · · · · · · · · · · · ·	X HAA	Somastic	Plastic Ta		Wax Tape	FBE		owercrete	
1.2	Coating Type:	<b>□</b> _	<b>□</b>	$\rightarrow$	pe L				Owerciele	
	Bare/None	<b>□</b>	ш –	NA		Comments:		NA		
	Coating Thickness (Inche	es):	0.250in	N	lumber of Layers:			2		
1.3	Holiday Testing Perforn	ned?: Device Used:	=	No V Wet Sponge	oltage Used:	NA	-	ap Location of Holi NA	days Below.	
1.4	Pipe-to-Soil Potentials i		US: 1:	, ,	3:00	Comments:		35 9:00	-526	-
	•	·····,	DS: 1:		3:00	-658		9:00	-663	-
	_			CD t- b	ery low, may be tu		e e			
	Comments:			CP appears to be v	ery low, may be tu	rned on at time o	or inspection.			
1.5	Soil Resistivity in Ditch	<u> </u>			ery low, may be to					
1.5	Soil Resistivity in Ditch Method:	( <b>Ω-cm</b> ): 4-Pin	24469.5 oh		ery low, may be to	Soil Box	NA	US: N/A	DS:	N/A
	Soil Resistivity in Ditch Method: X Comments:	4-Pin	24469.5 oh NA			Soil Box	NA SRM-100	US: N/A	DS:	N/A
1.6	Soil Resistivity in Ditch Method: X Comments: Soil Sample Location	4-Pin Comn	24469.5 of NA ments	nm/cm	Dit	Soil Box	NA SRM-100 0 position under p	pe.		
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1.6	Soil Resistivity in Ditch Method: X Comments: Soil Sample Location Ground Water Present?	4-Pin Comn	24469.5 of NA ments  Yes X No  Good - Adhered to Pipe	nm/cm Sample(s	Dít ) Collected?: NA Fair - Coati	Soil Box tch end (DS) 6:00	NA SRM-100 0 position under p	pe. Sample pH:		
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1.6 1.7 1.8 1.9	Soil Resistivity in Ditch Method: X Comments: Soil Sample Location Ground Water Present? Comments: Coating Condition:  Map of Coating Degrada *Note any calcareous degrada *Holidays Clock Clock	Comm  Comm  X  Coating r  wation*:	24469.5 of NA ments Yes X No  Good - Adhered to Pipe Poor - Coating Significantl removed & tie in weld areas as in good conition except to	Sample(s y Disbonded or Mis s blasted. Pipe sect for coating damage	Dit    Collected?:   NA	Soil Box  tch end (DS) 6:0  Yes  ing Partially Disb est pipes installe transportation. S  oint:	NA SRM-100 0 position under p X No onded or Degrade d. Removed pipe See comments page	Sample pH:  d section was also a ge 10.	NA ssesed and	
1.6 1.7 1.8 1.9	Soil Resistivity in Ditch Method: X Comments: Soil Sample Location Ground Water Present? Comments: Coating Condition:  Map of Coating Degrada *Note any calcareous degrada the Holidays  Clock Clock Clock	Comm  Comm  X  Coating r  wation*:	24469.5 of NA ments Yes X No  Good - Adhered to Pipe Poor - Coating Significantl removed & tie in weld areas as in good conition except to	Sample(s y Disbonded or Mis s blasted. Pipe sect for coating damage	Dit    Collected?:   NA	Soil Box  tch end (DS) 6:0  Yes  ing Partially Disb est pipes installe transportation. S  oint:	NA SRM-100 0 position under p X No onded or Degrade d. Removed pipe See comments page	Sample pH:  d section was also a ge 10.	NA ssesed and	
1.6 1.7 1.8 1.9	Soil Resistivity in Ditch Method: X Comments: Soil Sample Location Ground Water Present? Comments: Coating Condition:  Map of Coating Degrada *Note any calcareous degrada *Note any calcareous degrada *Output Holidays  clock  clock  clock	Comm  Comm  X  Coating r  wation*:	24469.5 of NA ments Yes X No  Good - Adhered to Pipe Poor - Coating Significantl removed & tie in weld areas as in good conition except to	Sample(s y Disbonded or Mis s blasted. Pipe sect for coating damage	Dit  NA  Fair - Coati ssing ion removed and to from removal and Zero Reference Po	Soil Box  tch end (DS) 6:0  Yes  ing Partially Disb est pipes installe transportation. S  oint:	NA SRM-100 0 position under p X No onded or Degrade d. Removed pipe See comments page	Sample pH:  d section was also a ge 10.	NA ssesed and	
1.6 1.7 1.8 1.9	Soil Resistivity in Ditch Method: X Comments: Soil Sample Location Ground Water Present? Comments: Coating Condition:  Map of Coating Degrada *Note any calcareous degrada the Holidays  Clock Clock Clock	Coating r  Coating r  Wa  ation*:  Disbondmen	24469.5 of NA ments Yes X No  Good - Adhered to Pipe Poor - Coating Significant removed & tie in weld areas as in good conition except the	Sample(s y Disbonded or Mis blasted. Pipe sect or coating damage	Dit  NA  Fair - Coati ssing ion removed and to from removal and Zero Reference Po	Soil Box  tch end (DS) 6:0  Yes  ing Partially Disb  est pipes installe transportation. S  oint:  Flow —	NA SRM-100 0 position under p X No onded or Degrade d. Removed pipe See comments pay	Sample pH:  d  section was also a ge 10.  S Exposed Pipe 36	ssesed and 60 degrees	
1.6 1.7 1.8 1.9	Soil Resistivity in Ditch Method: X Comments: Soil Sample Location Ground Water Present? Comments: Coating Condition:  Map of Coating Degrada *Note any calcareous degrada *Note any calcareous degrada *Note any calcareous degrada *Clock clock clock clock clock clock clock	Conting r  Coating r  Watation*:  posit locations  Disbondmen	24469.5 of NA ments Yes X No  Good - Adhered to Pipe Poor - Coating Significant removed & tie in weld areas as in good conition except the	Sample(s y Disbonded or Mis s blasted. Pipe sect for coating damage	Dit  NA  Fair - Coati ssing ion removed and to from removal and Zero Reference Po	Soil Box  tch end (DS) 6:0  Yes  ing Partially Disb  est pipes installe transportation. S  oint:  Flow —	NA SRM-100 0 position under p X No onded or Degrade d. Removed pipe See comments pay	Sample pH:  d  section was also a ge 10.  S Exposed Pipe 36	ssesed and 60 degrees	
1.6 1.7 1.8 1.9	Soil Resistivity in Ditch Method: X Comments: Soil Sample Location Ground Water Present? Comments: Coating Condition:  Map of Coating Degrada *Note any calcareous degrada *Note any calcareous degrada *Note any calcareous degrada *Output *	Conting r  Coating r  Watation*:  posit locations  Disbondmen	24469.5 of NA ments Yes X No  Good - Adhered to Pipe Poor - Coating Significant removed & tie in weld areas as in good conition except to	Sample(s y Disbonded or Mis s blasted. Pipe sect for coating damage	Dit  NA  Fair - Coati ssing ion removed and to from removal and Zero Reference Po	Soil Box  tch end (DS) 6:0  Yes  ing Partially Disb  est pipes installe transportation. S  oint:  Flow —	NA SRM-100 0 position under p X No onded or Degrade d. Removed pipe See comments pay	Sample pH:  d  section was also a ge 10.  S Exposed Pipe 36	ssesed and 60 degrees	

Form H: Di	rect Examination		et - Page 2	of 10							
	DA/II Route Number:	_	1.4.7	Sito D	<u>D/</u> locianation		D	1111	ILI Na Dietanesi	NA	
	Date of Excavation:		147 /2011	- Site D	esignation_ N-Segment:	T43A/B NA	D		og Distance: Ref. Section:	Table 5.6	: 2
	Mile Point:		89	_	IMA Number:	NA NA			Girth Weld:	NA	
Examin	ation Performed By:		r/J. Hayes	-	-	NA			m Girth Weld:	NA	
	&E Project Manager:		an Fink	- Red	gion Number:	NA	_				
	Approved By:		Gailey	_	egion # (ICDA):	NA					
	Order Number:	4149	7360	-	Stationing:	NA					
1.10	Photos Taken?*: *See Photo Log for	X Yes additional in	No formation.								
1.11	Coating Sample T	aken?:	Yes	X No	Loc	ation of Sample	e:		NA		
1.12	Liquid Underneath	Coating?:	Yes	X No	If Y	es, pH of Liquid			NA		
1.13	Corrosion Produc Comments:	t Present?:	Yes	X No	If Y	es, Was Sampl NA	e Taken?:	Yes	X No		
1.14	Soil pH (Sb Electro	ode):	Upstream:	6.0	Dov	vnstream:	7.5	Pip	e pH:	6.0	_
2.0 Data Af	ter Coating Rem	oval				·		<del>_</del>	·		_
2.1	Pipe Temperature		60.0° F		n	Measured Pipe	Diameter (In.)	:	63" =	20.05"	
2.2	Weld Seam Type:	` '=	DSAW	T SSAW	☐ ERW	☐ SM	•				
		=	Spiral	Lap	Flash	=	Smith	IF CAN'T DETE	ERMINE, VISUAI	LY PERFORM	
	o:			-	<b>—</b>		Simui	■ MACROETCH	& LOCATE		
2.3	Northing: Easting: Elevation:	nates & Idei	NA NA NA NA	ee Table 5.7.3	): PDO Acc		LS Weld	Clock Position	(s):	8:55	
2.4	Damage Found: Corrosion Dama Other Damage	-	Yes	X No No	n relevant to	Mechanical Da	-	Yes	X No		
2.5	UT Wall Thickness		DC: 0.270 ock 0.268	"/0.270" 5	O'clock	US / DS 0.267"/0.272" 0.266"/0.271" 0.261"/0.263"	2 O'clock 6 O'clock 10 O'clock	US / DS 0.267"/0.271" 0.268"/0.273" 0.266"/0.264"	3 O'clock 7 O'clock 11 O'clock	US / D 0.265"/0.2 0.266"/0. 0.269"/0.2	271" 272
	UT Wall Thickness	s Grid @ 6:0	0 is required			H-Form electr			<u> </u>		
2.6	Wet Fluorescent N	/ag. Part. Is	Required.	Commen	ts:	2 linear indica	ations on the re	emoved pipe se	ction. See MT	& Photo repo	rt
	Were there any line	ar indication	s? X	Yes	→	f Yes, attach NI Report to includ					
2.7	Take Photos to Do *See Photo Log for			Other Anomal							
2.8	Overview Map of O			al Information		Zero Referen	ce Point	1.10	S Exposed Pipe 3	60 dograes	
	See Fit Deptit Mea	isurement G	na ioi additioi	iai illioilliation		Zero Referen	Flow -		5 Exposed Fipe C	boo degrees	
*Note any	calcareous deposits	S.									_
12 o'cl	ock										]
9 o'cl	ock			<del>                                     </del>	+						ł
0 0 0											
				ļ							ļ
6 o'cl	ock										
_											
3 o'cl	ock										
12 o'cl	ock										1
F	eet 0 1		2	3	4	5	6	7	8	9	10

#### Form H: Direct Examination Data Sheet - Page 3 of 10

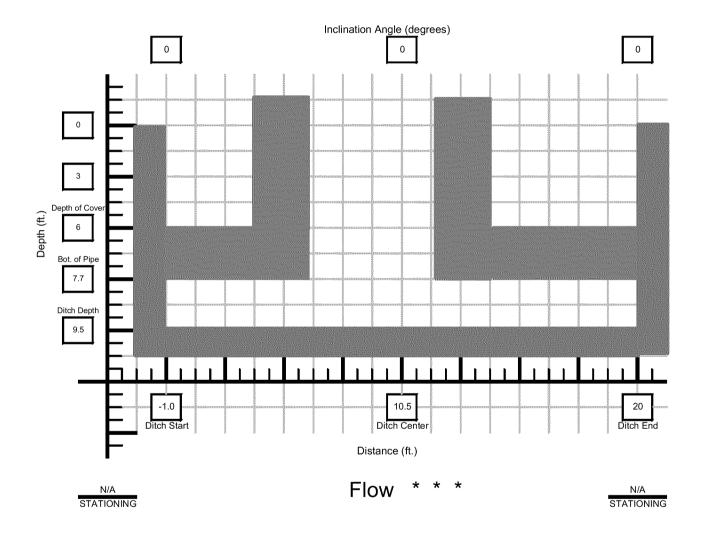
<u>DA/ILI</u>								
Route Number:	L-147							
Date of Excavation:	10/7/2011							
Mile Point:	1.89							
Examination Performed By:	H. Mayer/J. Hayes							
PG&E Project Manager:	Donovan Fink							
Approved By:	Kenji Gailey							
Order Number:	41497360							

D	<u>A</u>
Site Designation	T43A/B_B
N-Segment:	NA
IMA Number:	NA
•	NA
Region Number:	NA
Subregion # (ICDA):	NA
Stationing:	NA

<u>II</u>	<u>.l</u>
ILI Log Distance:	NA
RMP-11 Ref. Section:	Table 5.6.2
Reference Girth Weld:	NA
Distance From Girth Weld:	NA

#### **Excavation Drawing:**

At minimum draw pipe elevation profile and indicate stationing of 1) low point and 2) critical inclination angle. Place an arrow on the drawing indicating direction of gas flow in the region(s). Other labels may also be added (e.g. "to Station").



NOTES: (Record stationing and names of nearby landmarks such as creeks and roads. Provide any additional information that may help in spatially positioning pipe):

**See attached Delorme screen shot on page 11.

### Form H: Direct Examination Data Sheet - Page 5 of 10 EXTERNAL PIT DEPTH MEASUREMENT GRID SHEETS

			DA/ILI	l						D	<u>) A</u>							II	<u>LI</u>			
	Route	Numb		•	L-147			Site	e Desig	nation		T43A	/B_B			ILLL	.og Dis			N	A	
Da	te of Ex	cavati	on:	1	0/7/201	11	_			gment:			A _		RMP-11 Ref. Section:				: Table 5.6.2			
	P.	lile Po	int:	1.89			_	IMA Number:			NA		Re	ferenc	e Girth	Weld:		N	A			
Examination	n Perf	ormed	ву:	H. M	ayer/J.	Hayes	_					NA			Dist	ance Fr	om Girtl	h Weld:		N	A	
PG&E I				Do	novan I	Fink			gion Nu				A									
		roved			enji Gail			Subreg					IA						道[.001	100	9	
	Orde	r Numb	er:		4149736	0			Stati	oning:		N	A							009		
																			$ [ ]^{.100} $	019 29: - 0	9	
Grid Size = Clock Position		Inch x ify belo		Inch (s	pecify (	grid size	e)													hest pi		ng
	Anoma	aly#	NA								-	Grid#	NA									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
А																						
В			-																			
С																						
D																						
E																						$\square$
F			_	_																		
G																						
Н																						
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М																						
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s																						
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U																						
V																						
W																						$\Box$
Х																						

PIT DEPTH GRID 1 OF 2

### Form H: Direct Examination Data Sheet - Page 5 of 10 EXTERNAL PIT DEPTH MEASUREMENT GRID SHEETS

			DA/IL	I						п	PΑ								<u>LI</u>			
	Rout	te Num		•	L-147			Site	e Desid	<u>⊔</u> nation		T43A	VB_B			ILI I	.og Dis	<u>!!</u> :tance:	<del>-</del>	N	A	
Da		xcavat		1	0/7/201		_			, gment:		NA			RMP-11 Ref. Section:					Table 5.6.2		
		Mile Po		1.89 H. Mayer/J. Hayes Donovan Fink Kenji Gailey				IMA Number:  Region Number: Subregion # (ICDA):				NA			Reference Girth Weld:					NA		
Examination													A		Dist	ance Fr	om Girtl	h Weld:		NA		
PG&E												NA NA						808	عا ا	01009		
		proved er Num			4149736			Subreg		oning:			A A		•			1000 1000	010	1009 190 0	g Q	
	•				1110100		_		• 1011	·g.			., .		•					019! 19: - 0		
Grid Size = Clock Position		_Inch x		Inch (s	specify (	grid siz	e)												<b></b>	0299	9 it readi	ng
	Anom	aly#	NA								•	Grid #	NA									—
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
А																						
В																						
С																						Щ
D																						Щ
Ε	<u> </u>																		Ш			$\square$
F																						
G																						
Н																						
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Т																						$\square$
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V																						Щ
W																						Щ
X		1																				

PIT DEPTH GRID 2 OF 2

#### Form H: Direct Examination Data Sheet - Page 6 of 10

#### INTERNAL CORROSION WALL LOSS GRID

DA/	<u>ILI</u>	<u>DA</u>		<u>ILI</u>	<u>ILI</u>					
Route Number:	L-147	Site Designation	T43A/B_B	ILI Log Distance:	NA					
Date of Excavation:	10/7/2011	N-Segment:	NA	RMP-11 Ref. Section:	Table 5.6.2					
Mile Point:	1.89	IMA Number:	NA	Reference Girth Weld:	NA					
Examination Performed By:	H. Mayer/J. Hayes	<u> </u>	NA	Distance From Girth Weld:	NA					
PG&E Project Manager:	Donovan Fink	Region Number:	NA	_						
Approved By:	Kenji Gailey	Subregion # (ICDA):	NA							
Order Number:	Order Number: 41497360		NA	<u></u>						

Grid Size = 1 Inch x 1 Inch
Clock Position (specify below)
All measurements are in inches.

UT Grid is centered @ 6:00 position on pipe.

	1 2 3 4 5 6 $\sqrt{7}$ 8 9 10 11 12													
Α	0.251"	0.251"	0.249"	0.249"	0.249"	0.249"	0.249"	0.248"	0.248"	0.248"	0.248"	0.248"		
В	0.251"	0.254"	0.251"	0.251"	0.249"	0.249"	0.249"	0.249"	0.248"	0.248"	0.248"	0.249"		
С	0.253"	0.251"	0.251"	0.251"	0.251"	0.251"	0.251"	0.249"	0.249"	0.248"	0.249"	0.249"		
D	0.251"	0.251"	0.251"	0.251"	0.251"	0.249"	0.250"	0.249"	0.249"	0.248"	0.247"	0.249"		
Ε	0.251"	0.251"	0.251"	0.251"	0.251"	0.251"	0.251"	0.251"	0.247"	0.248"	0.247"	0.248"		
F	0.251"	0.251"	0.251"	0.251"	0.249"	0.249"	0.251"	0.249"	0.249"	0.247"	0.248"	0.249"		
G	0.251"	0.251"	0.247"	0.246"	0.249"	0.248"	0.247"	0.247"	0.246"	0.247"	0.248"	0.247"		
Н	0.248"	0.249"	0.249"	0.249"	0.248"	0.247"	0.247"	0.247"	0.246"	0.246"	0.246"	0.246"		
1	0.249"	0.249"	0.249"	0.249"	0.247"	0.246"	0.244"	0.247"	0.244"	0.244"	0.247"	0.246"		
j	0.247"	0.247"	0.247"	0.246"	0.246"	0.246"	0.242"	0.244"	0.244"	0.243"	0.244"	0.246"		
K	0.247"	0.247"	0.247"	0.246"	0.246"	0.246"	0.244"	0.244"	0.244"	0.244"	0.244"	0.246"		
L	0.249"	0.247"	0.247"	0.247"	0.248"	0.248"	0.248"	0.242"	0.244"	0.244"	0.246"	0.244"		

INTERNAL CORROSION GRID

1 of 1

### **COATING DAMAGE**

DA/I	<u>LI</u>	DA		<u>ILI</u>	
Route Number:	L-147	Site Designation	T43A/B_B	ILI Log Distance:	NA
Date of Excavation:	10/7/2011	N-Segment:	NA	RMP-11 Ref. Section:	Table 5.6.2
Mile Point:	1.89	IMA Number:	NA	Reference Girth Weld:	NA
Examination Performed By:	H. Mayer/J. Hayes		NA	Distance From Girth Weld:	NA
PG&E Project Manager:	Donovan Fink	Region Number:	NA	<del>-</del>	
Approved By:	Kenji Gailey	Subregion # (ICDA):	NA		
Order Number:	41497360	Stationing:	NA		

NO.	FEET FROM REFERENCE	O'CLOCK	MAX LENGTH (IN.)	MAX CIRC EXTENT (IN.)
NA				
NA	NA	NA	NA	NA
	1			
	1			
	1			
	1			
	1			
	1			
	1			
	+ +			
	+			
	<del>                                     </del>			
	ļ <u>I</u>			
	1 1			
	1 1			
	+			
	+ +			
	1			

### **CORROSION LOG**

DA/I	I <u>LI</u>	DA		<u>ILI</u>		
Route Number:	L-147	Site Designation	T43A/B_B	ILI Log Distance:	NA	
Date of Excavation:	10/7/2011	N-Segment:	NA	RMP-11 Ref. Section:	Table 5.6.2	
Mile Point:	1.89	IMA Number:	NA	Reference Girth Weld:	NA	
Examination Performed By:	H. Mayer/J. Hayes		NA	Distance From Girth Weld:	NA	
PG&E Project Manager:	Donovan Fink	Region Number:	NA			
Approved By:	Kenji Gailey	Subregion # (ICDA):	NA	_		
Order Number:	41497360	Stationing:	NA			

IC or EC	FEET FROM REFERENCE	O'CLOCK	MAX PIT DEPTH (MILS)	MAX LENGTH (IN.)	MAX CIRC EXTENT (IN.)
NA	NA	NA	NA	NA	NA
+					
			<u> </u>		
-					
-					
<del>-  </del>					
T					
$\Box$					

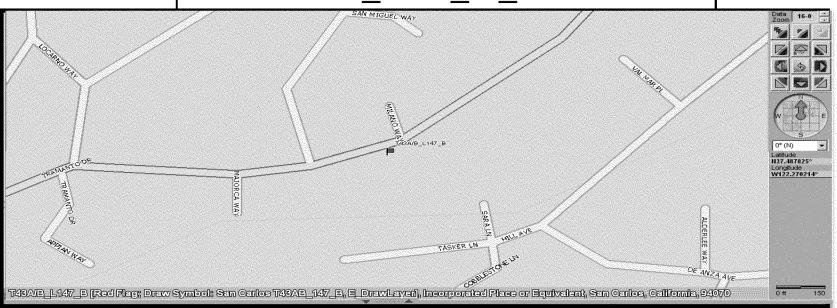
### **PHOTO LOG**

DA/	I <u>LI</u>	DA		<u>ILI</u>	
Route Number:	L-147	Site Designation	T43A/B_B	ILI Log Distance:	NA
Date of Excavation:	10/7/2011	N-Segment:	NA	RMP-11 Ref. Section:	Table 5.6.2
Mile Point:	1.89	IMA Number:	NA	Reference Girth Weld:	NA
Examination Performed By:	H. Mayer/J. Hayes		NA	Distance From Girth Weld:	NA
PG&E Project Manager:	Donovan Fink	Region Number:	NA		
Approved By:	Kenji Gailey	Subregion # (ICDA):	NA		
Order Number:	41497360	Stationing:	NA		

PHOTO NO.	LOCATION	DESCRIPTION	COMMENTS
·	***	*See attached photo report.	
-			

orm H: D		ata Sheet - Page 10 c			u i	
	DA/ILI Route Number:	L-147	<u>DA</u> Site Designation	T43A/B_B	ILI Log Distance: N	Α
	Date of Excavation:	10/7/2011	N-Segment:	NA		5.6.2
	Mile Point:	1.89	IMA Number:	NA	Reference Girth Weld: N	
Exami	nation Performed By:	H. Mayer/J. Hayes	-	NA	Distance From Girth Weld: N	Α
PC	G&E Project Manager:	Donovan Fink	Region Number:	NA		
	Approved By:	Kenji Gailey	Subregion # (ICDA):	NA	_	
	Order Number:	41497360	Stationing:	NA	<u>-</u>	
3.0 REC	OAT DATA				_	
3.1	Sandblast Media:	Sharp S	hot 30/60	Anchor Profile Me	asurement: Average: 3.2 mils	
3.2	Pipe Recoated With:					
	Powercrete J	X Poly Tape	Bar-Rust 235	Dev Grip 238	Dev Tar 247 X Protal 7200	PE Tape
3.3	For Epoxy Co	oating Systems, Record	Environmental Conditio	n:		
	Air Temperature:	62.4°F	_	Dew Point:	45.1°F	
	Pipe Temperature:	67.0°F	_ _	Relative Humidity:	51.4%	
	Time of Day:	12:30 pm				
3.4	Repair Coating Hard	ness (If ARC Coating:)	US 3:00 -	82 6:00 - 79	9:00 - 79 12:00 - 79	
•	rtopan Coating Hara	noos (ir / ii to oouungi,	DS 3:00 -	79 6:00 - 75	9:00 - 79 12:00 - 81	•
3.5	Measured Coating T	hickness: US	3:00 - 33.7	6:00 - 38.7	9:00 - 57.5 12:00 -	27.4
0.0	g .	DS		6:00 - 28.6	9:00 - 39.0 12:00 -	29.3
	Holiday Tested?:	X Yes No	•			
	Device Used:	Coil Wet S	ponge Voltage U	Jsed: UNK	Repair All Holidays. YES	
3.6	Coupon Test Sta				Yes X No	
0.0	•	<b>—</b>	103 140 2		A NO	
	If Yes, Date Installed:	NA NA				
	Surface Configuration	=	G-5 Box Carsor	= -	NA	
3.7	Backfill Material:	Native	Imported Sand	Other:	NA	
	Coating Protections?:	X Yes	No			
	If Yes, Check One:	Rockguard	Tuf-E-Nuf	Conwed  Other:	STACguard (transitions only	)
3.8	-	s Over Bell Hole After Bould be done for approxim		NA of the bell hole. Attach da	ıta.	
	Comments:			NA		
3.9	Attach site sketch of	fexcavation site.				
4.0 REPA	AIR DATA					
4.1	Repair Made:	Yes X No	4.2 Number	of Repair Made:	Replacement "In-Kind configuration"	
4.3	Repair Type	Metallic Sleeve	Non Metallic	Sleeve Replac	e Can Filler Metal	Other
4.4	Damage Repaired:	Corro	sion	1echanical	er	
	mments/Information:				ing up to test pipe tie in weld. About 1 ft of co	
	ed. 143B had coating re was inspected at the PC		n was blasted from coating	g up to test pipe tie in wei	d. About 1.5 ft of coating was inspected. Ren	noved
ipe section	was inspected at the Ft	Joc⊑ yaiu.				
		_				

# T43A/B\_L147\_B \_MP-1.89



### GE Energy

### **INSPECTION & LIFE EXTENSION SERVICES**

	MAGN	ETIC PART	ICLE EX	AMINATION I	REPORT	*		Nuclear	Non-f	Nuclear	
To:	Pacific Go	ıs & Electric (	Company	J	Fror	n: <b>H. Mayer/J. H</b>	ayes	Date:	0/7/2011		
Project:					<u> </u>	<u>_</u>					
			•	T43A/B_L147_E		39					
Purchase Order No				GEIS J	ob No:						
		97360					LAPI00				
	Weld	Structural	Casting	Machinery	Mach. Po		N/A	Other:	_		
Item	7					<u> </u>			N/A		
	Non-Weld	Plate	Pipe	Bar	Castin	g Mach. Pa	ts N/A	Other:			
	7	<u> </u>	<u> </u>				<u> </u>		N/A		
Material	Size	Material Thio		Type of Base Mat		Type of Filler N		Weld	✓ N/A		
	20"	0.250		Carbon Ste		C/S	Smooth	SnAsolow b	lded As V	Velded	
Location	70.6 Ft SW o	f the intersect Way in San C		tan Ave and Mila 94070	no Syst	tem		L-147			
Acceptance		Ct	> : C:		Prod	cedure					
Standards		Customer S	specificat	lions			GEIS QC	P # 500 Rev 17			
Type of Check	Initial	Plate Edge	In Process	Back Gouge	Root Po	ıss Repair	17	2 Hour 2	24 Hour	Final	
Type of Check	V									$\overline{A}$	
	Longitudino	ul 🗌 C	oil	DC Pro	obe	✓ Continu	ous	Other:			
	✓ Wet		ry	Direct	Contact	✓ Residua					
Type of Inspection	☐ Circular	A	.C Prod	✓ Yoke		Other					
	MT Yoke 8	k Model - Serial N	No./Blacklig	ght Model - Serial No	Э.		Surface	Preparation Me	thod		
	Parker DA	A-400 - S# 1883	0 / Spectrol	ine BIP - S# 159725	1	Abrasive Blasting (Kleen Blast) - NACE 2 Finish					
		Inspection Med	ium / Color ,	/ Batch No.		Demagnetization Method / Equipment					
	Magnag	glo 14A / Flo	urescent	Green / 09M12	к	N/A					
Reference: Summa	iry			✓ Se	e Attachme	ent					
The following ar	eas were reques	ted to be insp	ected:				1	Results of	inspection	)	
Bare pipe: -0.40' to	J						- No relevant indications found @ time of insp.				
Bare pipe : 17.4' to Removed pipe sect	<i>-</i>	ii 0/5 ditch start.						No relevant indications found @ time of insp.			
Summary:											
				0.020" , CLK Position 0.020", CLK Position							
These are on the r			,	o.oco , ocir i ositioi	1						
Indications were on t	he removed pipe sec	tion. Please see a	ttached phot	to report for additiona	ıl informatio	ın.					
Сору То:					sted By:			Reported By (Technician):			
Pacific Gas & Electr	ic Company			·	Do	avid Aguiar		H. Ma	yer/J. Ha	ues	
GE Inspection Servi	ces (Los Angeles)			V		Specifications		NDT superviso			
					Accept	Reject		1	J. Filiatr	ault	
	ECIFICATIONS AND I	PROCEDURES WI	HICH WERE	THE NDT PROCEDU	RE ACTUALL	Y PERFORMED BY		ANY IT IS SUBJEC	T TO THE LIM	IITATIONS	



### GE Energy

### **Inspection & Life Extension Services**

-	Į		Nuclear	✓ Non-Nuclear							
To:	Pacific G	ias & Ele	ctric Compa	ny		From: <b>H. Mayer</b> :	& J. Hayes	Date: 10/7/2011			
Project:				T43A/B_L	147_B _MP-	1.89					
Purchase Order N		97360		GEIS Job No:			LAPi0015				
ltem	Weld Str ✓	ructural	Casting	Machinery	Mach. Parts	Pipe	N/A	Other:			
	Non-Weld	Plate	Pipe	Bar	Casting	Mach. Parts	N/A	Other			
Material	Size: <b>20"</b>		No. of Pieces <b>1</b>	Type of Be <b>Carbo</b> e	n Steel	Ο,	ler Material <b>/S</b>	Weld Smooth	☑N/A ☑As Welded		
Location	70.6 Ft SW of t		rsection of B an Carlos, C		nd Milano	System		L-147			
Acceptance Standards		Custor	mer Specifico	ations		Procedure		QCP-601			
	Soundness Thickness Bond			Frequ	Single Crystal	Transducer Size	Dual Crystal Angle		Transducer Serial No.: 020HFC Couplant / Batch #		
Pulse Echo Angle-Beam Other			5 MHz		0.375"	0°		Sonatest Ultragel II			
Type of Inspection	UT Equipment/Mod ∪	lel ISN-60		Flat ✓		Concave	Convex		/ 25-901 07225 AF		
	Serial # 01NLKN Calibration Date:			Standard		Material	Notch Depth		Serial No.:		
	10/	/5/2011 n Due: 1/5/		Step Wedge Tube Wedge	<u> </u>	Material C/S	Thickness Range 0.200" - 0.500"		Serial No.: V34693		
Reference: Sum	mary			_	✓ See	Attachment	Results of Inspection:				
The following areas were requested to be inspected:  12" x 12" (1"x1" grid) at a random 6:00 position on the pipe.  12" lamination scans at cut-line locations.  Thickness readings US & DS inspection areas at the clock positions.							- No relevant	indications @ t	ime of inspection. ime of inspection. ime of inspection.		
** Please see	e attached repor	rts for ac	lditional info	rmation.							
** Please see attached reports for additional information.  Copy To:  Pacific Gas & Electric Company						Requested By:  David Aguiar			Reported By (Technician): H. Mayer/J. Hayes		
GE Inspection Services (Los Angeles)						Customer Specifications NDT Supervisor:			or: e J. Filiatrault		

NOTICE:
THIS EXAMINATION REPORT IS A REPORT OF THE RESULTS OF THE NDT PROCEDURE ACTUALLY PERFORMED BY THIS COMPANY
IT IS SUBJECT TO THE LIMITATIONS OF THE TESTING SPECIFICATIONS AND PROCEDURES WHICH WERE UTILIZED. BY FURNISHING
THIS REPORT, GE INSPECTION SERVICES DOES NOT GUARANTEE ANY CONDITION OF THE TESTED SPECIMEN.



This report is strictly confidential, legally privileged, containing GE Intellectual Property, & is intended for Pacific Gas & Electric representatives only. Distribution to GE competitors is strictly forbidden.



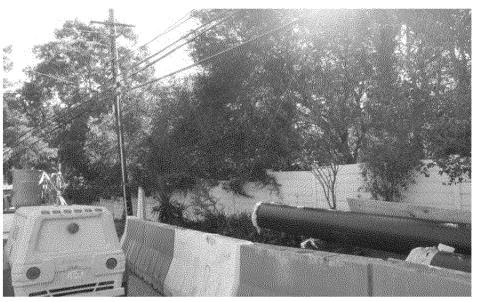
Topography looking upstream



Topography looking downstream



Typical surrounding topography



Typical surrounding topography



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Overview of Dig Site T43A-B\_L147\_B\_MP-1.89



Overview of Dig Site T43A-B\_L147\_B\_MP-1.89



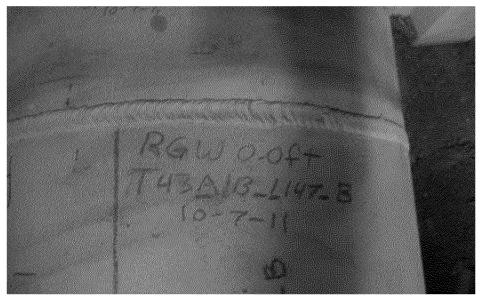
Overview of T43A(US) & T43B(DS) in same excavation.



Closeup of T43A(US) & T43B(DS) in same excavation.



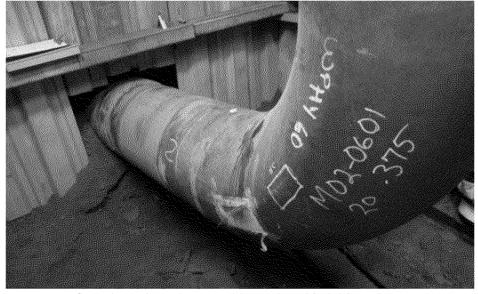
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Overview of Reference Girth Weld measurments were taken from.



Overview of coating condition -1ft to 2ft, 3:00 position



Overview of coating condition -1ft to 2ft, 3:00 position

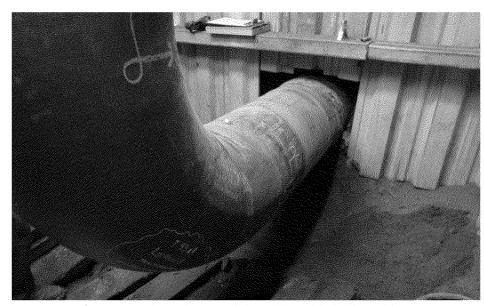


Overview of coating condition -1ft to 2ft, 9:00 position



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GE Energy



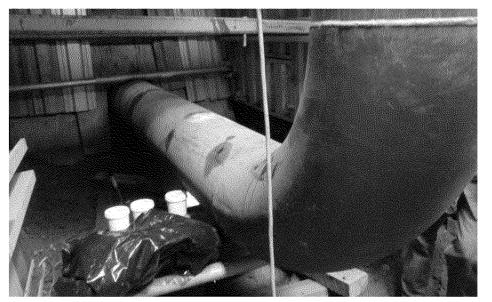
Overview of coating condition -1ft to 2ft, 9:00 position



Overview of coating condition 17ft to 20ft, 3:00 position



Overview of coating condition 17ft to 20ft, 3:00 position



Overview of coating condition 17ft to 20ft, 9:00 position



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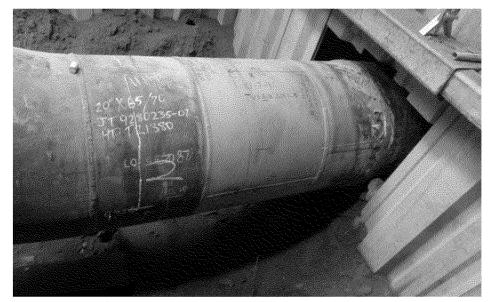
Overview of coating condition 17ft to 20ft, 9:00 position



Overview of MPI layout -1ft to 2ft, 3:00 position



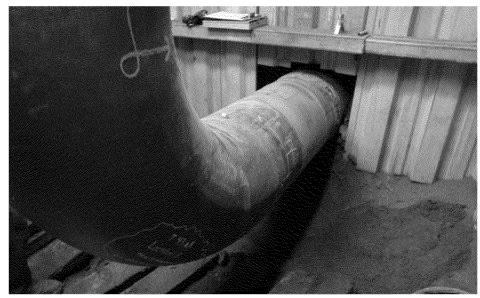
Overview of MPI layout -1ft to 2ft, 3:00 position



Overview of MPI layout -1ft to 2ft, 9:00 position



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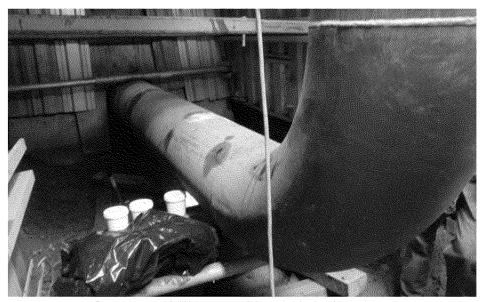
Overview of MPI layout -1ft to 2ft, 9:00 position



Overview of MPI layout 17ft to 20ft, 3:00 position



Overview of MPI layout 17ft to 20ft, 3:00 position



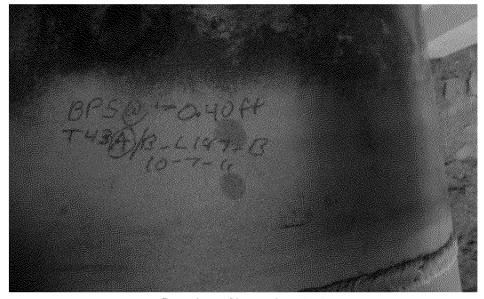
Overview of MPI layout 17ft to 20ft, 9:00 position



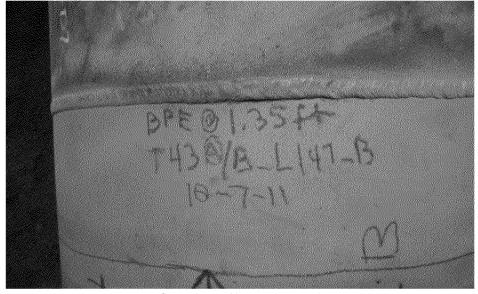
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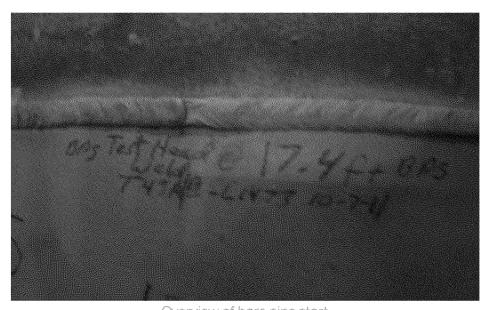
Overview of MPI layout 17ft to 20ft, 9:00 position



Overview of bare pipe start



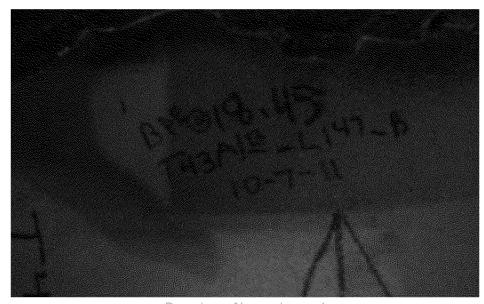
Overview of bare pipe end



Overview of bare pipe start



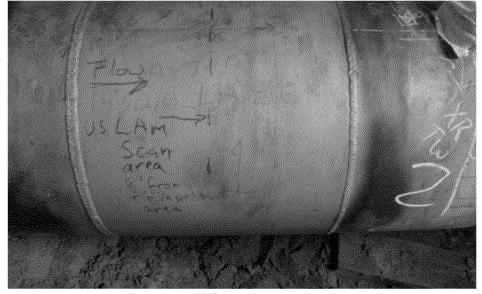
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Overview of bare pipe end



Overview of feature joint long seam @8:55



Overview of US lamination scan area.



Overview of DS lamination scan area.



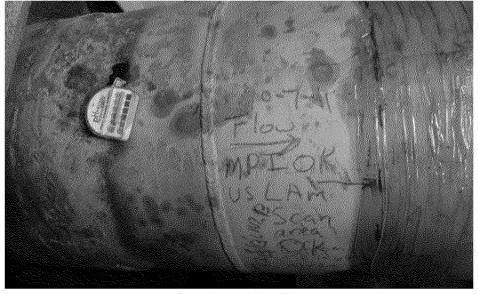
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Overview of US MPIOK and Lamination scan OK.



Overview DS of MPIOK and Lamination scan OK.



Overview of pipe Ph.



Closeup of pipe Ph.



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Removed pipe section coating assesment 3:00



Overview of coating condition 3:00 position



Overview of coating condition 3:00 position



Overview of coating condition 3:00 position



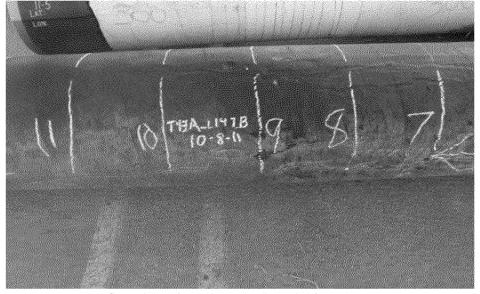
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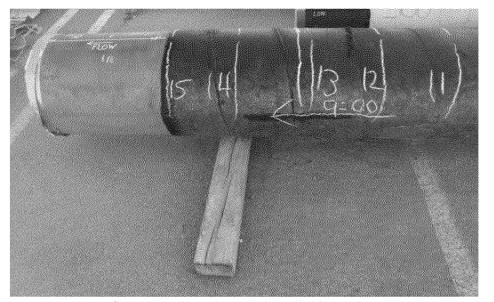
Removed pipe section coating assesment 9:00



Overview of coating condition 9:00 position



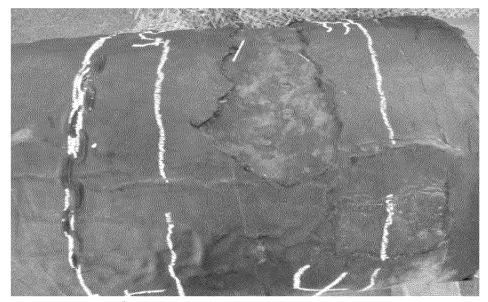
Overview of coating condition 9:00 position



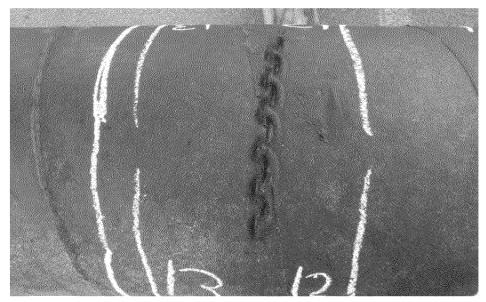
Overview of coating condition 9:00 position



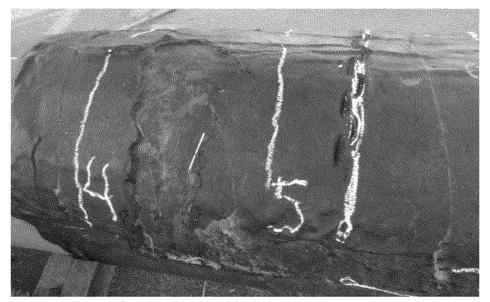
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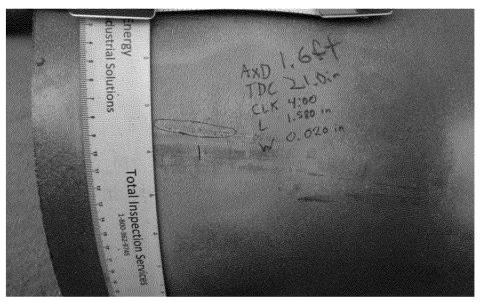
Coating damaged from removal process.



Coating damaged from removal process.



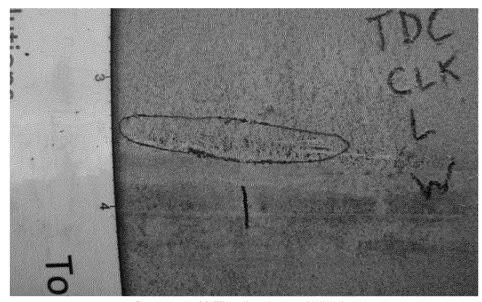
Coating damaged from removal process.



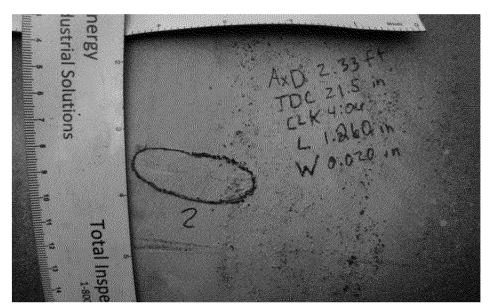
Removed pipe section linear indication-01



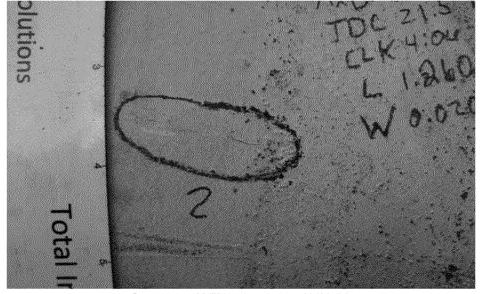
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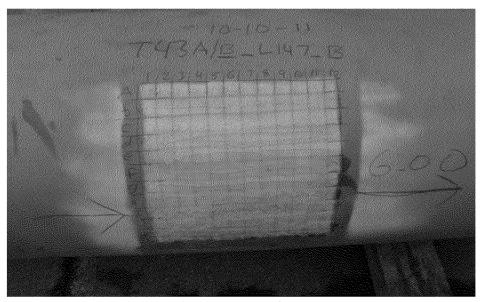
Close up of MT Indications of LIN-01



Removed pipe section linear indication-02



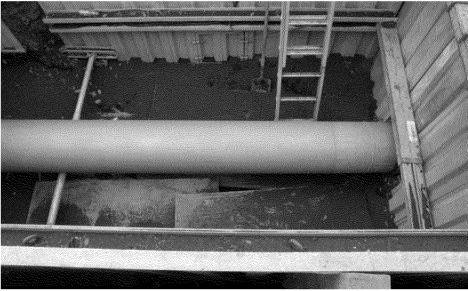
Close up of MT Indications of LIN-02



Overview of UT Grid.



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Overview of clean blasted inspection area prior to recoat activities





Overview of clean blasted inspection area prior to recoat activities



Overview of final coating condition US 3:00



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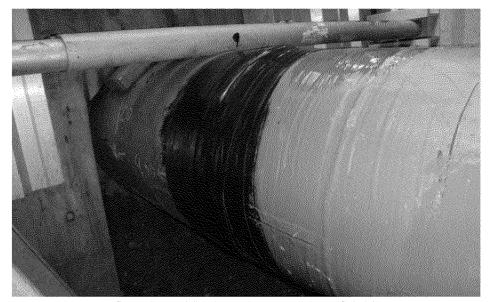
Overview of final coating condition 3:00



Overview of final coating condition 3:00



Overview of final coating condition 3:00



Overview of final coating condition US 3:00



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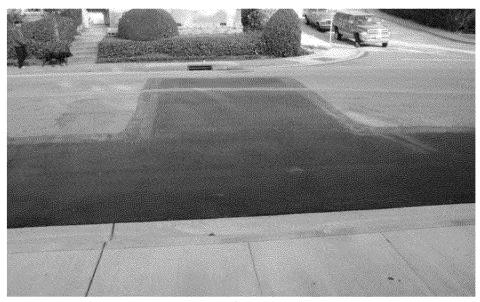
Overview of completed Slurry



Overview of completed Slurry



Overview of completed Cover looking upstream



Overview of completed Cover looking downstream



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## **EXHIBIT C**



### Line 147 T-43A, Location B MP. 1.951 Pipe Spool UT Thickness

Prepared by

Robert de Haas Sr. Engineering Technician Welding & NDE Services

Prepared for

Joe Medina Director Transmission Process & MAOI August 29, 2013

Report No.: 413.61-13.327

Pacific Gas and Electric Company Applied Technology Services 3400 Crow Canyon Road, San Ramon, California 94583



### APPLIED TECHNICAL SERVICES

### **Non Destructive Examination**

3400 Crow Canyon Road, San Ramon, CA 94583

#### Robert de Haas

(925) 866-5849 Cell (209) 480-1063



NONDESTRUCTIVE EXAMINATION DATA											
Location and Unit No:	Modesto, Line 147 pipe spool	<b>Examination Date:</b>	08/29/2013	Job	08607-01K						
Client Contact:	Joe Medina	Examiner(s):	Robert de Haas								
Manufacturer:	N/A										
		-									

**INTRODUCTION:** At the request of Joe Medina, Director Transmission Process and MAOI, Ultrasonic

thickness measurements were taken on a pipe spool, stored in the Modesto pipe storage yard.

**COMPONENT EXAMINED:** 20" Diameter pipe spool removed from Line 147, (T-43A), MP 1.951.

Pipe spool markings: Line 147

T-43A-11-B, Loc B

Lat. 37.4878247306 / Lon. 122.2701966194

**EXAMINATION METHOD:** Ultrasonic Thickness Measurements (UTT)

Procedure – ATS-UT-302, Rev 3 Panametrics – EPOCH4, Sn. 21417606

Aerotech Alpha HP - 0.25" diameter, 10 mHz transducer, Sn. G10507

Calibration block – Panametrics 2214E, Sn. 8840

Pipe surface condition – Flash rust

**EXAMINATION RESULTS:** UT readings showed a pipe wall thickness range of 0.25". Wall thickness readings were taken at

four points on the pipe circumference, 90° apart. One additional reading was taken at a polished

area where previous pipe grade testing was performed on the upstream end of the spool.

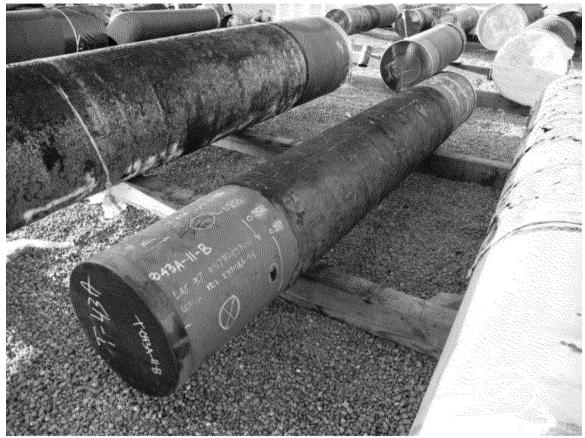
U/S end

<b>Clock position</b>	<u>12:00</u>	<u>03:00</u>	<u>06:00</u>	<u>09:00</u>
	0.256"	0.258"	0.257"	0.247"

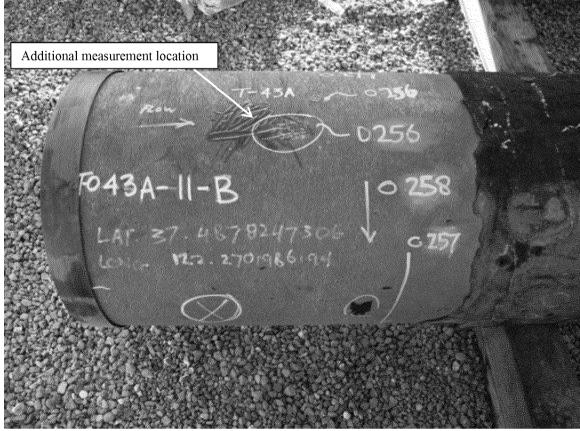
Polished area 0.256"

D/S end

Clock position	<u>12:00</u>	<u>03:00</u>	<u>06:00</u>	<u>09:00</u>		
	0.251"	0.253"	0.254"	0.247"		



Pipe spool



Upstream end on spool



Downstream end of spool

### **EXHIBIT D**



INSPECTION SERVICES
Pipeline Integrity Team
CWA # 2500461774
GEIS Job # LAPI0015

### IN-FIELD SERVICES

### **GEIS Pipeline Integrity Team NDE**

### Pacific Gas & Electric Company

Hydrostatic Test Dig from October 7, 2011 to November 5, 2011

T43A/B\_L147\_B\_MP-1.95

Documents Contained Within:

H-Form Report T43A/B\_L147\_B MP-1.95 NDE Reports of T43A/B\_L147\_B MP-1.95 Photo Report of T43A/B\_L147\_B MP-1.95

Authors: H. Mayer & J. Hayes Date: December 2, 2011



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FormH: Dire	ct Examination Da	_	ge 1 of 10								
		<u>VILI</u>	-147	64-1	<u>DA</u>	T43A/B	D		<u> </u>	NA NA	
	Route Number: Date of Excavation:		7/2011	_	Designation: N-Segment:	1434/b_ NA			og Distance: Ref. Section:	Table 5.6	32
	Mile Point:		1.95	_	MA Number:	NA.			e Girth Weld:	NA NA	,. <u>_</u>
Examir	nation Performed By:	H. Maye	er/J. Hayes	-	_				rom Girth Weld:	NA	
PG	6&E Project Manager:		ovan Fink		ion Number:	NA					
	Approved By: Order Number:		ji Gailey 497360	_ Subn	gion#(ICDA): Stationing:	NA NA					
-			+37300	-	Jadoring						
Excava	ation Priority:	_			_	Excavation	Heason	_			
lt	mmediate	Scheduled (Fo	or ILI -	1 Year	Other)	ECD#	· 🔲 1	J R	ecoat		
<i>l</i>	Vionitor	Effectiveness	X	Hydro Test		☐ ICOA		Other <u>NA</u>			
lf pract	tical, take P/S or CIS i	roads hafara av	cavation:					NA			
Excavation Det	•	tart GPS Coordin		(Uncorrected Fig	eld Measurement)			147			
	Northing: 37.				PDOP.			Excavation Length		NA	
	Easting: -12	2.2701986194			Acc~:	NA_	Actual	Excavation Length	(Ft.):	21.0ft	
		ne GPS Coordina	ates	(Uncorrected Fig	eld Measurement)			GPS File N	ame:	Guida 148T4313	3
	Northing: <u>NA</u> Easting: <u>NA</u>				PDOP. Acc~:	NA NA					
		nh End CDC Cod	ardinatas	A becomested Fig.	eld Measurement)						
	Northing: 37.	ch End GPS Coo 4878664944	orum lates	(Uncorrected Fit	na ivieasurement, PDOP						
		2.2702163300			Acc~:	NA					
1 0 Data Refe	ore Coating Remov	nal les									
		ren	_			_		_			
1.1	Native Soil Type:		X Clay	X Rock	X Sand	Loam	Wet	Other .		NA .	
	1.1A Backfill Mater	rial Found:		Silt	Slurry	Native	Depth	of Cover (Ft.):		6.00ft	
	Comments:					NA					
1.2	Coating Type:	X HAA	. 🔲 s	Somastic	Plastic Ta	pe	Wax Tape	FBE	P	owercrete	
	☐ Bare/i	Vone	Coal Tar	Other:			Comments:				
	Coating Thickness (In	nches):	0.25	 ∩in	1		_		2		
	coung montes (n				·	tarribor or Edyoro.					
1.3	Holiday Testing Per	formed?:	□ \(  \text{  \text{ \text{ \text{ \text{ \text{ \text{ \text{ \text{  \text{ \text{ \text{ \text{ \text{  \text{  \text{ \text{ \text{ \text{  \text{ \text{ \text{ \text{ \text{ \text{ \text{ \text{ \text{   \text{  \text{   \text{   \qq\qq\qq\qq\qq\qq\qq\qq\qq\qq\qq\qq\qq	res X N	ko '	/oltage Used:	NA	_ M	ap Location of Holi	days Below.	
		Deviœ L	Jsed:	Coil U	Vet Sponge		Comments		NA		_
1.4	Pipe-to-Soil Potentia	als in Ditch (-m\	<b>v</b> ):	US: 12			-530		9:00	-526	_
				DS: 12	:00 -661	3:00	-658	6:00 -6	9:00	-663	
											-
	Comments:			(	P appears to be	very low, may be t	umed off at time	of inspection.			
1.5	Soil Resistivity in D				•	very low, may be t	_	,			
1.5	Soil Resistivity in D	itch (Ω-cm): X 4-Pin		24469.5 oh	•	very low, may be t	umed off at time  Soil Box	, NA	LIS: N/A	DS:	N/A
	Soil Resistivity in D Method: Comments:	X 4-Pin	Comments		•		Soil Box	NA SRM-100	US: N/A	DS:	N/A
1.6	Soil Resistivity in D Method: Comments: Soil Sample Location	X 4-Pin	Comments	24469.5 oh NA	m/cm		Soil Box	NA SRW-100 0 position under p	ipe.		
	Soil Resistivity in D Method: Comments: Soil Sample Location Ground Water Prese	X 4-Pin	Comments  Yes	24469.5 oh	m/cm	E s) Collected?:	Soil Box	NA SRM-100			
1.6 1.7	Soil Resistivity in D Method: Comments: Soil Sample Locatio Ground Water Prese Comments:	X 4-Pin	Yes	24469.5 oh NA X No	m/cm	s) Collected?:	Soil Box Vitch end (DS) 6:0 Yes	NA SRM-100 0 position under p	ipe. Sample pH:		
1.6	Soil Resistivity in D Method: Comments: Soil Sample Location Ground Water Prese	X 4-Pin	Yes X Good - Ad	24469.5 oh NA X No Shered to Pipe	n/cm Sample(	s) Collected?:  NA  Fair - Coar	Soil Box Vitch end (DS) 6:0 Yes	NA SRW-100 0 position under p	ipe. Sample pH:		
1.6 1.7	Soil Resistivity in D Method: Comments: Soil Sample Locatic Ground Water Prese Comments: Coating Condition:	X 4-Pin	Yes  X Good - Ar Poor - Co	24469.5 oh NA  X No Chered to Pipe atting Significantly	Sample(	s) Collected?: NA Fair - Coa	Soil Box  Stitch end (DS) 6.0  Yes  ting Partially Disb	NA SRW-100 0 position under p X No onded or Degrade	Sample pH:	NA NA	
1.6 1.7	Soil Resistivity in D Method: Comments: Soil Sample Locatio Ground Water Prese Comments:	X 4-Pin	Yes  X Good - Ar Poor - Co Coating removed	24469.5 oh NA X No Shered to Pipe ating Significantly & tie in weld areas	Sample( Disbonded or Mis	s) Collected?: NA Fair - Coa	Soil Box  Nitch end (DS) 6:0  Yes  ting Partially Disb	NA SRW-100 0 position under p X No onded or Degrade	Sample pH:	NA NA	
1.6 1.7	Soil Resistivity in D Method: Comments: Soil Sample Locatic Ground Water Prese Comments: Coating Condition:	X 4-Pin	Yes  X Good - Ar Poor - Co Coating removed	24469.5 oh NA X No Shered to Pipe ating Significantly & tie in weld areas	Sample( Disbonded or Missiblasted, Pipe seor coating damag	s) Collected?.  NA  Fair - Coa  ssing  ction removed and e from removal ar	Soil Box  Stich end (DS) 6:0  Yes  ting Partially Disb	NA SRW-100 0 position under p  X No onded or Degrade ed. Removed pipe See comments pa	Sample pH:  d section was also a ge 10.	NA easesed and	
1.6 1.7	Soil Resistivity in D Method: Comments: Soil Sample Locatic Ground Water Prese Comments: Coating Condition:  Map of Coating Deg	A-Pin on ent?:	Yes  X Good - Ar Poor - Co Coating removed was in good	24469.5 oh NA X No Shered to Pipe ating Significantly & tie in weld areas	Sample( Disbonded or Missiblasted, Pipe seor coating damag	s) Collected?: NA Fair - Coa	Soil Box  Stich end (DS) 6:0  Yes  ting Partially Disb	NA SRW-100 0 position under p  X No onded or Degrade ed. Removed pipe See comments pa	Sample pH:	NA easesed and	
1.6 1.7 1.8	Soil Resistivity in D Method: Comments: Soil Sample Locatic Ground Water Prese Comments: Coating Condition:  Comments:  Map of Coating Deg *Note any calcareous	A-Pin  on  ent?:  gradation*:  s deposit location	Yes  X Good - Ar Poor - Co Coating removed was in good	24469.5 oh NA X No Shered to Pipe ating Significantly & tie in weld areas	Sample( Disbonded or Missiblasted, Pipe seor coating damag	s) Collected?.  NA  Fair - Coa  ssing  ction removed and e from removal ar	Soil Box  Nitch end (DS) 6:0  Yes  Ting Partially Disb  Itest pipes instal d transportation.	NA SRW-100 0 position under p  X No onded or Degrade ed. Removed pipe See comments pa	Sample pH:  d section was also a ge 10.	NA easesed and	
1.6 1.7 1.8	Soil Resistivity in D Method: Comments: Soil Sample Locatic Ground Water Prese Comments: Coating Condition:  Map of Coating Deg	A-Pin  on  ent?:  gradation*:  s deposit location	Yes  X Good - Ar Poor - Co Coating removed was in good	24469.5 oh NA X No Shered to Pipe ating Significantly & tie in weld areas	Sample( Disbonded or Missiblasted, Pipe seor coating damag	s) Collected?.  NA  Fair - Coa  ssing  ction removed and e from removal ar	Soil Box  Stich end (DS) 6:0  Yes  ting Partially Disb	NA SRW-100 0 position under p  X No onded or Degrade ed. Removed pipe See comments pa	Sample pH:  d section was also a ge 10.	NA easesed and	
1.6 1.7 1.8	Soil Resistivity in D Method: Comments: Soil Sample Locatio Ground Water Prese Comments: Coating Condition:  Comments:  Map of Coating Deg *Note any calcareous Holidays	A-Pin  on  ent?:  gradation*:  s deposit location	Yes  X Good - Ar Poor - Co Coating removed was in good	24469.5 oh NA X No Shered to Pipe ating Significantly & tie in weld areas	Sample( Disbonded or Missiblasted, Pipe seor coating damag	s) Collected?.  NA  Fair - Coa  ssing  ction removed and e from removal ar	Soil Box  Nitch end (DS) 6:0  Yes  Ting Partially Disb  Itest pipes instal d transportation.	NA SRW-100 0 position under p  X No onded or Degrade ed. Removed pipe See comments pa	Sample pH:  d section was also a ge 10.	NA easesed and	
1.6 1.7 1.8	Soil Resistivity in D Method: Comments: Soil Sample Locatio Ground Water Prese Comments: Coating Condition:  Comments:  Map of Coating Deg *Note any calcareous Holidays	A-Pin  on  ent?:  gradation*:  s deposit location	Yes  X Good - Ar Poor - Co Coating removed was in good	24469.5 oh NA X No Shered to Pipe ating Significantly & tie in weld areas	Sample( Disbonded or Missiblasted, Pipe seor coating damag	s) Collected?.  NA  Fair - Coa  ssing  ction removed and e from removal ar	Soil Box  Nitch end (DS) 6:0  Yes  Ting Partially Disb  Itest pipes instal d transportation.	NA SRW-100 0 position under p  X No onded or Degrade ed. Removed pipe See comments pa	Sample pH:  d section was also a ge 10.	NA easesed and	
1.6 1.7 1.8	Soil Resistivity in D Method: Comments: Soil Sample Locatio Ground Water Prese Comments: Coating Condition:  Comments:  Map of Coating Deg *Note any calcareous Holidays	A-Pin  on  ent?:  gradation*:  s deposit location	Yes  X Good - Ar Poor - Co Coating removed was in good	24469.5 oh NA X No Shered to Pipe ating Significantly & tie in weld areas	Sample( Disbonded or Missiblasted, Pipe seor coating damag	s) Collected?.  NA  Fair - Coa  ssing  ction removed and e from removal ar	Soil Box  Nitch end (DS) 6:0  Yes  Ting Partially Disb  Itest pipes instal d transportation.	NA SRW-100 0 position under p  X No onded or Degrade ed. Removed pipe See comments pa	Sample pH:  d section was also a ge 10.	NA easesed and	
1.6 1.7 1.8 1.9	Soil Resistivity in D Method: Comments: Soil Sample Locatio Ground Water Prese Comments: Coating Condition:  Comments:  Map of Coating Deg *Note any calcareous Holidays	A-Pin  on  ent?:  gradation*:  s deposit location	Yes  X Good - Ar Poor - Co Coating removed was in good	24469.5 oh NA X No Shered to Pipe ating Significantly & tie in weld areas	Sample( Disbonded or Missiblasted, Pipe seor coating damag	s) Collected?.  NA  Fair - Coa  ssing  ction removed and e from removal ar	Soil Box  Nitch end (DS) 6:0  Yes  Ting Partially Disb  Itest pipes instal d transportation.	NA SRW-100 0 position under p  X No onded or Degrade ed. Removed pipe See comments pa	Sample pH:  d section was also a ge 10.	NA easesed and	
1.6 1.7 1.8 1.9	Soil Resistivity in D Method: Comments: Soil Sample Locatio Ground Water Press Comments: Coating Condition:  Comments:  Map of Coating Deg *Note any calcareous Holidays	A-Pin  on  ent?:  gradation*:  s deposit location	Yes  X Good - Ar Poor - Co Coating removed was in good	24469.5 oh NA X No Shered to Pipe ating Significantly & tie in weld areas	Sample( Disbonded or Missiblasted, Pipe seor coating damag	s) Collected?.  NA  Fair - Coa  ssing  ction removed and e from removal ar	Soil Box  Nitch end (DS) 6:0  Yes  Ting Partially Disb  Itest pipes instal d transportation.	NA SRW-100 0 position under p  X No onded or Degrade ed. Removed pipe See comments pa	Sample pH:  d section was also a ge 10.	NA easesed and	
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1.6 1.7 1.8 1.9	Soil Resistivity in D Method: Comments: Soil Sample Locatio Ground Water Presi Comments: Coating Condition:  Map of Coating Deg "Note any calcareous Holidays  clock	A-Pin  on  ent?:  gradation*:  s deposit location	Yes  X Good - Ar Poor - Co Coating removed was in good	24469.5 oh NA X No Shered to Pipe ating Significantly & tie in weld areas	Sample( Disbonded or Missiblasted, Pipe seor coating damag	s) Collected?.  NA  Fair - Coa  ssing  ction removed and e from removal ar	Soil Box  Nitch end (DS) 6:0  Yes  Ting Partially Disb  Itest pipes instal d transportation.	NA SRW-100 0 position under p  X No onded or Degrade ed. Removed pipe See comments pa	Sample pH:  d section was also a ge 10.	NA easesed and	
1.6 1.7 1.8 1.9	Soil Resistivity in D Method: Comments: Soil Sample Locatio Ground Water Presi Comments: Coating Condition:  Map of Coating Deg "Note any calcareous Holidays  clock	A-Pin  on  ent?:  gradation*:  s deposit location	Yes  X Good - Ar Poor - Co Coating removed was in good	24469.5 oh NA X No Shered to Pipe ating Significantly & tie in weld areas	Sample( Disbonded or Missiblasted, Pipe seor coating damag	s) Collected?.  NA  Fair - Coa  ssing  ction removed and e from removal ar	Soil Box  Nitch end (DS) 6:0  Yes  Ting Partially Disb  Itest pipes instal d transportation.	NA SRW-100 0 position under p  X No onded or Degrade ed. Removed pipe See comments pa	Sample pH:  d section was also a ge 10.	NA easesed and	
1.6 1.7 1.8 1.9	Soil Resistivity in D Method: Comments: Soil Sample Locatio Ground Water Presi Comments: Coating Condition:  Map of Coating Deg "Note any calcareous Holidays  clock	A-Pin  on  ent?:  gradation*:  s deposit location	Yes  X Good - Ar Poor - Co Coating removed was in good	24469.5 oh NA X No Shered to Pipe ating Significantly & tie in weld areas	Sample( Disbonded or Missiblasted, Pipe seor coating damag	s) Collected?.  NA  Fair - Coa  ssing  ction removed and e from removal ar	Soil Box  Nitch end (DS) 6:0  Yes  Ting Partially Disb  Itest pipes instal d transportation.	NA SRW-100 0 position under p  X No onded or Degrade ed. Removed pipe See comments pa	Sample pH:  d section was also a ge 10.	NA easesed and	
1.6 1.7 1.8 1.9	Soil Resistivity in D Method: Comments: Soil Sample Locatio Ground Water Presi Comments: Coating Condition:  Map of Coating Deg *Note any calcareous Holidays  clock	A-Pin  on  ent?:  gradation*:  s deposit location	Yes  X Good - Ar Poor - Co Coating removed was in good	24469.5 oh NA X No Shered to Pipe ating Significantly & tie in weld areas	Sample( Disbonded or Missiblasted, Pipe seor coating damag	s) Collected?.  NA  Fair - Coa  ssing  ction removed and e from removal ar	Soil Box  Nitch end (DS) 6:0  Yes  Ting Partially Disb  Itest pipes instal d transportation.	NA SRW-100 0 position under p  X No onded or Degrade ed. Removed pipe See comments pa	Sample pH:  d section was also a ge 10.	NA easesed and	
1.6 1.7 1.8 1.9 12 of	Soil Resistivity in D Method: Comments: Soil Sample Locatio Ground Water Prese Comments: Coating Condition:  Comments:  Map of Coating Deg "Note any calcareous Holidays  clock	A-Pin on ent?:  radation*: s deposit location	Yes  X Good - Ar Poor - Co Coating removed was in good	24469.5 oh NA X No Shered to Pipe ating Significantly & tie in weld areas	Sample( Disbonded or Missiblasted, Pipe seor coating damag	s) Collected?.  NA  Fair - Coa  ssing  ction removed and e from removal ar	Soil Box  Nitch end (DS) 6:0  Yes  Ting Partially Disb  Itest pipes instal d transportation.	NA SRW-100 0 position under p  X No onded or Degrade ed. Removed pipe See comments pa	Sample pH:  d section was also a ge 10.	NA easesed and	
1.6 1.7 1.8 1.9 12 of 6 of 3 of 12 o	Soil Resistivity in D Method: Comments: Soil Sample Locatio Ground Water Presi Comments: Coating Condition:  Map of Coating Deg *Note any calcareous Holidays  clock	A-Pin on ent?:  radation*: s deposit location	Yes  X Good - Ar Poor - Co Coating removed was in good	24469.5 oh NA X No Shered to Pipe ating Significantly & tie in weld areas	Sample( Disbonded or Missiblasted, Pipe seor coating damag	s) Collected?.  NA  Fair - Coa  ssing  ction removed and e from removal ar	Soil Box  Nitch end (DS) 6:0  Yes  Ting Partially Disb  Itest pipes instal d transportation.	NA SRW-100 0 position under p  X No onded or Degrade ed. Removed pipe See comments pa	Sample pH:  d section was also a ge 10.	NA easesed and	
1.6 1.7 1.8 1.9 12 of 6 of 3 of 12 o	Soil Resistivity in D Method: Comments: Soil Sample Locatio Ground Water Prese Comments: Coating Condition:  Comments:  Map of Coating Deg *Note any calcareous Holidays  clock  clock	x 4-Pin on ent?:  radation*: s deposit location Disbool	Yes  X Good-Ar Poor-Co Coating removed was in good	24469.5 oh NA  X No Shered to Pipe ating Significantly & tie in weld areas d contition except t	Sample( Disbonded or Mis siblasted. Pipe se or coating damag	s) Collected?:  NA  Fair - Coa ssing ction removed and te from removal ar Zero Reference I	Soil Box  Altch end (DS) 6:0  Yes  Iting Partially Disb  Itest pipes install d transportation.  Point:  Flow —	NA SRM-100 0 position under p  X No onded or Degrade ed. Removed pipe See comments pa	Sample pH: d section was also age 10. IS Exposed Pipe 3	nva	
1.6 1.7 1.8 1.9 12 of 6 of 3 of 12 o	Soil Resistivity in D Method: Comments: Soil Sample Locatio Ground Water Prese Comments: Coating Condition:  Comments:  Map of Coating Deg *Note any calcareous Holidays  clock  clock	x 4-Pin on ent?:  radation*: s deposit location Disbool	Yes  X Good - Ar Poor - Co Coating removed was in good	24469.5 oh NA  X No Shered to Pipe ating Significantly & tie in weld areas d contition except t	Sample( Disbonded or Mis siblasted. Pipe se or coating damag	s) Collected?:  NA  Fair - Coa ssing ction removed and te from removal ar Zero Reference I	Soil Box  Altch end (DS) 6:0  Yes  Iting Partially Disb  Itest pipes install d transportation.  Point:  Flow —	NA SRM-100 0 position under p  X No onded or Degrade ed. Removed pipe See comments pa	Sample pH: d section was also age 10. IS Exposed Pipe 3	nva	
1.6 1.7 1.8 1.9 12 of 6 of 3 of 12 o	Soil Resistivity in D Method: Comments: Soil Sample Locatio Ground Water Prest Comments: Coating Condition:  Map of Coating Deg "Note any calcareous Holidays clock  clock	A-Pin  an aradetion*: s deposit location  Disbool	Yes  X Good - Ar Poor - Co Coating removed was in good s andments  2 s deposits con	24469.5 oh  NA  X No Shered to Pipe ating Significantly & tie in weld areas d conition except to	Sample( Disbonded or Mis siblasted. Pipe se or coating damag	s) Collected?:  NA  Fair - Coa ssing ction removed and te from removal ar Zero Reference I	Soil Box  Altch end (DS) 6:0  Yes  Iting Partially Disb  Itest pipes install d transportation.  Point:  Flow —	NA SRM-100 0 position under p  X No onded or Degrade ed. Removed pipe See comments pa	Sample pH: d section was also age 10. IS Exposed Pipe 3	nva	
1.6 1.7 1.8 1.9 12 of 6 of 3 of 12 o	Soil Resistivity in D Method: Comments: Soil Sample Locatio Ground Water Presi Comments: Coating Condition:  Map of Coating Deg "Note any calcareous Holidays  clock  clock  clock  clock Feet 0	A-Pin  an aradetion*: s deposit location  Disbool	Yes  X Good-Ar Poor-Co Coating removed was in good	24469.5 oh  NA  X No Shered to Pipe ating Significantly & tie in weld areas d conition except to	Sample( Disbonded or Mis siblasted. Pipe se or coating damag	s) Collected?:  NA  Fair - Coa ssing ction removed and te from removal ar Zero Reference I	Soil Box  Nitch end (DS) 6:0  Yes  ting Partially Disb  Itest pipes instal d transportation.  Point:  Flow —	NA SRM-100 0 position under p  X No onded or Degrade ed. Removed pipe See comments pa	Sample pH: d section was also age 10. IS Exposed Pipe 3	nva	

Note	orm H: Direct Examination					
Date of Execution:   107/2011		-	<u>DA</u>	T424 & D	II II on Dieternos	NIA
Mile Point   1.56	_					
Name	_					
Region Number					_	
Approved By			- Region Mumber:		Distance From Giral Werd.	14-1
1.10   Photos Taken?*:   Yes   No   Location of Sample:   NA	· · · —				<del>-</del>	
1.10   Photos Taken?*:   Yes   No   No   See Photo Log for additional information.   1.11   Coating Sample Taken?*:   Yes   No   If Yes, pH of Liquid:   NA   NA   NA   NA   NA   NA   NA   N					<del>-</del>	
1.12 Liquid Underneath Coating?:	1.10 Photos Taken?*:	X Yes No			_	
1.13   Corrosion Product Present?:   Yes   X   No	1.11 Coating Sample Ta	ken?: Yes	X No Loca	ation of Sample:	NA	
1.13   Corrosion Product Present?:   Yes   X   No   If Yes, Was Sample Taken?:   Yes   X   No   Comments:   Yes   X   No   NA   Yes   X   No   Yes   X   No   Na   Yes   X   No   Northing:   NA   Northing:   NA   Na   Na   Na   Northing:   NA   Na   Na   Na   Na   Northing:   NA   Na   Na   Na   Northing:   NA   Na   Na   Na   Na   Na   Northing:   NA   Na   Na   Na   Na   Northing:   NA   Na   Na   Na   Na   Na   Na   Na	1.12 Liquid Underneath	Coating?:	X No If Ye	s, pH of Liquid:	NA	
2.1   Pipe Temperature (°F):   60.0° F		Present?: Yes	X No If Ye	·	Yes X No	
Pipe Temperature ("F):   60.0" F	1.14 Soil pH (Sb Electro	de): Upstream:	6.0 Down	nstream: 7.5	Pipe pH:	6.0
Pipe Temperature ("F):   60.0" F	D-4- Aften Cestin - Dem					
2.2   Weld Seam Type:	Data After Coating Remo	<u>ovai</u>				
2.3 Girth Weld Coordinates & Identify Type (See Table 5.7.3):  Northing: NA Elevation: NA Elevation: NA  2.4 Damage Found: Other Damage: Other	2.1 Pipe Temperature (	(° <b>F</b> ): 60.0° F		easured Pipe Diameter	(ln.): 63" = 2	20.05"
Northing:   NA	2.2 Weld Seam Type:	=======================================	=	=		LY PERFORM
Corrosion Damage	Northing: Easting:	NA NA	PDOF		Veld Clock Position(s):	8:55
TDC:   0.270"/0.275"   1 O'clock   0.266"/0.271"   2 O'clock   0.267"/0.271"   3 O'clock   0.266"/0.271"   6 O'clock   0.266"/0.273"   7 O'clock   0.266"/0.272"   7 O'clock   0.260"/0.272"   7 O'c	Corrosion Dama	· 🛏	<b>-</b>	<del>-</del>		
2.6 Wet Fluorescent Mag. Part. Is Required.  Were there any linear indications?  X Yes No  No  Take Photos to Document Corrosion and Other Anomalies*  *See Photo Log for additional information.  2.8 Overview Map of Corroded Area*:  *See Pit Depth Measurement Grid for additional Information  *Note any calcareous deposits.  12 o'clock  9 o'clock  3 o'clock	2.5 UT Wall Thickness	TDC: 0.270 4 O'clock 0.268	"/0.275" 1 O'clock 0 "/0.270" 5 O'clock 0	.267"/0.272" 2 O'cloc .266"/0.271" 6 O'cloc	k 0.267"/0.271" 3 O'clock k 0.268"/0.273" 7 O'clock	0.265"/0.271" 0.266"/0.272
Were there any linear indications?  X Yes No If Yes, attach NDE report electronically as part of the H-Form. Report to include black light and white light photos of indications.  2.7 Take Photos to Document Corrosion and Other Anomalies* *See Photo Log for additional information.  2.8 Overview Map of Corroded Area*: *See Pit Depth Measurement Grid for additional Information  *Note any calcareous deposits.  12 o'clock  9 o'clock  3 o'clock	UT Wall Thickness	Grid @ 6:00 is required	. Be sure to attach grid to	H-Form electronically.	See page 6 of 10.	
Report to include black light and white light photos of indications.  2.7 Take Photos to Document Corrosion and Other Anomalies* *See Photo Log for additional information.  2.8 Overview Map of Corroded Area*: *See Pit Depth Measurement Grid for additional Information  Zero Reference Point:  US Exposed Pipe 360 degrees  *Note any calcareous deposits.  12 o'clock  9 o'clock  6 o'clock  3 o'clock	2.6 Wet Fluorescent M	ag. Part. Is Required.	Comments:	2 linear indications on th	ne removed pipe section. See MT	& Photo report.
2.7 Take Photos to Document Corrosion and Other Anomalies* *See Photo Log for additional information.  2.8 Overview Map of Corroded Area*:  *See Pit Depth Measurement Grid for additional Information  Elow  *Note any calcareous deposits.  12 o'clock  9 o'clock  3 o'clock	Were there any linea	ar indications?	<b>→</b>		• •	
*See Pit Depth Measurement Grid for additional Information  Zero Reference Point:  US Exposed Pipe 360 degrees  Flow  *Note any calcareous deposits.  12 o'clock  9 o'clock  3 o'clock			Other Anomalies*		•	
*Note any calcareous deposits.  12 o'clock 9 o'clock 3 o'clock	2.8 Overview Map of C	orroded Area*:				
*Note any calcareous deposits.  12 o'clock  9 o'clock  6 o'clock  3 o'clock	*See Pit Depth Meas	surement Grid for addition	nal Information	Zero Reference Point:	US Exposed Pipe 3	60 degrees
9 o'clock 6 o'clock 3 o'clock				Flov	w	<b></b>
9 o'clock 6 o'clock 3 o'clock	Note any cal <u>ca</u> reous deposits.	<u>.                                      </u>				
6 o'clock 3 o'clock	12 o'clock					
6 o'clock 3 o'clock						
6 o'clock 3 o'clock	Q oʻolook					
3 o'clock	3 O GIOGN					
3 o'clock						
3 o'clock	6 o'clock		<del>                                     </del>	<del>                                     </del>	<del>-  </del>	
	0 0 0 0 0 N					
	3 o'clock		<del>                                     </del>	<del>†                                      </del>	<del>-  </del>	
12 o'clock						
	12 o'clock					

#### Form H: Direct Examination Data Sheet - Page 3 of 10

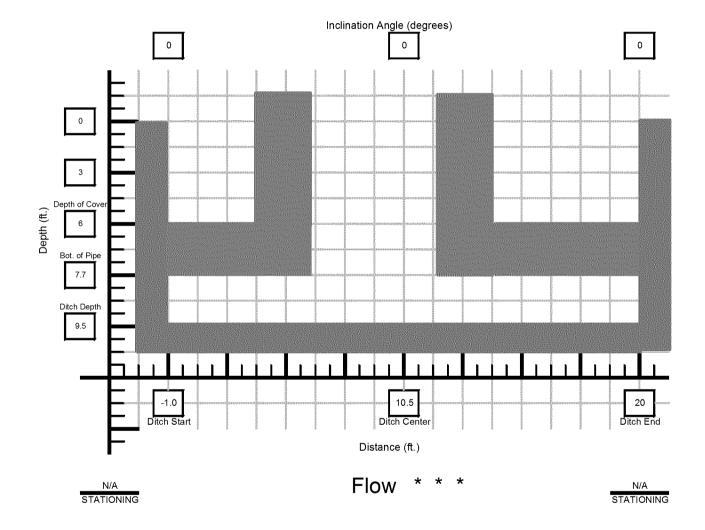
DA	<u>/ILI</u>
Route Number:	L-147
Date of Excavation:	10/7/2011
Mile Point:	1.95
Examination Performed By:	H. Mayer/J. Hayes
PG&E Project Manager:	Donovan Fink
Approved By:	Kenji Gailey
Order Number:	41497360

D	<u>A</u>
Site Designation	T43A/B_B
N-Segment:	NA
IMA Number:	NA
	NA
Region Number:	NA
Subregion # (ICDA):	NA
Stationing:	NA

<u>II</u>	<u>.l</u>
ILI Log Distance:	NA
RMP-11 Ref. Section:	Table 5.6.2
Reference Girth Weld:	NA
Distance From Girth Weld:	NA

### **Excavation Drawing:**

At minimum draw pipe elevation profile and indicate stationing of 1) low point and 2) critical inclination angle. Place an arrow on the drawing indicating direction of gas flow in the region(s). Other labels may also be added (e.g. "to Station").



NOTES: (Record stationing and names of nearby landmarks such as creeks and roads. Provide any additional information that may help in spatially positioning pipe):

**See attached Delorme screen shot on page 11.

Form H: Direct Examination Data Sheet - Page 5 of 10

EXTERNAL PIT DEPTH MEASUREMENT GRID SHEETS

			DA/IL	I						D	PΑ							II	<u>LI</u>			
	Rou	te Numi		="	L-147			Site	Desig	= nation		T43A	/B_B			ILIL	og Dis	tance:			1A	
Da	te of E	Excavat	ion:	1	0/7/201	11				gment:		Ν			R		Ref. S			Table	5.6.2	
_		Mile Po			1.95				IMA Nu	ımber:			Α					Weld:			IA	
Examination					ayer/J.			Б	<b></b>				A		Dist	ance Fr	om Girt	h Weld:		N	1A	
PG&E I		r Mana			novan f Gail		—	eg Subreg		ICDA).		N	A							100		
		er Numl			4149736			o abi eg		oning:			A		•				1.00	009	9	
			_							Ū					•				<b>=</b>  .10	019	9	
Grid Size = Clock Position		Inch x		Inch (s	specify (	grid siz	e)												.20 Hig	029 hest p	9 it readi	ng
	Anon	naly#	NA								•	Grid#	NA	<u>.                                    </u>								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
А																						
В																						
С																						
D																						
Е																						
F																						
G																						
Н																						
ı																						
J											NΑ	\										
К																						
L																						
М		$\dagger$																				
N		$\dagger$																				
0	<u> </u>	t	$\vdash$	$\vdash$																	$\mid \vdash \mid$	$\square$
P		T																			$\mid \vdash \mid$	$\dashv$
Q		t																			$\mid \vdash \mid$	
R		1																			$\vdash \vdash$	$\vdash$
s	_	T																			$\mid \vdash \mid$	$\vdash \vdash$
Т		$\vdash$	$\vdash$	$\vdash$	$\vdash$																$\vdash\vdash$	$\dashv$
U		+																			$\vdash\vdash$	$\vdash$
V		$\vdash$																			$\vdash\vdash$	$\vdash \vdash$
		1																				$\blacksquare$
W	<u> </u>	$\vdash$					$\vdash$														$\vdash \vdash$	$\square$
X		1		I	1	l								l							1	

PIT DEPTH GRID 1 OF 2

### Form H: Direct Examination Data Sheet - Page 5 of 10 EXTERNAL PIT DEPTH MEASUREMENT GRID SHEETS

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	Pout	e Numb	DA/ILI	ļ	L-147			City	e Desig		<u> </u>	T/12/	√B_B				og Die	<u>  </u> stance:	<u> </u>	N	ΙΛ	
Da	te of E			1	0/7/201		_	Site		gment:		143A			R		Ref. S				5.6.2	
		/lile Po			1.95		_		IMA Nu				IA					Weld:			Α	
Examination PG&E I					ayer/J. novan I		_	Por	gion Nu	ımbarı			IA IA		Dist	ance Fr	om Girt	h Weld:		N	Α	
FGALI		roved			enji Gail		—	Subreg				N			•				00	100	9	
	Orde	r Numb	oer:		4149736			-		oning:			IA		, ,				.01	009	9	
																			1.10	019! 029!	9	
Grid Size = Clock Position		Inch x ify belo		Inch (s	specify (	grid siz	e)												Hig	hest p	it readi	ng
	Anoma	aly#	NA								-	Grid#	NA									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
А																						
В																						
С																						
D																						
E																						
F																						
G																						
н																						
1				$\vdash$							Щ											
J											NA	\										$\overline{}$
K																						
L																						
M																						
N	$\vdash$			_	_																	
0				_	_																	$\dashv$
Р																						$\dashv$
Q _																						$\square$
R				_																		
S			_																			$\square$
Т					_																	$\square$
U																						$\square$
V																						
W																						Щ
Х																						

PIT DEPTH GRID 2 OF 2

### INTERNAL CORROSION WALL LOSS GRID

DA/IL	<u>.l</u>	<u>DA</u>					
Route Number:	L-147	Site Designation	T43A/B_B				
Date of Excavation:	10/7/2011	N-Segment:	NA				
Mile Point:	1.95	IMA Number:	NA				
Examination Performed By:	H. Mayer/J. Hayes	<u> </u>	NA				
PG&E Project Manager:	Donovan Fink	Region Number:	NA				
Approved By:	Kenji Gailey	Subregion # (ICDA):	NA				
Order Number:	41497360	Stationing:	NA				

<u>IL</u>	<u>.l</u>
ILI Log Distance:	NA
RMP-11 Ref. Section:	Table 5.6.2
Reference Girth Weld:	NA
Distance From Girth Weld:	NA

Grid Size = 1 Inch x 1 Inch
Clock Position (specify below)

All measurements are in inches.

UT Grid is centered @ 6:00 position on pipe.

	or Grid is defined by the control of pipe.											
	1	2	3	4	5	6 \	/ 7	8	9	10	11	12
Α	0.251"	0.251"	0.249"	0.249"	0.249"	0.249"	0.249"	0.248"	0.248"	0.248"	0.248"	0.248"
В	0.251"	0.254"	0.251"	0.251"	0.249"	0.249"	0.249"	0.249"	0.248"	0.248"	0.248"	0.249"
С	0.253"	0.251"	0.251"	0.251"	0.251"	0.251"	0.251"	0.249"	0.249"	0.248"	0.249"	0.249"
D	0.251"	0.251"	0.251"	0.251"	0.251"	0.249"	0.250"	0.249"	0.249"	0.248"	0.247"	0.249"
Ε	0.251"	0.251"	0.251"	0.251"	0.251"	0.251"	0.251"	0.251"	0.247"	0.248"	0.247"	0.248"
F	0.251"	0.251"	0.251"	0.251"	0.249"	0.249"	0.251"	0.249"	0.249"	0.247"	0.248"	0.249"
G	0.251"	0.251"	0.247"	0.246"	0.249"	0.248"	0.247"	0.247"	0.246"	0.247"	0.248"	0.247"
Н	0.248"	0.249"	0.249"	0.249"	0.248"	0.247"	0.247"	0.247"	0.246"	0.246"	0.246"	0.246"
ı	0.249"	0.249"	0.249"	0.249"	0.247"	0.246"	0.244"	0.247"	0.244"	0.244"	0.247"	0.246"
J	0.247"	0.247"	0.247"	0.246"	0.246"	0.246"	0.242"	0.244"	0.244"	0.243"	0.244"	0.246"
К	0.247"	0.247"	0.247"	0.246"	0.246"	0.246"	0.244"	0.244"	0.244"	0.244"	0.244"	0.246"
L	0.249"	0.247"	0.247"	0.247"	0.248"	0.248"	0.248"	0.242"	0.244"	0.244"	0.246"	0.244"

INTERNAL CORROSION GRID

1 of 1

### **COATING DAMAGE**

DA/I	LI	DA		ILI	<u>ILI</u>			
Route Number:	L-147	Site Designation	T43A/B_B	ILI Log Distance:	NA			
Date of Excavation:	10/7/2011	N-Segment:	NA	RMP-11 Ref. Section:	Table 5.6.2			
Mile Point:	1.95	IMA Number:	NA	Reference Girth Weld:	NA			
Examination Performed By:	H. Mayer/J. Hayes		NA	Distance From Girth Weld:	NA			
PG&E Project Manager:	Donovan Fink	Region Number:	NA	<del>-</del>	•			
Approved By:	Kenji Gailey	Subregion # (ICDA):	NA					
Order Number:	41497360	Stationing:	NA					

NO.	FEET FROM REFERENCE	O'CLOCK	MAX LENGTH (IN.)	MAX CIRC EXTENT (IN.)
NA	NA	NA	NA	NA
	+ +			
	+ +	+		
	+			
	+			

### **CORROSION LOG**

DA/I	<u>LI</u>	DA		ILI		
Route Number:	 L-147	Site Designation	T43A/B_B	ILI Log Distance:	NA	
Date of Excavation:	10/7/2011	N-Segment:	NA	RMP-11 Ref. Section:	Table 5.6.2	
Mile Point:	1.95	IMA Number:	NA	Reference Girth Weld:	NA	
Examination Performed By:	H. Mayer/J. Hayes		NA	Distance From Girth Weld:	NA	
PG&E Project Manager:	Donovan Fink	Region Number:	NA	_		
Approved By:	Kenji Gailey	Subregion # (ICDA):	NA	_		
Order Number:	41497360	Stationing:	NA			

IC or EC	FEET FROM REFERENCE	o'clock	MAX PIT DEPTH (MILS)	MAX LENGTH (IN.)	MAX CIRC EXTENT (IN.)
NA					
NA	NA	NA	NA	NA	NA NA
			-		
			<del> </del>		
Ī					
$\vdash$					
<b></b>					
		-			

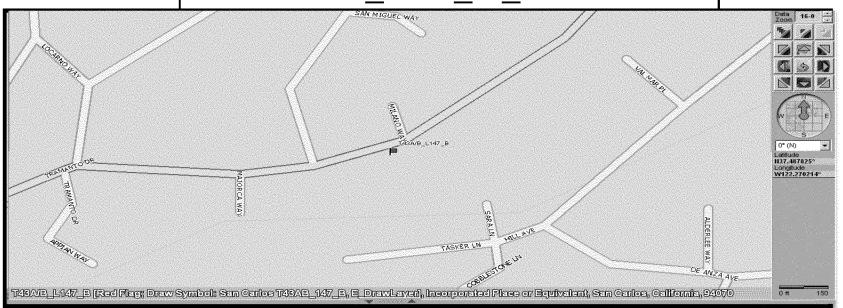
### **PHOTO LOG**

DA/	<u>ILI</u>	DA		<u>ILI</u>	
Route Number:	 L-147	Site Designation	T43A/B_B	ILI Log Distance:	NA
Date of Excavation:	10/7/2011	N-Segment:	NA	RMP-11 Ref. Section:	Table 5.6.2
Mile Point:	1.95	IMA Number:	NA	Reference Girth Weld:	NA
Examination Performed By:	H. Mayer/J. Hayes	<del>-</del>	NA	Distance From Girth Weld:	NA
PG&E Project Manager:	Donovan Fink	Region Number:	NA		
Approved By:	Kenji Gailey	Subregion # (ICDA):	NA		
Order Number:	41497360	Stationing:	NA	_	

PHOTO NO.	LOCATION	DESCRIPTION	COMMENTS							
·	****See attached photo report.									

Form H: Di		Data Sheet - Page 10 o			,	,
	DA/ILI Route Number:	L-147	<u>D.#</u> Site Designation	<u>1</u> T43A/B B	<u>ILI</u> ILI Log Distance:	NA NA
	Date of Excavation:	10/7/2011	N-Segment:	NA	RMP-11 Ref. Section:	Table 5.6.2
	Mile Point:	1.95	IMA Number:	NA NA	Reference Girth Weld:	NA
Examiı	nation Performed By:	H. Mayer/J. Hayes		NA NA	Distance From Girth Weld:	NA NA
	&E Project Manager:	Donovan Fink	Region Number:	NA		
	Approved By:	Kenji Gailey	Subregion # (ICDA):	NA NA	•	
	Order Number:	41497360	Stationing:	NA		
3.0 REC	OAT DATA		_			
3.1	Sandblast Media:	Sharp S	Shot 30/60	Anchor Profile Meas	surement: Average: 3.2 mils	
3.2	Pipe Recoated With:					
	Powercrete J	X Poly Tape	Bar-Rust 235	Dev Grip 238	Dev Tar 247 X Protal 720	00 PE Tape
3.3	For Enoxy Co	oating Systems, Record	Environmental Condition	<del></del>	<del></del>	<del>-</del>
5.5	Air Temperature:	62.4°F	Livironinental Condition	Dew Point:	45.1°F	
	Pipe Temperature:	67.0°F	_	Relative Humidity:	51.4%	
	Time of Day:		_	reducto Harmany.	31.170	
	-	·	_			
3.4	Repair Coating Hard	Iness (If ARC Coating:)	US 3:00 -	82 6:00 - 79	9:00 - 79 12:00 -	79
			DS 3:00 -	79 6:00 - 75	9:00 - 79 12:00 -	81
3.5	Measured Coating T	'hickness: US	33.7	6:00 - 38.7	9:00 - 57.5 12:	00 - 27.4
		DS	37.3	6:00 - 28.6	9:00 - 39.0 12:	00 - 29.3
	Holiday Tested?:	X Yes No	·		·	
	·	= =				
	Device Used:	Coil Wet S	Sponge Voltage	Used: UNK	Repair All Holidays. `	YES
3.6	Coupon Test Sta	ation Installed?:	Yes X No E	ETS Installed?:	es X No	
	If Yes, Date Installed:	NA		_	_	
	Surface Configuration	n:: Fink	G-5 Box Carso	nite Other:	NA	
2.7	_	=	<b>—</b>	= -	NIA	
3.7	Backfill Material:	Native	Imported Sand	Other:	NA	
	Coating Protections?:	X Yes	No			
	If Yes, Check One:	Rockguard	Tuf-E-Nuf	Conwed Other:	STACguard (transit	tions only)
				<b>—</b>	O'rAoguaid (trainsi	none only)
3.8		gs Over Bell Hole After E		NA NA		
	*If specified, a CIS sh	ould be done for approxin	nately 100' on either side	of the bell hole. Attach data	a.	
	Comments:			NA		
3.9	Attach site sketch of	f excavation site.				
4.0 BEDA	ID DATA					
4.0 REPA 4.1	Repair Made:	Yes X No	4.2 Number	of Repair Made:	Replacement "In-Kind configu	ration"
4.1	•		4.2 Number			
4.3	Repair Type	Metallic Sleeve	Non Metalli	Sleeve Replace	Can Filler Meta	al 🔲 Other
4.4	Damage Repaired:	Corre	osion 🔲 I	Mechanical  Othe	r	
•	G	<b>—</b>	<b>—</b>	<b>→</b> •••••		
	4.0.5 "	T40.4				
	mments/Information:				g up to test pipe tie in weld. Abou	
			n was blasted from coatir	ng up to test pipe tie in weid.	. About 1.5 ft of coating was inspe	ctea. Removea
pipe section	was inspected at the Po	Gal yaru.				
	<u></u>					

# T43A/B\_L147\_B \_MP-1.95



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### INSPECTION & LIFE EXTENSION SERVICES

									ľ		
	MAGNETIC PARTICLE EXAMINATION REPORT									☑ Non-	·Nuclear
To:						From:			Date:		
	Pacific Ga	s & Electric	Company			Ιн	. Mayer/J. H	aves	es 10/7/2011		
Project:									l		
			T	43A/B_L1	47 B MF	P-1.95					
Purchase Order No	D:				GEIS Job No						
	4149	7360						LAPI00	15		
	Weld	Structural	Casting	Machin	ery Ma	ch. Part	s Pipe		Other:		
		П		П	•	П	[7]			N/A	
Item	Non-Weld	Plate	Pipe	Bar	С	asting	Mach. Par	ts N/A	Other:	11,71	
	7		V							N/A	
	Size	Material Th	horand	Type of Bas	se Material		Type of Filler M	aterial	Weld	V N/A	Δ
Material	20"	0.250		Carbon			C/S	ateriai	Smooth		` Welded
	70.6 Ft SW of					Syster			Sillooth	As	vveided
Location		Way in San (			i WillallO	Gyster			L-147		
Acceptance		y ou				Proced	duro		_ 1-1/		
Standards		Customer	<b>Specificati</b>	ons		1 10000		EIS OCI	P # 500 Rev 1	7	
010111001100	Initial	Plate Edge	In Process	Back Go	une Ro	I ot Pass				Hour	Final
Type of Check	✓				age 10			12			<b>7</b>
	☐ Longitudinal		Coil		DC Probe		✓ Continuo	us	Other:		
	☑ Wet		Dry		Direct Conta	act	✓ Residual				
Type of	Circular	П	AC Prod	<b>.</b>	Yoke		Other				
Inspection											
	MT Yoke &	Model - Serial	No. / Blackligh	nt Model - Se	erial No.			Surface I	Preparation Meth	nod	
	Parker DA	-400 - S# 188:	30 / Spectrolii	ne BIP - S# 1	597251		Abrasive	Blasting	(Kleen Blast) - N	ACE 2 Fini	sh
		Inspection Med	dium / Color /	Batch No.			Den	nagnetiza	tion Method / Eq	uipment	
	Magnag	ilo 14A / Flo	ourescent C	Green / 09	M12K				N/A		
Reference: Summa	ıry			<b>4</b>	See Atta	chment			Results of I	nenectio	n
	eas were request								results of fi	вресно	11
	1.35' from original 18.45' from original								nt indications found ( nt indications found (		
Removed pipe sect		U/S ditter star	ι.						lications were found.	g time of ms	
Summary:											
	=1.60' (From U/S en							<u> </u>			
Lin-02: Axial Start=2.33' (From U/S end of pipe), AL=1.20", CW=0.020", CLK Position= 4:06  These are on the removed pipe section.											
Indications were on t	the removed pipe sect	ion Plasea coa	attached nhoto	report for ad	ditional infor	mation		<u> </u>			
Copy To:	are removed pipe sect	ion i reade dec	attacirca priote		Requested E				Reported By (Te	chnician):	
Pacific Gas & Electr	ric Company				quodica L	•	id Aguiar			er/J. Ha	aves
GE Inspection Servi				}	✓ Custo		ecifications		NDT supervisor:		.,
,	,										rault
Accept Reject Andre J. Filiatrault											

NOTICE: THIS EXAMINATION REPORT IS A REPORT OF THE RESULTS OF THE NDT PROCEDURE ACTUALLY PERFORMED BY THIS COMPANY IT IS SUBJECT TO THE LIMITATIONS OF THE TESTING SPECIFICATIONS AND PROCEDURES WHICH WERE UTILIZED. BY FURNISHING THIS REPORT, GE INSPECTION & LIFE EXTENSION SERVICES DOES NOT GUARANTEE ANY CONDITION OF THE TESTED SPECIMEN.



### GE Energy

### Inspection & Life Extension Services

		ULTRA9		☐ Nuclear	✓ Non-Nuclear						
То:						From:		Date:			
	Pacific G	Sas & Ele	ectric Compa	ny		H. Mayer	& J. Hayes		10/7/2011		
Project:				T43A/B_L	.147_B_MP-	1.95					
Purchase Order N	No:				ŒIS Job No:						
	414	197360				LAPI0015					
Item	Weld St ☑	ructural	Casting	Machinery	Mach.Parts	Pipe ✓	N/A	Other:			
	Non-Weld	Plate	Pipe	Bar	Casting	Mach. Parts	N/A	Other			
Material	Size:		No. of Pieces	Type of B	ase Metal	Type of Fil	ler Material	Weld	✓N/A		
	20"		1		n Steel	С	:/S	Smooth	As Welded		
Location	70.6 Ft SW of				nd Milano	System					
	1	Way in S	San Carlos, C	A 94070				L-147			
Acceptance		01		4.		Procedure		000 004			
Standards	Soundness Th	nickness	mer Specifica Bond	ations		Transducer		QCP-601	Towns down Operation		
	Soundness II		Bond	[7]	Cinalo Cavotal		Dual Crysta		Transducer Serial No.: 020HFC		
				Single Crystal Jency	Size		gle	Couplant / Batch #			
	Pulse Echo Ang	gle-Beam	Other	•	/iHz	0.375"		)°	Sonatest Ultragel II		
					at	Concave	Convex		/ 25-901 07225 AF		
Type of	UT Equipment/Mod	del JSN-60							/ 20-901 0/220 AF		
Inspection		# 01NL	ζNI	Standard		Material	l Notch	Depth	Serial No.:		
			-	otariaara		material	1101011	Берш	ociiai ito		
		ation Da 0/5/2011	te:	Ot 1011		Material	Thickne	ss Range	Serial No.:		
		n Due: 1/5	/2012	Step Wedge		C/S		- 0.500"	V34693		
Deference Com	i .	.,, <u>D</u> . 0. 17 0	2072	Tube Wedge		Attachment	0.200	- 0.500	V34093		
Reference: Sum The following	g areas were re	equeste	d to be inspe	cted:	See /	Attachment	-	Results of l	nspection:		
	l" grid) at a rand						- No relevant	indications@t	ime of inspection.		
12" lamination	n scans at cut-lir	ne locatio	ons.				- No relevant	indications @ t	ime of inspection.		
Thickness rea	dings US & DS in	spection	areas at the	clock position	ons.		- No relevant	indications @ t	ime of inspection.		
** Please see	e attached repo	rts for a	dditional info	rmation.							
Сору То:					Requested By	<i>/</i> :		Reported By	(Technician):		
Pacific Gas & Ele	ectric Company					David Aguia	ır	H. N	1ayer/J. Hayes		
GE Inspection Se	ervices (Los Angele	es)			✓ Custome	r Specification	ns	NDT Supervis	or:		
					✓ Accept	Reject		Andre J Filiatrault			

THIS EXAMINATION REPORT IS A REPORT OF THE RESULTS OF THE NDT PROCEDURE ACTUALLY PERFORMED BY THIS COMPANY IT IS SUBJECT TO THE LIMITATIONS OF THE TESTING SPECIFICATIONS AND PROCEDURES WHICH WERE UTILIZED. BY FURNISHING THIS REPORT, GE INSPECTION SERVICES DOES NOT GUARANTEE ANY CONDITION OF THE TESTED SPECIMEN.



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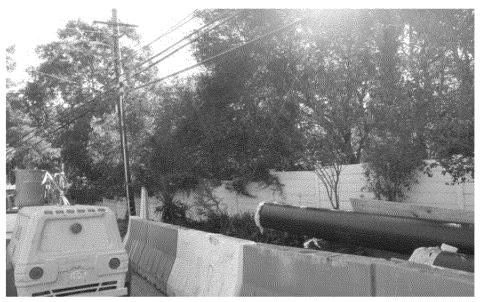
Topography looking upstream



Topography looking downstream



Typical surrounding topography

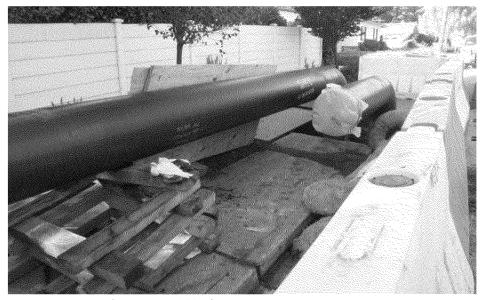


Typical surrounding topography

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Overview of Dig Site T43A-B\_L147\_B\_MP-1.89



Overview of Dig Site T43A-B\_L147\_B\_MP-1.89

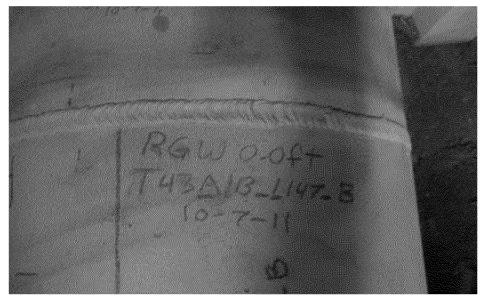


Overview of T43A(US) & T43B(DS) in same excavation.



Closeup of T43A(US) & T43B(DS) in same excavation.

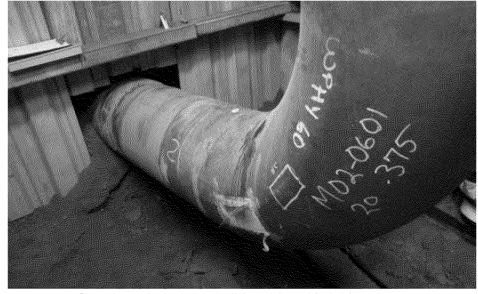
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Overview of Reference Girth Weld measurments were taken from.



Overview of coating condition -1ft to 2ft, 3:00 position



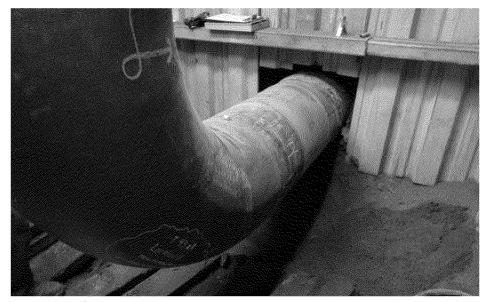
Overview of coating condition -1ft to 2ft, 3:00 position



Overview of coating condition -1ft to 2ft, 9:00 position

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Rev 2.0 (08-27-13)



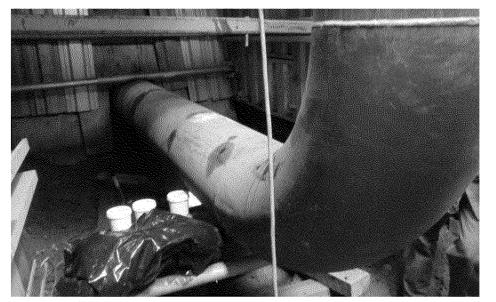
Overview of coating condition -1ft to 2ft, 9:00 position



Overview of coating condition 17ft to 20ft, 3:00 position



Overview of coating condition 17ft to 20ft, 3:00 position



Overview of coating condition 17ft to 20ft, 9:00 position

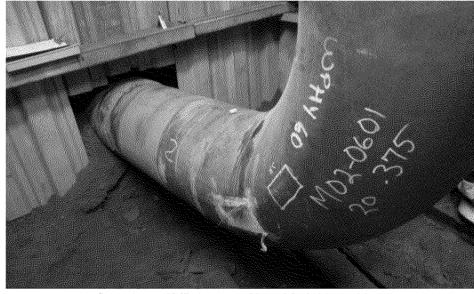
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Overview of coating condition 17ft to 20ft, 9:00 position



Overview of MPI layout -1ft to 2ft, 3:00 position

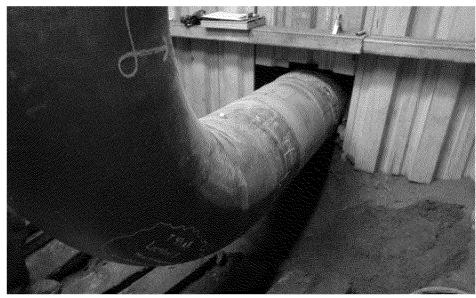


Overview of MPI layout -1ft to 2ft, 3:00 position



Overview of MPI layout -1ft to 2ft, 9:00 position

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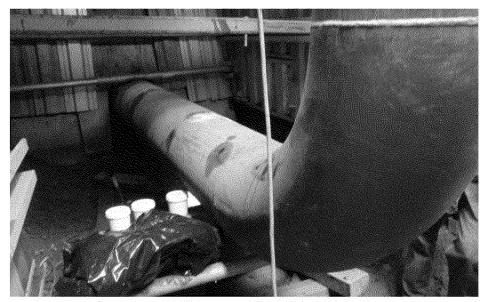
Overview of MPI layout -1ft to 2ft, 9:00 position



Overview of MPI layout 17ft to 20ft, 3:00 position



Overview of MPI layout 17ft to 20ft, 3:00 position

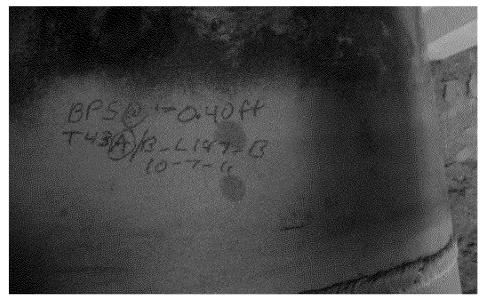


Overview of MPI layout 17ft to 20ft, 9:00 position

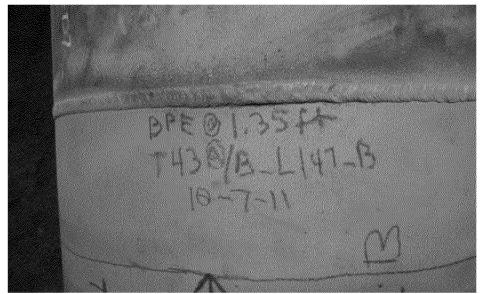
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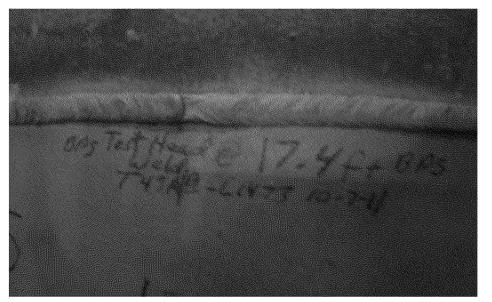
Overview of MPI layout 17ft to 20ft, 9:00 position



Overview of bare pipe start

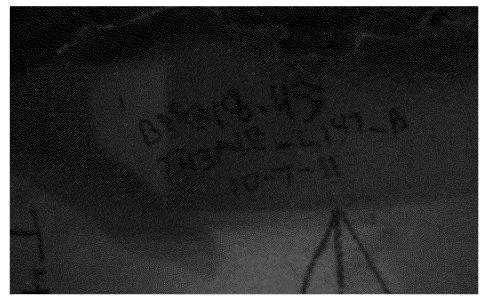


Overview of bare pipe end



Overview of bare pipe start

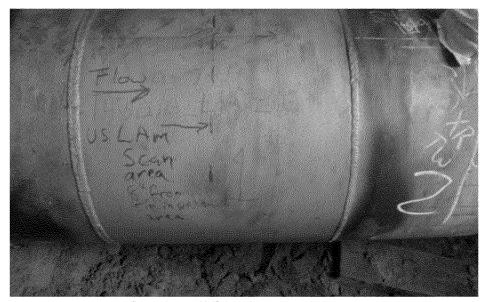
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Overview of bare pipe end



Overview of feature joint long seam @8:55



Overview of US lamination scan area.



Overview of DS lamination scan area.

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Overview of US MPIOK and Lamination scan OK.



Overview DS of MPIOK and Lamination scan OK.



Overview of pipe Ph.



Closeup of pipe Ph.

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Removed pipe section coating assesment 3:00



Overview of coating condition 3:00 position



Overview of coating condition 3:00 position



Overview of coating condition 3:00 position

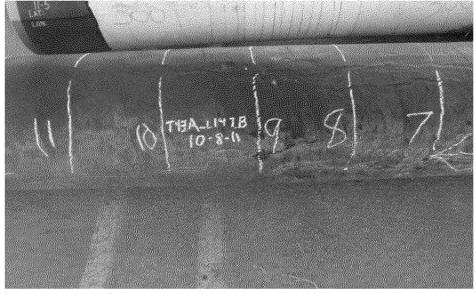
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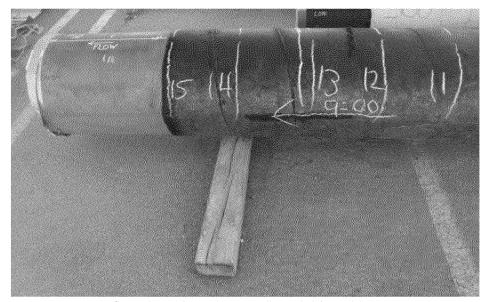
Removed pipe section coating assesment 9:00



Overview of coating condition 9:00 position

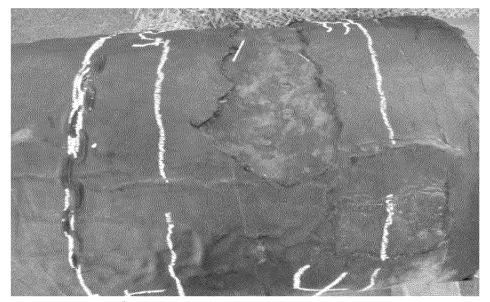


Overview of coating condition 9:00 position

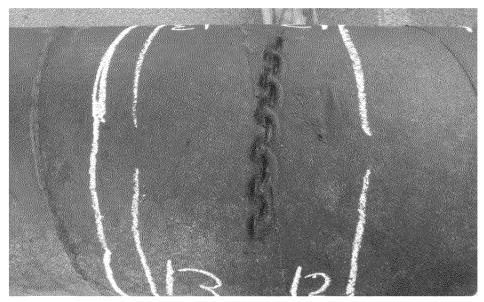


Overview of coating condition 9:00 position

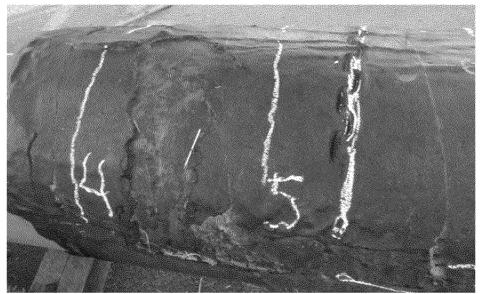
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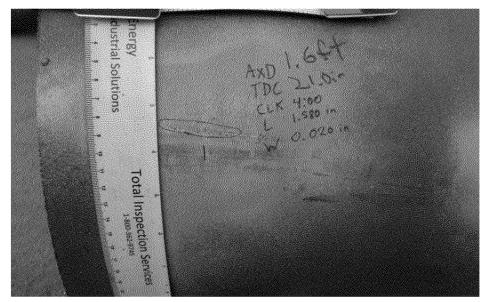
Coating damaged from removal process.



Coating damaged from removal process.

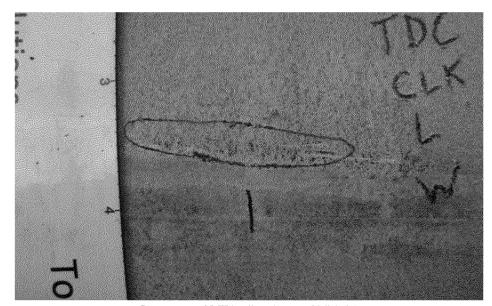


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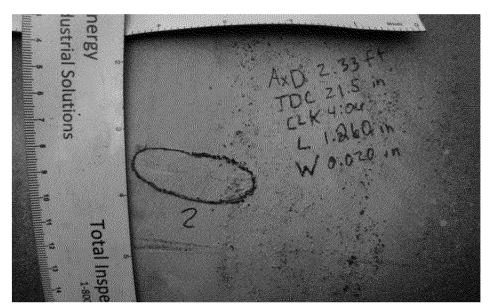


Removed pipe section linear indication-01

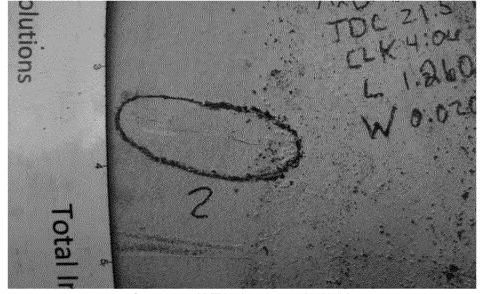
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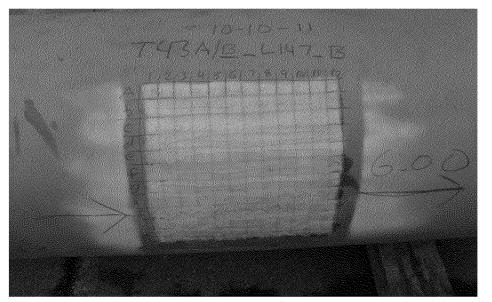
Close up of MT Indications of LIN-01



Removed pipe section linear indication-02

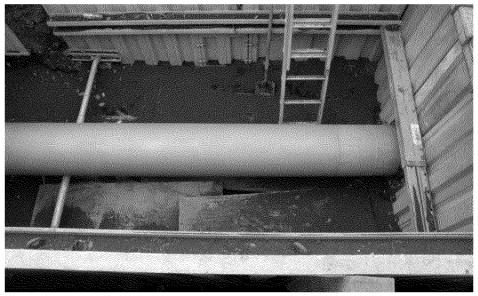


Close up of MT Indications of LIN-02



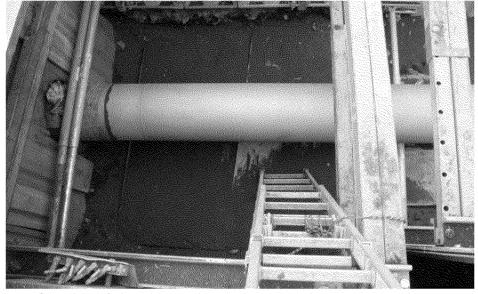
Overview of UT Grid.

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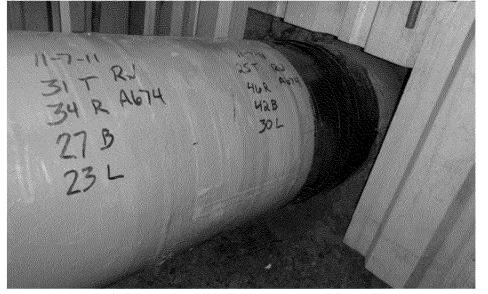


Overview of clean blasted inspection area prior to recoat activities





Overview of clean blasted inspection area prior to recoat activities



Overview of final coating condition US 3:00

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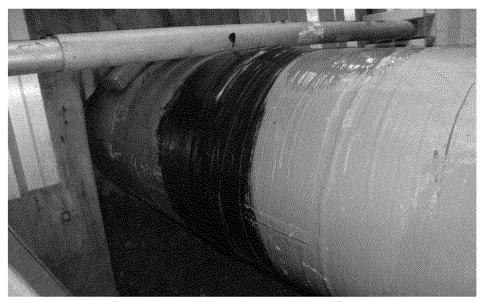
Overview of final coating condition 3:00



Overview of final coating condition 3:00



Overview of final coating condition 3:00



Overview of final coating condition US 3:00

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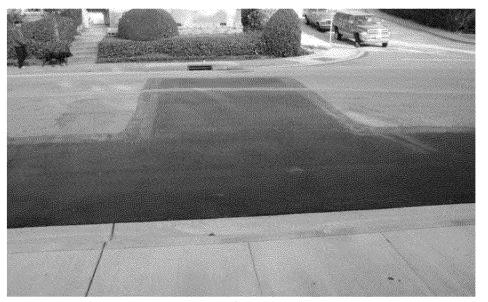
Overview of completed Slurry



Overview of completed Slurry



Overview of completed Cover looking upstream



Overview of completed Cover looking downstream

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Overview of completed Cover, 3:00 view



Overview of completed Cover, 9:00 view

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# **EXHIBIT E**

Exponent\*

PG&E Line 147 Britton and Rogers Avenue Leak: Metallurgical Analysis



PG&E Line 147 Britton and Rogers Avenue Leak: Metallurgical Analysis

Prepared by:

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149 Commonwealth Drive Menlo Park, CA 94025

October 2013

☐ Exponent, Inc.

Doc. no. 1306838.000 A0T0 1013 RE15

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Appendix A Microhardness Testing

### **Executive Summary**

Exponent Failure Analysis Associates (Exponent) has been retained by Pacific Gas and Electric (PG&E) to help determine the cause of the leak identified in Line 147 along Brittan Avenue in San Carlos, California, and why the leak was not detected during a recent hydrostatic test (hydrotest). The subject leak was identified on October 18, 2012, and the hydrotest had been performed approximately one year earlier, on October 24, 2011.

Exponent's metallurgical investigation of the leak followed work conducted by Anamet laboratories. Our work included visual, metallographic, fractographic, and chemical analysis of the leak site. Our analysis largely agreed with the opinions presented by Anamet: the leak occurred within a weld repair section, all cracking occurred during the repair itself, with no metallographic or fractographic evidence that any crack growth occurred following the repair weld. Specifically, there was no evidence of progressive crack growth due to fatigue, stress corrosion cracking (SCC) or ductile tearing from the "pressure reversal" phenomenon occasionally observed during hydrotesting. Significant deposits were observed within the cracks. These deposits were largely iron-oxide based, although high levels of sulfur (likely associated with mercaptan-odorizer present in the natural gas) were identified.

The subject leak was caused by cracking that occurred within a location on the pipe body that had been repaired using weld-metal deposition ("weld repair"). This weld repair was not associated with either a girth or longitudinal seam weld. The cracks associated with the leak within the outer diameter (OD) weld were caused by solidification cracking during the weld repair. Cracks that initiated along the pipe inner diameter (ID), within the heat-affected zone (HAZ) beneath the repair weld were also observed. The HAZ exhibited significant grain coarsening with areas of Widmanstatten ferrite along the prior-austenite grain boundaries. Areas of fracture along the prior-austenite grain boundaries were observed, indicative of the low-toughness associated with severely-coarsened grains, possible segregation of impurity elements (such as sulfur and phosphorus), and high residual stresses from the weld repair. Microhardness testing indicated hardness levels less than 190 HV (approximately 90 on the Rockwell B Scale) within the HAZ. At this low hardness level, hydrogen embrittlement is unlikely to have contributed to the intergranular fracture observed within the HAZ. Like the solidification cracking observed at the pipe outer diameter, these HAZ cracks occurred during or shortly after the weld was made as the metal cooled.

The cracks showed no evidence of propagation over time. The relatively large pressures associated with the hydrotest were insufficient to grow the subject cracks. The subject leak was not detected during hydrotesting. The primary purpose of hydrotesting is to help establish pipeline integrity and find large-scale leaks. The leak path was small, full of oxide, and provided a tortuous path for liquid water to escape.

### **Background**

PG&E Line 147 connects Lines 132 and 101, and extends along a portion of Brittan Avenue in San Carlos, California. The maximum allowable operating pressure (MAOP) of Line 147 documented on the hydrotesting test report was 400 psig. The portion of Line 147 that contained the leak was installed in 1957.

On October 24, 2011, Line 147 was hydrotested between mile posts 1.95 and 3.4. The 8.32-hour-long hydrotest was conducted at a minimum sustained pressure of 607 psig (at the maximum elevation), and included a 30-minute pressure spike to 748 psig (maximum). Thus, the hydrotest was conducted at a pressure in excess of 50-percent greater than the Line 147 MAOP. The hydrotest was certified by RCP Inc. to meet the requirements of the Federal Code of Regulations, Title 49, Part 192, Subpart J for a Class 3 location. The buried pipe segment (7,541 feet) gained 2-degrees F fluid temperature, and the exposed pipe segment (175 feet) lost 3-degrees F over the test period. Given the coefficient of thermal expansion of water, a variation of 1-degree Fahrenheit is equal to 10.14 gallons of water. Thus, a small hydrostatic test leak would have been within the inherent error associated with the test.

On October 13, 2012, approximately one-year after the Line 147 hydrotest, a PG&E gas crew leader observed bubble formations in water associated with an excavation on Brittan Avenue. PG&E testing on October 15, 2012 confirmed the gas leak near the intersection of Brittan Avenue and Rogers Avenue. On November 13, a 6-inch PLIDCO cap was welded over the leak site (50-feet east of Rogers Avenue on Brittan Avenue) at the bottom (6 o'clock position) of the pipe.

Exponent conducted a metallurgical analysis to help determine the cause of the leak and why the leak was not detected during hydrotesting. Our analysis included visual, fractographic, metallographic, and chemical analysis of the leak and associated welds/piping. The results of our investigation are described below.

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RCP Inc., Hydrostatic Test Certification, March 15, 2012.

<sup>&</sup>lt;sup>2</sup> PG&E Leak Repair, Inspection and Gas Quarterly Incident Report (A-Form), 58-12-60279- updated.

#### **Non-Destructive Examination**

The portion of Line 147 that contained the subject leak was initially examined by Anamet Inc. (Anamet). As described in their September 6, 2013 report, Anamet conducted leak testing, metallographic analysis, as well as tensile and Charpy V-notch (CVN) testing of the subject pipe. The subject leak and adjacent pipe were transferred from Anamet to Exponent; received by Exponent on September 23, 2013 in the condition shown in Figure 1 and Figure 2.

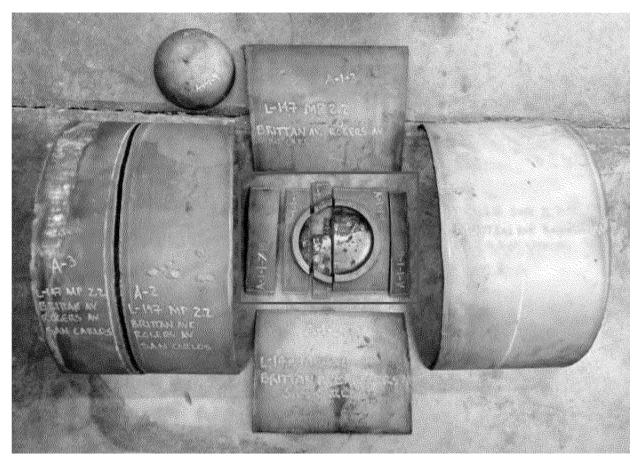


Figure 1. Photograph of the section of L-147 containing the crack and the PLIDCO cap welded over it to stop the gas leak. The red box shows the area magnified in Figure 3. Note the sectioning of the pipe and the yellow markings were made by Anamet.



Figure 2. Photograph of a section of L-147 removed from the section of pipe containing the crack. Note the sectioning of the pipe and the yellow markings were made by Anamet.

The leak site was located in the area in the red box in Figure 1; enlarged in Figure 3. A PLIDCO cap had been welded onto the pipe to stop the leak until the subject pipe section could be removed. Beneath the cap, several weld repairs had been conducted. Anamet had sectioned the approximately 0.4-inch long crack into two pieces, then mounted, polished and etched the parts for analysis. The two metallurgical mounts are shown in Figure 4 as received from Anamet. Exponent retained Anamet's sample ID numbers, which for the metallurgical mounts are A-1-1-8 and A-1-1-7, left and right, respectively in Figure 4. As indicated in Anamet's report, these samples were subjected to serial grinding to evaluate different leak cross-sections. As such, portions of the leak that have been ground-away are no longer available for examination.

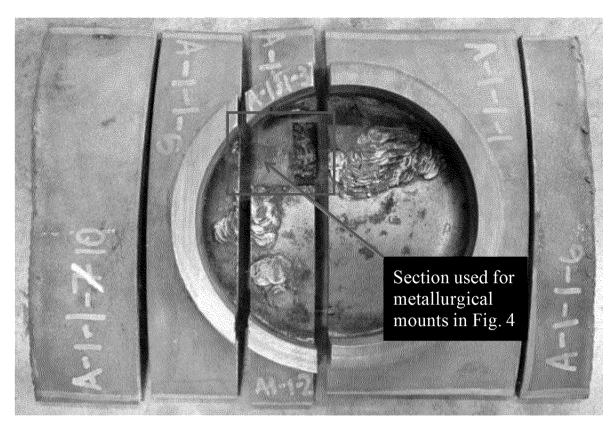


Figure 3. Photograph of the section of L-147 (boxed in red in Figure 1) containing the crack and the PLIDCO cap. Note the sectioning of the pipe and the yellow markings were made by Anamet.

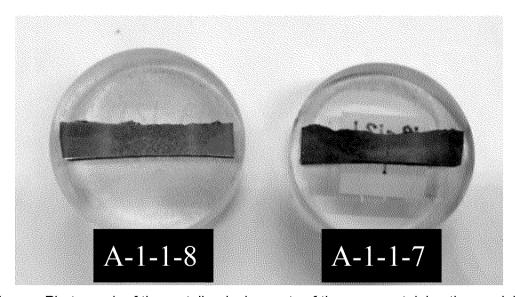


Figure 4. Photograph of the metallurgical mounts of the area containing the crack in L-147 under the PLIDCO cap. Note the metallurgical mounts were made by Anamet: Exponent retained Anamet's sample ID numbers A-1-1-8 (left); A-1-1-7 (right).

## **Fractographic Examination**

## **Optical Microscopy**

Exponent extracted each of leak sections remnants that had been encapsulated by Anamet in metallographic mounts, cooled them in liquid nitrogen, and then fractured them to analyze the leak surfaces. Optical microscope images of the post-fractured leak surfaces are shown in Figure 5 and Figure 6. The dark portions of each sample are the pre-existing crack/leak locations. The brighter-colored areas occurred when Exponent broke the samples open to reveal the leak surface.

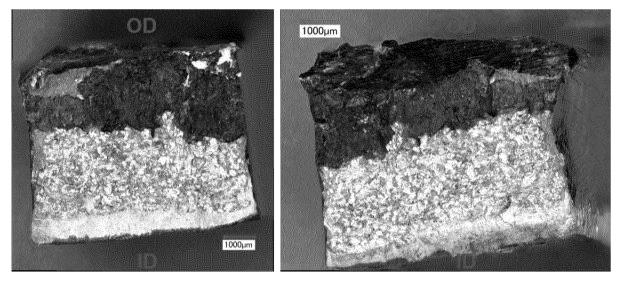


Figure 5. Optical micrographs of the leak surface after opening Anamet's A-1-1-8 metallurgical mount.

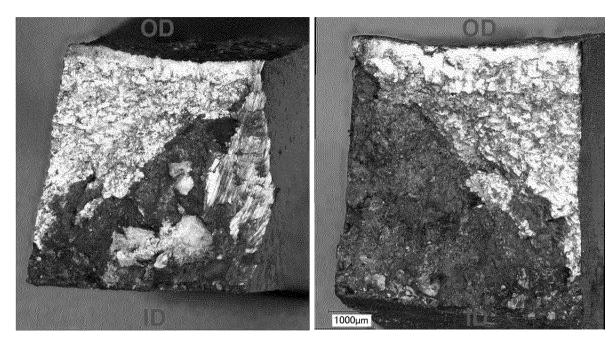


Figure 6. Optical micrographs of the leak surface after opening Anamet's A-1-1-7 metallurgical mount.

As shown in Figure 5, the pre-existing crack in Sample A-1-1-8 only extended from the OD approximately halfway through the pipe wall. The pre-existing crack A-1-1-7 extended from the ID nearly to the OD surface. While neither of these two samples display a clear ID-to-OD leak path, the pre-existing crack in Sample A-1-1-7 extends nearly through the pipe wall thickness. Based on the metallographic images in Anamet's report, as well as fractographic analysis of the remaining broken-open metallographic specimens, it is apparent that the throughwall (ID-to-OD) path for the subject leak was less than the 0.4 inch total length of the cracks.

#### **Scanning Electron Microscopy**

The leak surface fracture morphologies were analyzed using SEM/EDS. SEM images of the Sample A-1-1-8 fracture surface are shown in Figure 7. Interdentritic fracture morphology was observed at the pre-existing OD fracture area, consistent with cracking that occurred during cooling of the original weld (known as solidification or "hot cracking"). Solidification cracking occurs when the final solidifying metal cannot support the thermally or mechanically-induced strain from the welding process, and can be caused by poor joint restraint, improper welding parameters, and by interdendritic segregation of steel impurities (such as sulfur). The fracture surface was heavily oxidized, also consistent with solidification cracks in welds.<sup>3</sup> Brittle cleavage fracture morphology was observed on the bottom-half of the fractured Sample A-1-1-8. This cleavage fracture occurred when the sample was cooled in liquid nitrogen and then fractured to allow observation of the leak surfaces. Ductile tearing associated with the intentional fracture of Sample A-1-1-8 was observed at the inner surface. The ductile tearing is

ASM Handbook, Volume 6: Welding, Brazing, and Soldering, ASM International, 2003, pp. 649-651.

caused by a transition from a triaxial stress state to a biaxial stress state when the final ligament breaks, and results in a characteristic ductile "shear-lip" at the final fracture location.

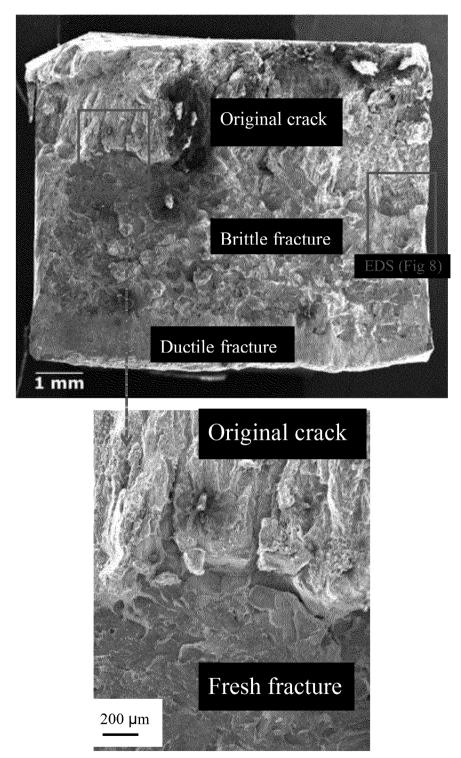


Figure 7. SEM images of Sample A-1-1-8 fracture surface (left side of Figure 5). Top image shows the entire surface with one red box magnified (bottom image) and another red box for the area analyzed with EDS in Figure 8.

The Sample A-1-1-8 fracture surface was examined using EDS, which is highlighted in the red box in top image of Figure 7 and presented in Figure 8. The freshly-induced cleavage fracture surface below shows only the presence of iron and a small amount of carbon. The original crack surface, however, exhibited significantly increased levels of carbon, oxygen and sulfur, consistent with iron oxide (rust) as well as sulfur deposits. The sulfur is most likely from mercaptan-based odorizer added to natural gas to give the characteristic "rotten-egg" smell.

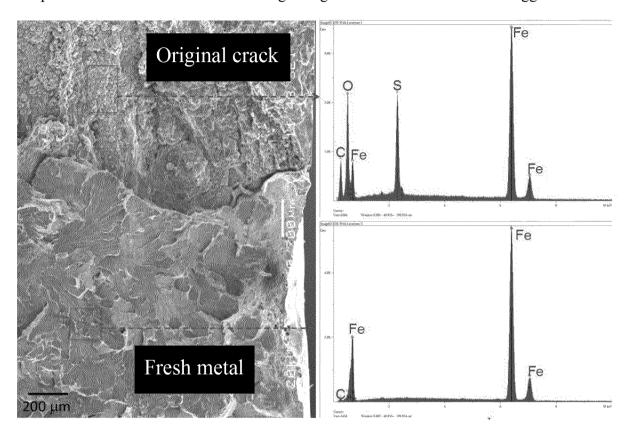
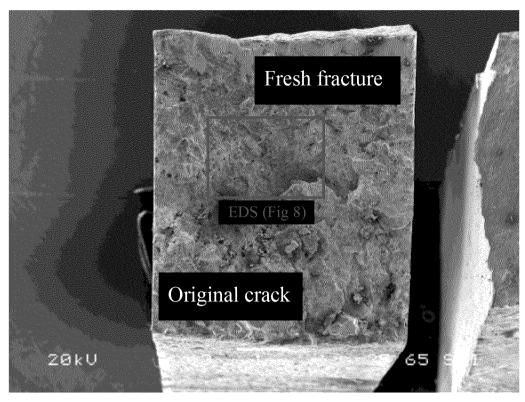


Figure 8. EDS analysis of the area in the red box in the right side of the top image in Figure 7. The lower portion is the freshly cracked surface; the top is the surface of the original crack composed of iron oxide with a large amount of sulfur, likely from the mercaptans added to give scent to the gas.

Similar SEM and EDS examination was performed on the Sample A-1-1-7 fracture surface faces, example images are shown in Figure 9 and Figure 10. The substantial oxide deposits on the original leak surface obscured much of fracture morphology in the original-cracked portion of Sample A-1-1-7, as shown in Figure 9. However, the transition between the original crack surface and the intentional brittle (cleavage) fracture area showed no evidence of progressive growth, also shown in Figure 9.

EDS analysis of the Sample A-1-1-7 fracture surface showed similar findings as exhibited in Sample A-1-1-8. The freshly-exposed brittle fracture surface showed primarily iron with a small amount of carbon, while the original leak surface exhibited significant amounts of carbon, oxygen, and sulfur, as shown in Figure 10.



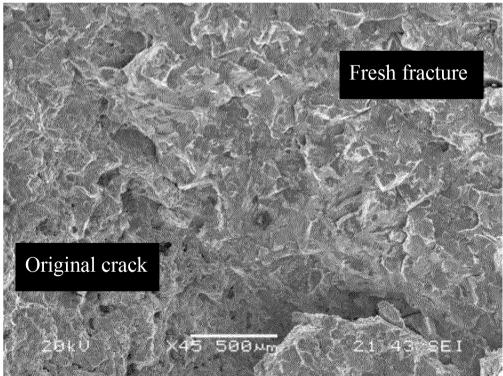


Figure 9. One side of the crack surface in Sample A-1-1-7 (right side of Figure 6). The red box shows the area analyzed with EDS in Figure 10.

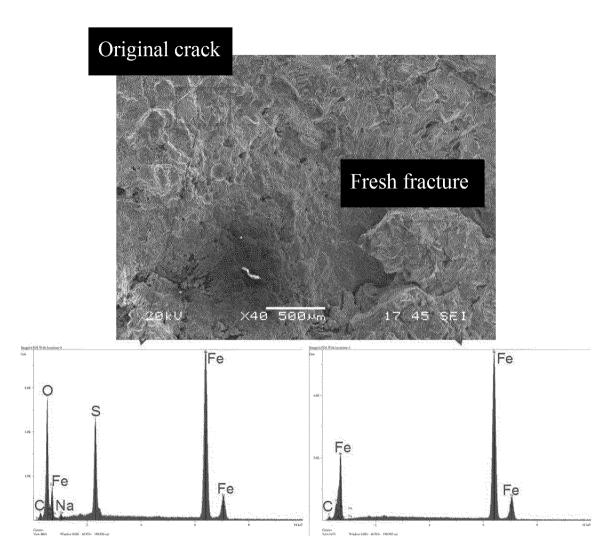


Figure 10. EDS analysis of the area in the red box in the top image in Figure 9. The right side is the freshly cracked surface; the left side is the surface of the original crack composed of iron oxide with significant sulfur.

## **Metallographic Analysis**

Anamet sectioned the subject leak perpendicular to the longitudinal axis of the pipe, and conducted metallographic analyses as described in their September 6, 2013 report. A composite optical image from Anamet's report, shown here as Figure 11, shows that the weld repair contained significant weld porosity and cracks near the center of the weld bead that run parallel to the dendritic structure. There is also evidence of intergranular fracture in the heat-affected zone (HAZ) next to the weld.

Following our fractographic examination, Exponent put the broken halves of the crack back together for further metallographic analysis and microhardness testing, shown in Figure 12 and Figure 13. The samples were re-polished and etched with two-percent nital solution. Like Anamet's analysis, significant porosity and interdendritic cracking were observed within the repair weld. The HAZ below the weld was characterized by grain coarsening with Widmanstatten-morphology pro-eutectoid ferrite, shown in Figure 14. The very large grains within the HAZ and the solidification cracking of the weld pool are both consistent of slow weld speeds with high heat input.

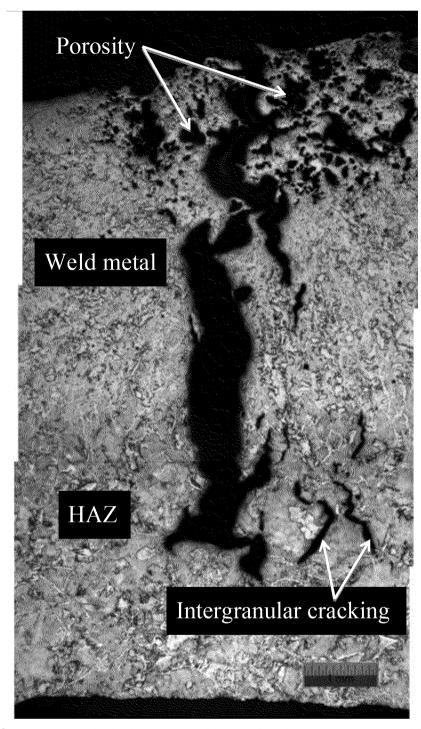
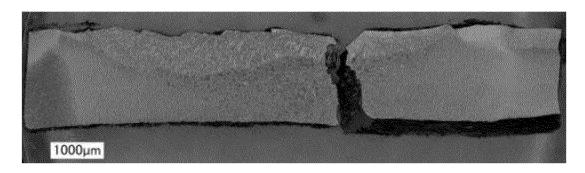


Figure 11. Composite optical micrograph of a metallurgical mount prepared by Anamet. Image reproduced from the September 6, 2013 Anamet report with permission from Anamet.



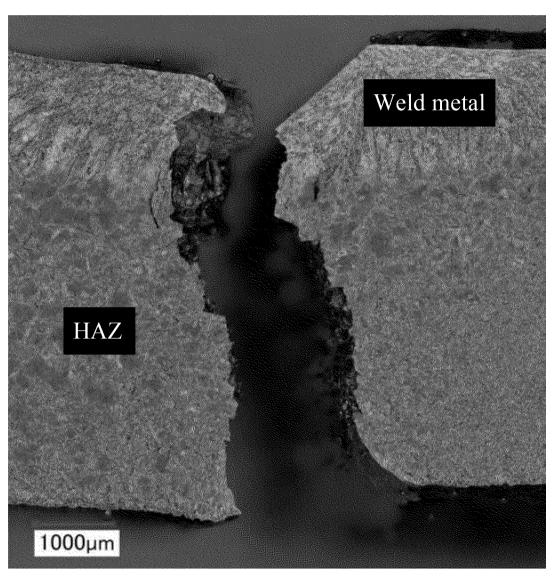
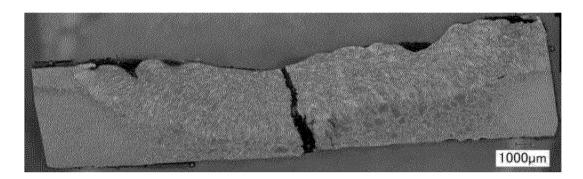


Figure 12. Images of Sample A-1-1-8, re-mounted following fractographic examination.



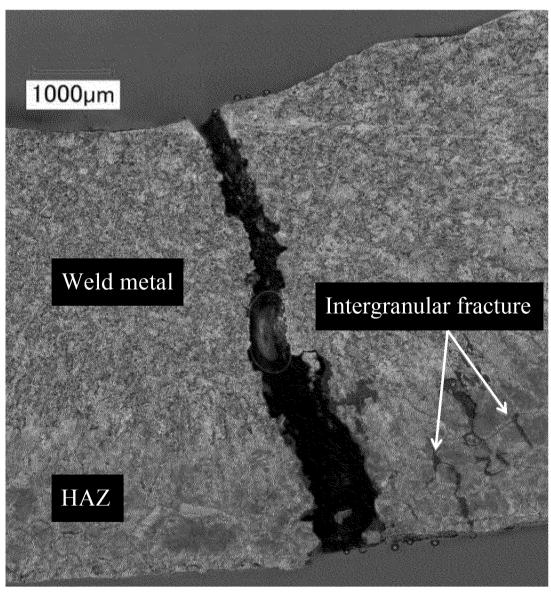


Figure 13. Images of Sample A-1-1-7, remounted following fractographic examination.

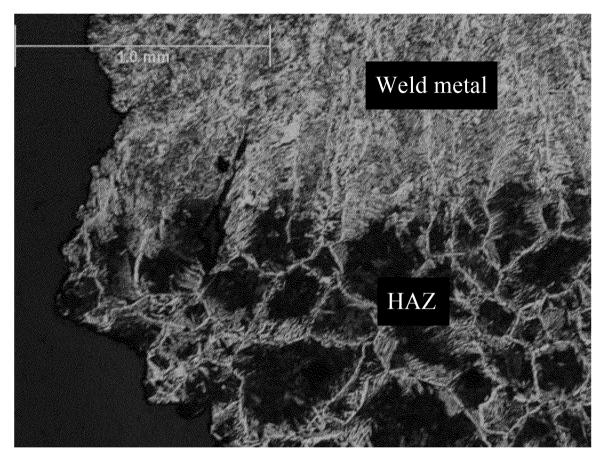


Figure 14. Metallographic image that shows significant grain coarsening beneath the weld in Sample A-1-1-8, with Widmanstatten ferrite at the prior-austenite grain boundaries in the heat-affected zone (HAZ).

Anamet conducted SEM/EDS analysis of the unopened crack in a metallographic mount: originally Figure 20 in their September 6, 2013 report, shown here as Figure 15. Consistent with Exponent's analysis, Anamet determined that the crack was filled with iron oxide and contained appreciable amounts of sulfur.

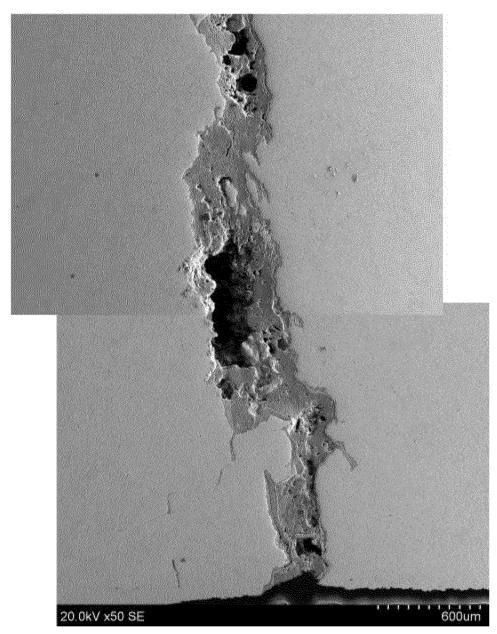


Figure 15. Composite SEM micrograph of the metallographic mount prepared by Anamet. Image reproduced from the September 6, 2013 Anamet report with permission from Anamet.

Vickers microhardness (HV) traverses were conducted over both metallographic mounts to assess hardness in the weld, HAZ, and base metal, shown by red lines in Figure 16. Each microhardness traverse and associated values are shown in Appendix B. Accounting for all testing samples, the base and weld metal exhibited average hardness values between 130-155 HV. The HAZ exhibited slightly higher hardness levels, between 155-190HV. However, it should be noted that the HAZ hardness levels are relatively low, consistent with the significant

grain coarsening observed. For carbon steels, a hardness of over 350HV would be considered excessive, and indicate a possible susceptibility to hydrogen cracking in the HAZ.<sup>4, 5</sup>

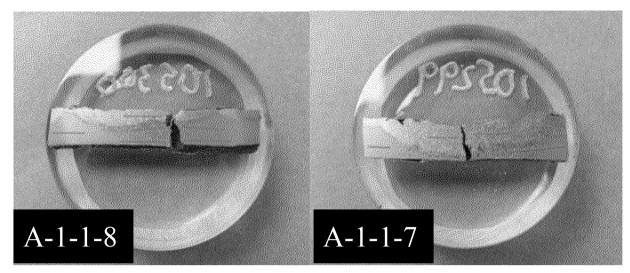


Figure 16. Metallurgical mounts of samples A-1-1-8 and A-1-1-7 made subsequent to opening the crack and examining it via optical microscopy and SEM/EDS. The red lines show where strings of microhardness testing points.

<sup>&</sup>lt;sup>4</sup> J.F. Lancaster, <u>Metallurgy of Welding</u>, Fourth Edition, 1987, pg. 177.

<sup>&</sup>lt;sup>5</sup> ASM Metals Handbook, Volume 6, Welding, Brazing and Soldering, pg. 648.

## **Chemical Analysis**

Chemical analyses of the base and weld metal near the leak were performed using direct-current optical-emission spectrometry, shown in Table 1 below. The analysis indicated elemental levels consistent with typical carbon steel. Lower carbon and manganese contents were observed in the weld metal compared to the pipe material, while sulfur and silicon levels were slightly higher.

Table 1 Chemical analysis of the base and weld metal near the crack in L-147.

Element	Base Metal (wt.%)	Weld metal (wt.%)
Fe	Matrix	Matrix
С	0.21	0.15
Mn	0.42	0.33
Cu	0.04	0.03
S	0.02	0.03
Р	0.02	0.02
Cr	0.01	0.02
Ni	0.01	0.01
Мо	<0.005	<0.005
V	<0.005	<0.005
В	<0.005	<0.005
Si	<0.005	0.04

The carbon equivalents of the pipe base and weld metal were calculated using the equation:

$$C_{equiv} = C + \frac{Mn}{6} + \frac{(Cr + Mo + V)}{5} + \frac{(Cu + Ni)}{15}$$

Carbon equivalent is an indicator as to the hardenability of the steel and the propensity for hydrogen-induced cracking. Based on this formula, the carbon equivalent of the base metal was 0.29, while the carbon equivalent of the weld was 0.21. Both these carbon equivalents are relatively low: carbon steels with a carbon equivalent around 0.30 will usually form a pearlite-bainite structure in the HAZ, and are not particularly susceptible to cracking from hydrogen embrittlement.

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<sup>&</sup>lt;sup>6</sup> G. Krauss, <u>Steels: Processing, Structure, and Performance</u>, ASM International, 2005, pg. 407.

<sup>&</sup>lt;sup>7</sup> J.F. Lancaster, Metallurgy of Welding, Fourth Edition, 1987, pg. 180.

## **Mechanical Testing**

Tensile testing of the base and seam-weld metal was performed on a section of L-147 by Anamet. The results of the testing are given below in Table 2. The base metal exhibited a slightly higher tensile strength than the seam weld, while the seam-weld metal had a slightly higher yield strength.

Table 2. Anamet's transverse tensile testing (ASTM A370-10) of base and seam-weld metal from L-147.

	Base Metal	Seam-Weld Metal
Width of Specimen (in.)	1.508	1.508
Thickness of Specimen (in.)	0.254	0.257
Area (sq. in.)	0.383	0.388
Tensile Strength (psi)	61800	58700
Yield Strength (psi)*	39300	42900
Elongation in 2.0 Gage (%)	41	11
Fracture location	-	weld
Fracture Characteristic	-	Ductile**

<sup>\*</sup> Upper Yield Strength (formerly Y.P.) 0.5% E.U.L.

<sup>\*\*</sup> Indication observed.

#### **Discussion**

Our analysis confirmed that the subject leak in Line 147 occurred at a location in the pipe body that was repaired using weld metal deposition; not associated with a girth or a longitudinal seam weld. The leak was caused by porosity and solidification cracking within the weld metal that occurred during the repair process. Further, significant grain coarsening was observed in portions of the HAZ beneath the OD repair weld, which resulted in areas of intergranular fracture and contributed to the leak. This HAZ cracking also occurred during or shortly after the weld-repair process. HAZ hardness levels were insufficient to result in hydrogen embrittlement.

The cracks associated with the subject Line 147 leak have been present since the time of the weld repair. No fractographic or metallographic evidence of crack propagation (i.e. crack growth) during service or hydrotesting was observed.

Based on our analysis, it is clear that the cracks associated with the subject leak were present during the 2011 Line 147 hydrotest. The 8.32-hour hydrotest was conducted at a minimum of 600 psig, with a half-hour pressure "spike" to a maximum line pressure of 748 psig. No evidence of ductile tearing from the hydrotest was observed on the leak fracture surface. Ductile tearing can result in growth of large anomalies in pipelines during hydrotesting: known as the "pressure reversal" phenomenon. Given that the cracks associated with the leak were relatively short in axial length (less than approximately ½-inch), and relatively blunt (as observed in Anamet metallographic images), the 748-psig hydrotest pressures were insufficient to result in ductile tearing.

The subject leak was not detected during the 2011 hydrotesting. The Code of Federal Regulations Title 49, Part §192.505 indicates that a hydrotest is a strength test for pipelines to be operated at pressures that result in hoop stresses above 30% SMYS. The hydrotest conducted by PG&E on Line 147 was conducted at a minimum of 1.5 times the pipe MAOP, consistent with the federal regulations for a Class 3 location. The eight-hour portion of the hydrotest is intended to catch large-scale leaks. However, small-scale leaks can escape detection; particularly over a long test duration with large temperature changes throughout the day. The subject leak path was small, full of oxide, and provided a tortuous path for liquid water to escape.

#### **Conclusions**

- The subject leak discovered in PG&E Line 147 occurred in a weld repair of the pipe body; not associated with either a longitudinal seam or girth weld.
- The cracks associated with the subject leak occurred during the weld repair. Solidification cracking was observed within the weld deposit, while excessive grain growth, associated with high heat input, resulted in decreased toughness and local areas of intergranular fracture within the weld heat-affected zone.
- No evidence of progressive crack growth during service was observed at the leak site. Thus, the subject leak did not grow during service.
- The cracks associated with the subject leak were present during the October 2011 hydrotest. However, the hydrotest did not result in any ductile tearing or crack extension (pressure reversal) at the leak site.
- The leak path was small, full of oxide, and provided a tortuous path that limited the amount of water that could escape during hydrotesting.

#### Limitations

At the request of PG&E, Exponent has conducted an investigation of a crack that was present in Line-147 and how this was not detected by hydrotesting. Exponent examined the remaining material of the crack (some was destroyed during examination by Anamet Inc.) via optical microscopy and scanning electron microscopy with energy dispersive x-ray spectroscopy. The scope of services performed during this investigation may not adequately address the needs of other users of this report, and any re-use of this report or its findings, conclusions, or recommendations presented herein is at the sole risk of the user. The opinions and comments formulated during this assessment are based on observations and information available at the time of the investigation. No guarantee or warranty as to future life or performance of any reviewed condition is expressed or implied.

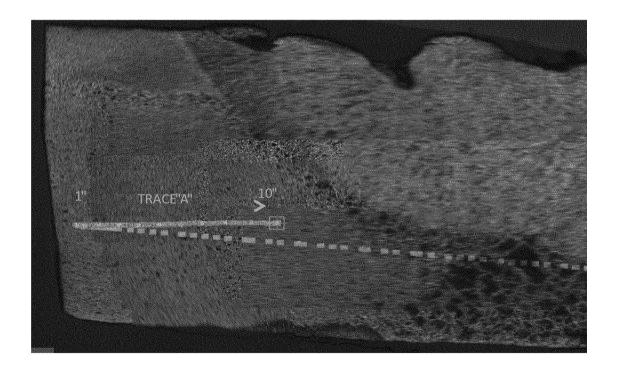
The findings presented herein are made to a reasonable degree of engineering certainty. We have made every effort to accurately and completely investigate all areas of concern identified during our investigation. If new data becomes available or there are perceived omissions or misstatements in this report regarding any aspect of those conditions, we ask that they be brought to our attention as soon as possible so that we have the opportunity to fully address them.

# Appendix A

**Microhardness Testing** 

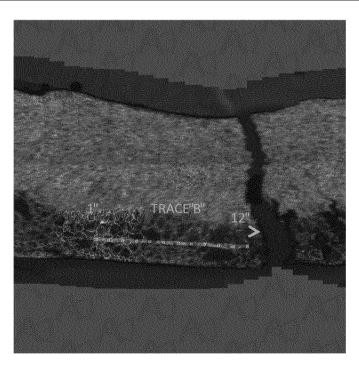
Job Number	Item Number	Comments	Operator
1306838	105299	Kevin Moore	C. Jewett

Trace A Loc	Mean Length	Hardness (HV)
1	78.8	149
2	79.3	147
3	80.1	145
4	78.1	152
5	79.4	147
6	82.7	135
7	83.1	134
8	79.5	147
9	78.8	149
10	83.1	134
	Avg:	144
	Max:	152
	Min:	134



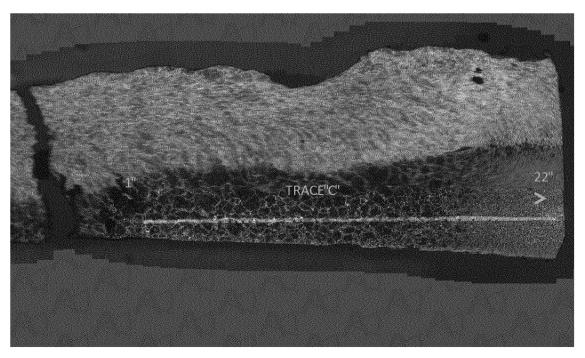
Job Number	Item Number	Comments	Operator
1306838	105299	Kevin Moore	C. Jewett

Trace B Loc	Mean Length	Hardness (HV)
Hace b Loc		
1	73.1	173
2	73.4	172
3	77.2	156
4	77.9	153
5	72.8	175
6	76.4	159
7	78.7	150
8	70.5	187
9	79.2	148
10	76.6	158
11	75.9	161
12	82.2	137
	Avg:	161
	Max:	187
	Min:	137



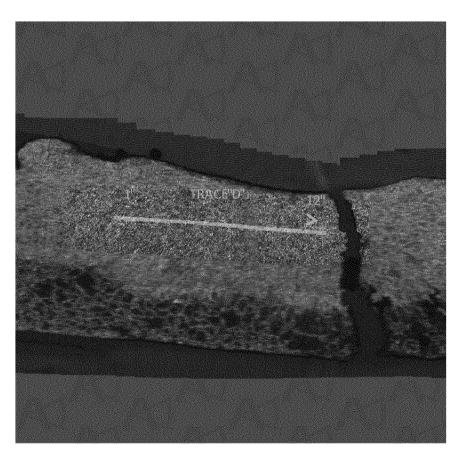
Job Number	Item Number	Comments	Operator
1306838	105299	Kevin Moore	C. Jewett

Trace C Loc	Mean Length	Hardness (HV)
1	69.3	193
2	72.1	178
2 3	78	152
4	77.1	156
5	73.3	173
6	72.7	175
7	78.6	150
8	69.6	191
9	75.6	162
10	72	179
11	72.6	176
12	75.6	162
13	71.3	183
14	75	165
15	68.4	198
16	74.8	166
17	82.1	137
18	80.9	142
19	80.3	144
20	78.3	151
21	78.5	150
22	80	145
	Avg:	165
	Max:	198
	Min:	137



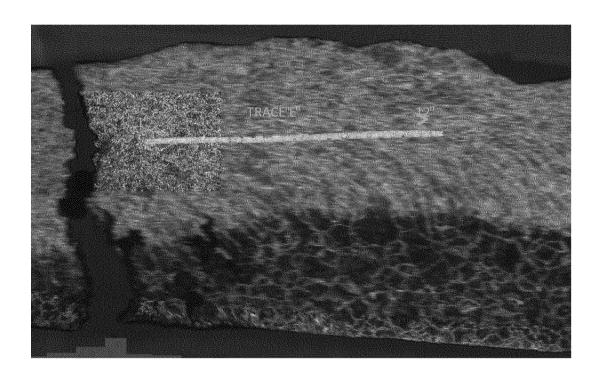
Job Number	Item Number	Comments	Operator
1306838	105299	Kevin Moore	C. Jewett

	obe giii		
Mean Length	Mean Length	Hardness (HV)	
1	83.4	133	
2	76.9	157	
3	78.8	149	
4	80.6	143	
5	79.0	149	
6	78.5	151	
7	79.6	146	
8	79.1	148	
9	79.9	145	
10	80.1	145	
11	77.8	153	
12	78.4	151	
	Avg:	148	
	Max:	157	
	Min:	133	



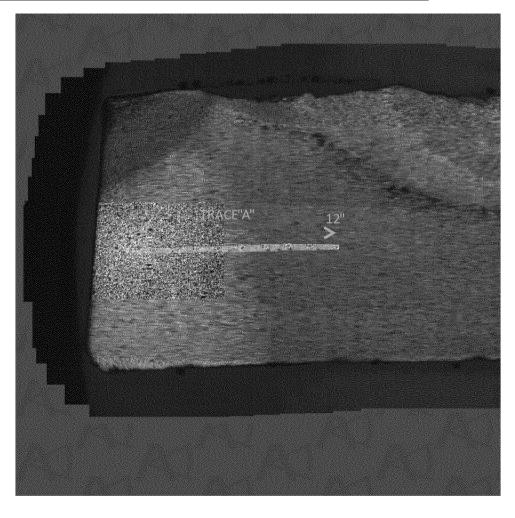
Job Number	Item Number	Comments	Operator
1306838	105299	Kevin Moore	C. Jewett

Mean Length	Mean Length	Hardness (HV)	
1	77.5	154	
2	77.3	155	
3	80.7	142	
4	79.8	146	
5	79.3	147	
6	84.5	130	
7	77.7	153	
8	79.8	146	
9	79.3	147	
10	82.5	136	
	Avg:	146	
	Max:	155	
	Min:	130	



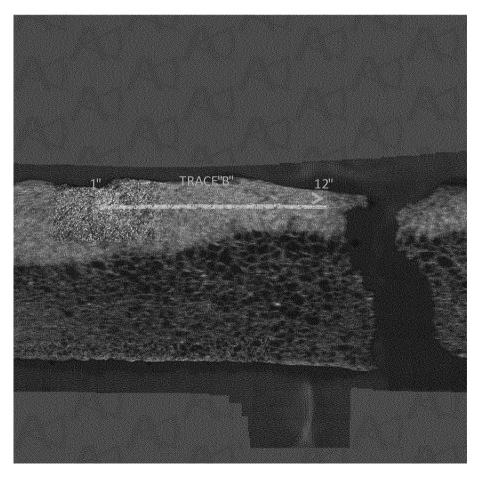
Job Number	Item Number	Comments	Operator
1306838	105300	Kevin Moore	C. Jewett

Trace A Loc	Mean Length	Hardness (HV)
1	81.3	140
2	82.9	135
3	85.1	128
4	80.0	145
5	78.2	151
6	81.6	139
7	79.3	147
8	79.0	149
9	80.2	144
10	77.3	155
	Avg:	143
	Max:	155
	Min:	128



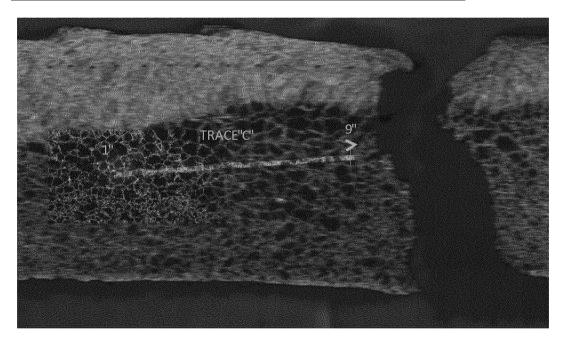
Job Number	Item Number	Comments	Operator
1306838	105300	Kevin Moore	C. Jewett

	T	500 giii
Trace B Loc	Mean Length	Hardness (HV)
1	76.9	157
2	79.2	148
3	79.7	146
4	79.6	146
5	80.1	144
6	79.4	147
7	79.0	149
8	78.2	152
9	79.3	148
10	77.3	155
11	79.6	146
12	69.8	190
	Avg:	152
	Max:	190
	Min:	144



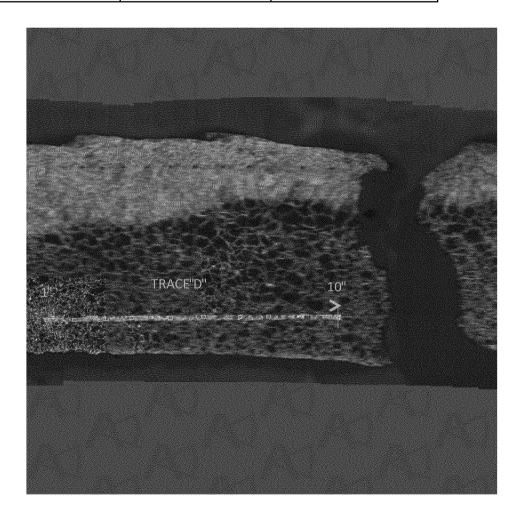
Job Number	Item Number	Comments	Operator
1306838	105300	Kevin Moore	C. Jewett

Trace C Loc	Mean Length	Hardness (HV)
1	70.1	189
2	71.2	183
3	73.5	171
4	70.4	187
5	75.8	161
6	75.2	164
7	72.4	177
8	73.1	173
9	71.8	180
Avg:	Avg:	176
Max:	Max:	189
Min:	Min:	161



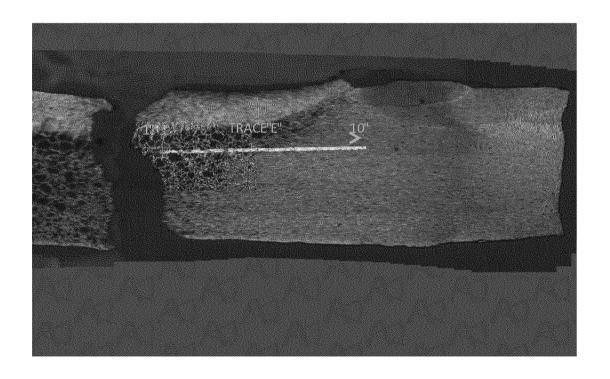
Job Number	Item Number	Comments	Operator
1306838	105300	Kevin Moore	C. Jewett

Trace D Loc	Mean Length	Hardness (HV)	
1	78.0	152	
2	75.0	165	
3	75.9	161	
4	76.9	157	
5	77.8	153	
6	78.0	152	
7	74.7	166	
8	75.4	163	
9	76.2	160	
10	76.5	158	
	Avg:	159	
	Max:	166	
	Min:	152	



Job Number	Item Number	Comments	Operator
1306838	105300	Kevin Moore	C. Jewett

Trace E Loc	Mean Length	Hardness (HV)
1	76.8	157
2	76.4	159
3	80.1	145
4	79.0	149
5	78.2	152
6	82.3	137
7	83.1	134
8	85.4	127
9	84.5	130
10	83.4	133
	Avg:	142
	Max:	159
	Min:	127



Job Number	Item Number	Comments	Operator
1306838	105300	Kevin Moore	C. Jewett

Trace F Loc	Mean Length	Hardness (HV)
1	70.9	184
2	75.3	164
3	74.6	167
4	75.6	162
5	74.9	165
6	80.1	144
7	81.8	139
8	81.8	139
9	82.7	136
10	84.3	130
	Avg:	153
	Max:	184
	Min:	130

