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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Attorneys for PACIFIC GAS AND ELECTRIC COMPANY

Dated: October 18, 2013

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

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I, SUMEET SINGH, do declare:

 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

-1-

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.

-2-

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

-3-

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.

Shing timp

SUMEET SINGH, Senior Director Integrity Management PACIFIC GAS AND ELECTRIC COMPANY

EXHIBIT A

#75-27 12-20-56 ⁷⁴⁸⁰

DEPARTMENT OF GAS OPERATIONS

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

Date October 2, 1957

Sheet 2

G.M. No. 139349

57

1. Project Description: Relocate 24.ª Main 147; Erittan Avenue, San Carlos

	·		•			• • •					
2.	Pipe	eline Data:	Size	Wall Thickness	Steel Specifications						
	(a)	Mainline	<u>20n</u>	0:3125	API 51X, Gr x 42						
·	(b)	Design Operating Pressure	, maximum	<u>500</u>] ps	-	•					
	(c)	Stress at Max. D.O.P. <u>1</u>	<u>6,000</u> psi psi		<u>38.)</u>						
	(d)	Location class <u>3</u>	Type co	onstruction	<u>C</u>						
	(e)	Test pressure750	psi; flui	id <u>Vater</u> I	eriod of test1 hour						
	(f)	Stress at Test Pressure		si; as % of yield	57.62	· .					
3.	Test	Data									
	(a)	Date and time started tes	t10-21-57	1.20 by g flui	d used Votor						
	(b)	Date and time reached tes									
	(c)										
	(d)	Date and time Purging started 10.39.57 10.50 AM concluded _10.55 AM									
	(e)	Date and time Pipeline ti		· · · ·							
	(f)	Date and time Pipeline Pl				٠					
	(g)			•	•						
	(h)	Who made test? p. c. & F				·.					
Div	ision	Construction Department or (Indicate Name)	<u>XXX</u>								
Ins	truct	Retain one copy of th Send one copy each to Division Manager conce	V.P. in Char	ge of Gas Operati	oject file. ons and to	۲ ۲ ۲ ۲ ۲ ۲ ۲ ۲ ۲ ۲ ۲ ۲ ۲ ۲ ۲ ۲ ۲ ۲ ۲					
		· · · · · ·									

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



GE ENERGY Industrial Solutions

Page 1 of 30

Form H: Direct Examination Data S									
<u>DA/ILI</u> Route Number:	L-147	Site De	<u>DA</u> esignation:	T43A/B_B		ILI	Log Distance:	NA	
Date of Excavation:	10/7/2011	<u> </u>	I-Segment:	NA		RMP-11	Ref. Section:	Table 5.0	6.2
Mile Point: Examination Performed By:	1.89 H. Mayer/J. Hayes	IM	A Number:	NA			e Girth Weld:	NA NA	
PG&E Project Manager:	Donovan Fink	Regio	n Number:	NA		Distance i	on one weig.	IN/A	
Approved By:	Kenji Gailey		ion # (ICDA):	NA					
Order Number:	41497360	_	Stationing:	NA					
Excavation Priority:				Excavation Rea	ason				
Immediate S	Scheduled (For ILI -	1 Year	Other)	ECDA			lecoat		
Monitor	Effectiveness	Hydro Test		ICDA		Other NA			
If practical, take P/S or CIS read						NA			
• •	GPS Coordinates	(Uncorrected Field	i Measurement)			INA			
Northing: 37.487		-	PDOP:	NA		Excavation Length		NA	
Easting: -122.27			Acc~:	NA	Actual	Excavation Length	-	21.0ft	
Centerline (Northing: NA	GPS Coordinates	(Uncorrected Field	i Measurement) PDOP:	NA		GPS File I	lame:	Guida 148T431	3
Easting: NA			Acc~:	NA					
D/S Ditch I	End GPS Coordinates	(Uncorrected Field	d Measurement)						
Northing: 37.487	8664944	ι.	PDOP:	NA					
Easting: -122.27	702163300		Acc~:	NA					
0 Data Before Coating Removal									
1.1 Native Soil Type:	X Clay	X Rock	X Sand	Loam	Wet	Other		NA	
1.1A Backfill Material I		Silt	Slurry	Native	•	of Cover (Ft.):	,	6.00ft	
Comments:				 NA					
1.2 Coating Type:		Somastic	Plastic Tape		Nax Tape	FBE		Powercrete	
		^L						on close to	
Bare/Non		Other:	NA		omments:		NA		
Coating Thickness (Inch	es): 0.2	50in	Nu	mber of Layers:			2		
1.3 Holiday Testing Perform	med?:	Yes X No	Vol	Itage Used:	NA	M	ap Location of Ho	lidays Below.	
	Device Used:	Coil 🔲 We	et Sponge		Comment	IS:	NA		_
1.4 Pipe-to-Soil Potentials	in Ditch (-mV):	US: 12:0	00 -526	3:00 -5	530	6:00 -	535 9:00	-526	_
		DS: 12:0			658		5 40 9:00	-663	_
Comments:		CP	appears to be ver	ry low, may be turne	ed off at time	e of inspection.			
1.5 Soil Resistivity in Ditch Method: X		24469.5 ohm/	'cm	Г	Soil Box	NA			
Comments:	.	NA		 _	4	SRM-100	US: N/A	DS:	N/A
1.6 Soil Sample Location	Comments			Ditch	end (DS) 6	:00 position under p	ipe.		
1.7 Ground Water Present	?: Yes	X No	Sample(s)	Collected?:	Yes	X No	Sample pH	: NA	4
Comments:				NA	•				
1.8 Coating Condition:	X Good - /	Adhered to Pipe	Γ	Fair - Coating	Partially Dis	sbonded or Degrad	ed		
	Poor - C	coating Significantly D	isbonded or Missi	ng					
Comments:		& tie in weld areas bl						assesed and	
	was in goo	d conition except for	coating damage fr	rom removal and tra	insportation	. See comments pa	ge 10.		
1.9 Map of Coating Degrad	ation*:		Ze	ero Reference Poir	nt:	ι	JS Exposed Pipe 3	360 degrees	
*Note any calcareous de	posit locations				_				
Holidays	Disbondments				Flow				
12 o'clock									ĩ
9 o'clock		1 1				1		1	1
									1
									1
6 o'clock									Ĩ
									1
3 o'clock									Ĩ
									1
12 o'clock									1
Feet 0 1	2	3	4 5	6		7	8	9	10
			ī						
1 CaCO3 - (Calcareous deposits co	ontaining calcium							
2 FeO - (General iron oxide with	scale							
									
3 FeCO3 - (Calcareous deposits co	ontaining iron							

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Form H: Direct Examination Data Sheet - Page 2 of 10

	DA/IL	<u>_l</u>	-		DA						
	Route Number:	L-1			signation	T43A/B	_B		og Distance:	NA	
	Date of Excavation:	10/7/			N-Segment:	NA			tef. Section:	Table 5.6	.2
Examin	Mile Point:	1.6	/J. Hayes	If	MA Number:	NA NA			Girth Weld: m Girth Weld:	NA NA	
	&E Project Manager:	-	an Fink	Pori	on Number:	NA		Distance Pro	in Girui Weid.	11/1	
10	Approved By:	Kenji I		•	gion # (ICDA):	NA					
	Order Number:	4149		Gabro	Stationing:	NA					
1.10	Photos Taken?*: *See Photo Log for	X Yes	No No		j-						
1.11	Coating Sample Ta	aken?:	Yes	X No	Loca	tion of Sample	:		NA		
1.12	Liquid Underneath	Coating?:	Yes	X No	If Yes	s, pH of Liquid:			NA		
1.13	Corrosion Product Comments:	Present?:	Yes	X No	lf Ye	s, Was Sample NA	e Taken?:	Yes	X No		
1.14	Soil pH (Sb Electro	ode):	Upstream:	6.0	Dowr	istream:	7.5	Pip	e pH:	6.0	-
2.0 Data Af	ter Coating Remo	oval									
2.1	Pipe Temperature	(°F):	60.0° F		M	easured Pipe	Diameter (In.):	:	63" =	20.05"	
2.2	Weld Seam Type:	⊒	SAW	SSAW Lap	ERW Flash		_S Smith			LLY PERFORM	
		_	_	·			Smun	MACROETCH	& LOCATE		
2.3	Girth Weld Coordin	nates & Ider	ntify Type (See NA NA NA	Table 5.7.3)	PDOP Acc~		LS Weld	Clock Position	(s):	8:55	
	Elevation:		NA								
2.4	Damage Found: Corrosion Dama Other Damage	-	Yes	X No Nor		Mechanical Da marks, no cor	-	Yes reater than 20%	X No		
2.5	UT Wall Thickness		DC: 0.270"/(bock 0.268"/(0.275" 1 0 0.270" 5 0	D'clock 0.	US / DS 267"/0.272" 266"/0.271" 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'clocl	0.266"/0.2	271" 272
	UT Wall Thickness	Grid @ 6:0	0 is required. E	Be sure to at	tach grid to I	H-Form electro	onically. See	page 6 of 10.			
2.6	Wet Fluorescent M	lag. Part. Is	Required.	Comment	6:	2 linear indica	ations on the re	moved pipe se	ction. See MT	& Photo repor	t.
	Were there any line	ar indication:	s? X	Yes	No If	Yes, attach NE	E report electr	onically as par	t of the H-Forr	n.	
2.7	Take Photos to Do			her Anomalio		eport to include	e black light an	d white light ph	otos of indica	lions.	
2.8	Overview Map of C										
	*See Pit Depth Mea			I Information		Zero Referen	ce Point:	U	S Exposed Pipe	360 degrees	
							Flow -				
*Note any	calcareous deposits	•								-	
12 o'cl	ock										
0 alal	aak									<u> </u>	ł
9 o'cl	OCK										
6 o'cl	ock										1
3 o'cl	ock					1				 	ł
12 o'cl					Ļ	<u> </u>	Ļ	Ļ		Ļ	l
F	eet 0 1		2	5	4	5	6	(8	9	10

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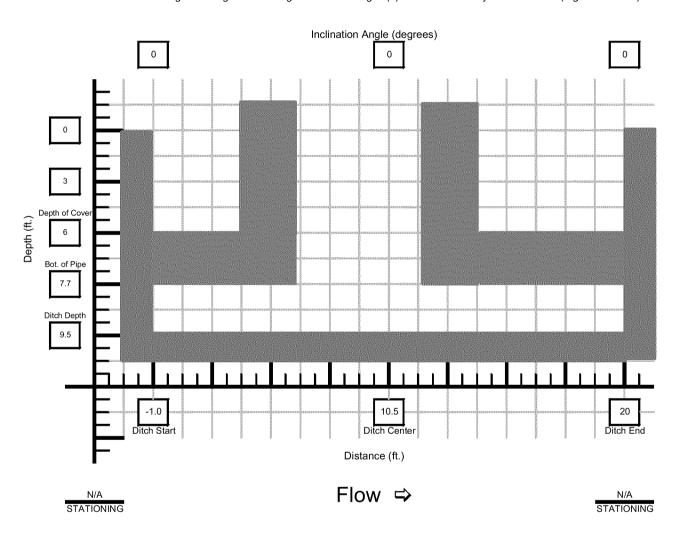
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Form H: Direct Examination Data Sheet - Page 3 of 10

DA	/ILI	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			

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").



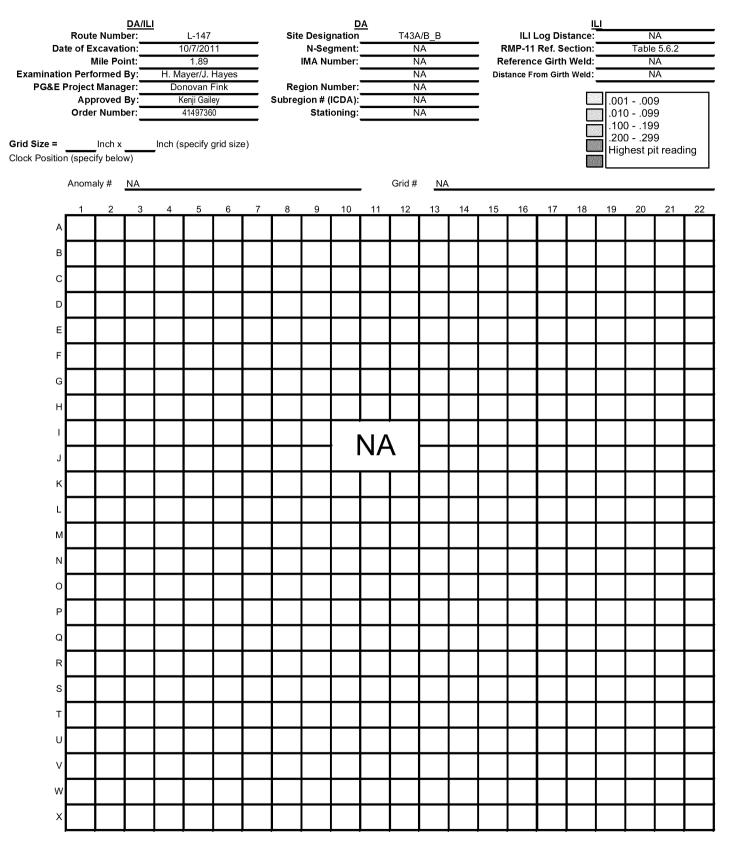
NOTES: (Record stationing and names of nearby landmarks such as creeks and roads. Provide any additional information that may help in spatially positioning pipe):

**See attached Delorme screen shot on page 11.

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

EXTERNAL PIT DEPTH MEASUREMENT GRID SHEETS

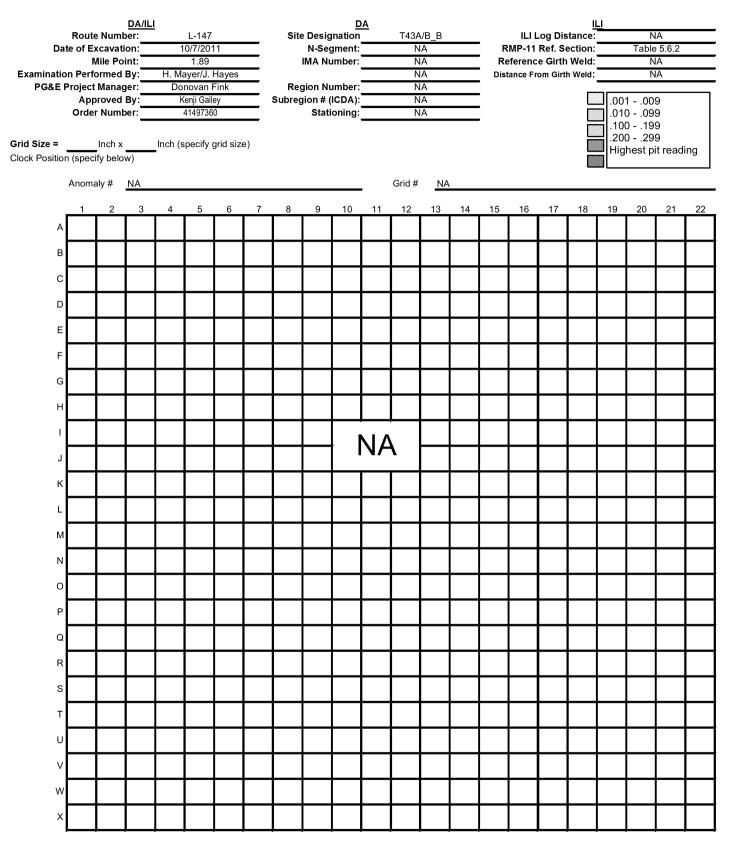


PIT DEPTH GRID 1 OF 2

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EXTERNAL PIT DEPTH MEASUREMENT GRID SHEETS



PIT DEPTH GRID 2 OF 2

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INTERNAL CORROSION WALL LOSS GRID

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:	1.89	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		

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

А

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С

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0.244"

All measurements are in inches.

			0.	0114 10 001				•			
1	2	3	4	5	6 \	/ 7	8	9	10	11	12
0.251"	0.251"	0.249"	0.249"	0.249"	0.249"	0.249"	0.248"	0.248"	0.248"	0.248"	0.248"
0.251"	0.254"	0.251"	0.251"	0.249"	0.249"	0.249"	0.249"	0.248"	0.248"	0.248"	0.249"
0.253"	0.251"	0.251"	0.251"	0.251"	0.251"	0.251"	0.249"	0.249"	0.248"	0.249"	0.249"
0.251"	0.251"	0.251"	0.251"	0.251"	0.249"	0.250"	0.249"	0.249"	0.248"	0.247"	0.249"
0.251"	0.251"	0.251"	0.251"	0.251"	0.251"	0.251"	0.251"	0.247"	0.248"	0.247"	0.248"
0.251"	0.251"	0.251"	0.251"	0.249"	0.249"	0.251"	0.249"	0.249"	0.247"	0.248"	0.249"
0.251"	0.251"	0.247"	0.246"	0.249"	0.248"	0.247"	0.247"	0.246"	0.247"	0.248"	0.247"
0.248"	0.249"	0.249"	0.249"	0.248"	0.247"	0.247"	0.247"	0.246"	0.246"	0.246"	0.246"

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

INTERNAL CORROSION GRID 1 of 1

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COATING DAMAGE

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:	1.89	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	_	

NO.	FEET FROM REFERENCE	O'CLOCK	MAX LENGTH (IN.)	MAX CIRC EXTENT (IN.)
NA	NA	NA	NA	NA
	1 1			
	+ +			
	+ +			
	† †			
	+ +			
	+ +			
	┼───┼			
	┥───┤			
	↓			
	+ +			
	+ +			

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CORROSION LOG

DA/I	LI	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
				}	

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Form H: Direct Examination Data Sheet - Page 9 of 10

PHOTO LOG

DA/II	<u>_1</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:	1.89	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	_	
_					

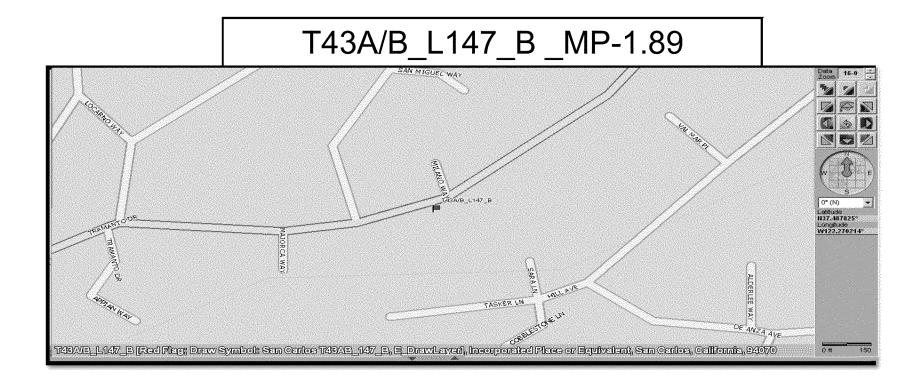
PHOTO NO.	LOCATION	DESCRIPTION	COMMENTS
	***	*See attached photo report.	

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Form H: D	irect Examination Data	Sheet - Page 10 of 1			
	DA/ILI Route Number:	L-147	<u>DA</u> 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
		. Mayer/J. Hayes	_	NA	Distance From Girth Weld: NA
PG	&E Project Manager:	Donovan Fink	Region Number:	NA	-
	Approved By: Order Number:	Kenji Gailey 41497360	Subregion # (ICDA): Stationing:	NA NA	-
		41497300	Stationing.	NA .	-
<u>3.0 REC</u>	<u>ΟΑΤ DΑΤΑ</u>				
3.1	Sandblast Media:	Sharp Shot 3	30/60	Anchor Profile Mea	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 Coatir	ng Systems, Record Env	ironmental Condition		
	Air Temperature:	62.4°F		Dew Point:	45.1°F
	Pipe Temperature:	67.0°F	F	Relative Humidity:	51.4%
	Time of Day:	12:30 pm			
3.4	Repair Coating Hardnes	s (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 Thick	kness: US 3	:00 - 33.7	6:00 - 38.7	9:00 - 57.5 12:00 - 27.4
		DS 3	:00 - 37.3	6:00 - 28.6	9:00 - 39.0 12:00 - 29.3
	Holiday Tested?: X	Yes 🔲 No			
	Device Used:	Coil Wet Spong	ge Voltage Us	ed: UNK	Repair All Holidays. YES
3.6	Coupon Test Station		—		Yes X No
0.0	•				
	If Yes, Date Installed:	NA			
	Surface Configuration::	Fink G-5	5 Box 🔲 Carsonit	e 🔲 Other:	NA
3.7	Backfill Material:	Native Imp	oorted Sand	Other:	NA
	Coating Protections?:	X Yes No		— —	
	-				
	If Yes, Check One:		\rightarrow	conwed Other:	STACguard (transitions only)
3.8	Pipe-to-Soil Readings O *If specified, a CIS should			NA the bell hole. Attach dat	ta
		be done for approximater	y 100 on enner side of		ta.
	Comments:			NA	
3.9	Attach site sketch of exe	cavation site.			
4.0 REPA					
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 S	Sleeve Replace	e Can Filler Metal Other
	-		·	— <u>—</u>	
4.4	Damage Repaired:	Corrosior	n 📙 Me	chanical Othe	er
	mments/Information:				ing up to test pipe tie in weld. About 1 ft of coating
·	d. 143B had coating remove was inspected at the PG&E	, , , ,	is blasted from coating	up to test pipe tie in weld	d. About 1.5 ft of coating was inspected. Removed
pipe section	was inspected at the FOOL	. yaiu.			
· · · · · · · · · · · · · · · · · · ·					

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GE Energy INSPECTION & LIFE EXTENSION SERVICES

MAGNETIC PARTICLE EXAMINATION REPORT								Nuclear	✓ Non-N	Nuclear	
To: Fro							Date:				
Pacific Gas & Electric Company					H. Mayer/J. Hayes			10/7/2011			
Project:			T43A/B_L:	147 B MP	-1.89						
Purchase Order No	:			GEIS Job No:							
41497360 LAPI0015											
	Weld Structural Casting I							N/A Other:			
						\checkmark			N/A		
Item	Non-Weld	Plate P	ipe Bai	- Co	asting	Mach. Parts	N/A	Other:			
	~								N/A		
Material	Size	Material Thickness	Type of Ba	se Material	Туре	e of Filler Mat	terial	Weld	✓ N/A		
Material	20''	0.250"	Carbo	n Steel		C/S	Smooth	SnAncolow/belo	ded As V	Velded	
Location		f the intersection o Way in San Carlos		d Milano	System		L-147				
Acceptance		-			Procedure						
Standards		Customer Speci	fications			GE	EIS QCF	9 # 500 Rev 1	.7		
	Initial	Plate Edge In Pr	ocess Back G	ouge Roo	ot Pass	Repair	-		i Hour	Final	
Type of Check										7	
	Longitudina	l Coil		DC Probe	\checkmark	Continuous	5	Other:			
	🗹 Wet	Dry		Direct Conta	ct 🔽	Residual					
Type of Inspection	Circular	AC Proc	t I	Yoke		Other					
	MT Yoke & Model - Serial No. / Blacklight Model - Serial No.					Surface Preparation Method					
	Parker DA-400 - S# 18830 / Spectroline BIP - S# 1597251					Abrasive Blasting (Kleen Blast) - NACE 2 Finish					
	Inspection Medium / Color / Batch No.					Demagnetization Method / Equipment					
Magnaglo 14A / Flourescent Green / 09M12K N/A					N/A						
Reference: Summa	5			See Attac	hment			Results of Ir	nsnection	n	
		ted to be inspected	<u>1:</u>			L					
Bare pipe: -0.40' to Bare pipe : 17.4' to					evant indications found @ time of insp. evant indications found @ time of insp.						
Removed pipe section. 2 Linear indications were found.											
Summary: Lin-01: Axial Start=	=1.60' (From U/S er	nd of pipe). AL=1.58" .	CW=0.020" . CLK	Position= 4:0	0						
Lin-01: Axial Start=1.60' (From U/S end of pipe), AL=1.58", CW=0.020", CLK Position= 4:00 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 the removed pipe section. Please see attached photo report for additional information.											
				Requested By:				Reported By (Technician):			
Pacific Gas & Electr				David Aguiar				H. Mayer/J. Hayes			
GE Inspection Services (Los Angeles)				Customer Specifications			NDT supervisor:				
NOTICE: THIS EXAMINATION REPORT IS A REPORT OF THE RESULTS OF THE NOT PROCEDURE ACTUALLY PERFORMED BY THIS COMPANY IT IS								J. Filiatr			

NOTICE: THIS EXAMINATION REPORT IS A REPORT OF THE RESULTS OF THE NOT 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**

ULTRASONIC EXAMINATION REPORT								Non-Nuclear			
To:					From:		Date:				
Pacific Gas & Electric Company				H. Mayer &			à J. Hayes 10/7/2011				
Project:			T43A/B_l	_147_B _MP·	-1.89						
Purchase Order 1	No:			GEIS Job No:							
	41497360					LAPIC	0015				
ltem	Weld Structur	al Casting	Machinery	Mach. Parts	Pipe	N/A	Other:				
	Non-Weld Plate	Pipe	Bar	Casting	Mach. Parts	N/A	Other				
Material	Size: 20"	No. of Pieces 1		Base Metal I n Steel		ller Material Weld ✓N/A C/S Smooth As Welded					
Location	70.6 Ft SW of the	70.6 Ft SW of the intersection of Brittan Ave and Milano									
	Way	Way in San Carlos, CA 94070				L-147					
Acceptance Standards	Cu	ations	tions			QCP-601					
	Soundness Thickness Bond				Transducer			Transducer Serial No.:			
				Single Crystal		Dual Crysta		020HFC			
	Pulse Echo Angle-Be	am Other	Freq	uency	Size	Angle		Couplant / Batch #			
		✓ 5 MHz 0.375" 0°)°	Sonatest Ultragel II						
Type of	UT Equipment/Model Flat Concave		Concave	Co	nvex	/ 25-901 07225 AF					
Inspection	USN-	\checkmark									
	Serial # 01	Standard		Material	Notch Depth		Serial No.:				
	Calibration Date:				Material						
		10/5/2011		Step Wedge 🗹		Thickness Range		Serial No.:			
	Calibration Due	: 1/5/2012	Tube Wedge		C/S	0.200"	- 0.500"	V34693			
Reference: Sum				✓ See	Attachment		Results of I	nspection:			
	g areas were reque							•			
	1" grid) at a random 6		he pipe.					ime of inspection.			
	n scans at cut-line loo			- No relevant indications @ time of inspection.							
Thickness readings US & DS inspection areas at the clock positions.											
** Dia 200 5-	a attached remarks for	r additional inf	rmotion								
Copy To:	e attached reports fo	n addillorial Into	nnialion.	Requested B			Reported By	(Technician):			
Copy To: Pacific Gas & Electric Company				David Aguiar			Reported By (Technician): H. Mayer/J. Hayes				
Facilité Gas & Electric Company D'avid Aguiar H. Ma GE Inspection Services (Los Angeles) I Customer Specifications NDT Supervisor						· · ·					
SE INSPECTION O	ernees (Eos Angoles)		Accept								
							Andro	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.



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Pacific Gas & Electric Company 20" Route L-147 Excavation Site T43A-B_L147_B_MP-1.89



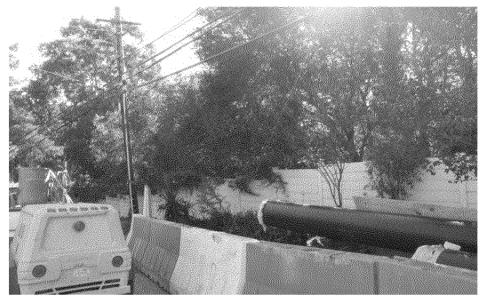
Topography looking upstream



Topography looking downstream



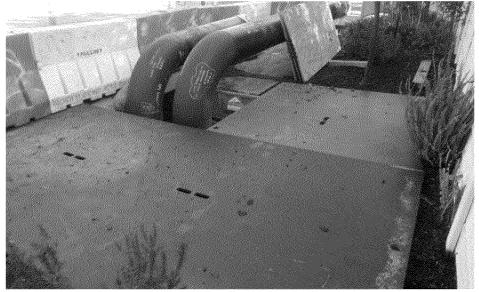
Typical surrounding topography



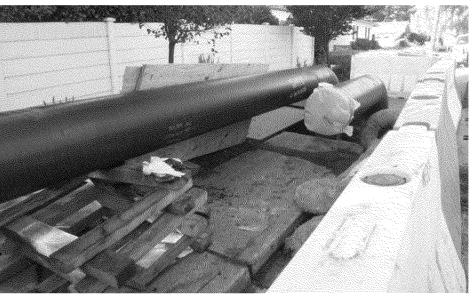
Typical surrounding topography

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Pacific Gas & Electric Company 20" Route L-147 Excavation Site T43A-B_L147_B_MP-1.89



Overview of Dig Site T43A-B_L147_B_MP-1.89



Overview of Dig Site T43A-B_L147_B_MP-1.89



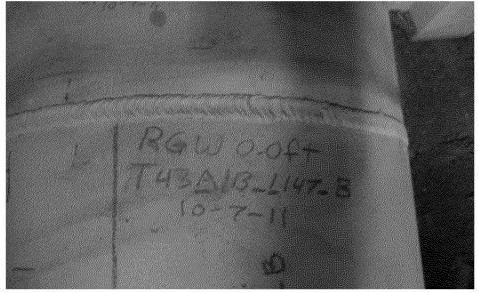
Overview of T43A(US) & T43B(DS) in same excavation.



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

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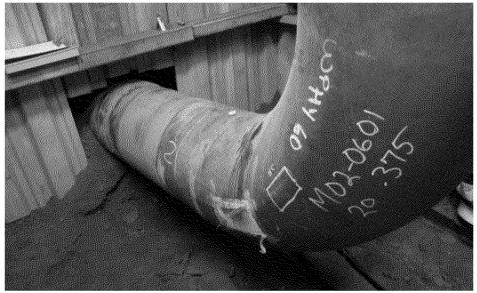
Pacific Gas & Electric Company 20" Route L-147 Excavation Site T43A-B_L147_B_MP-1.89



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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Pacific Gas & Electric Company 20" Route L-147 Excavation Site T43A-B_L147_B_MP-1.89



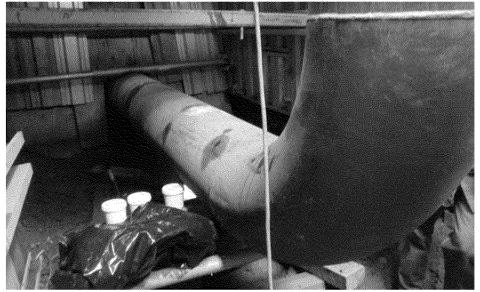
Overview of coating condition -1ft to 2ft, 9:00 position



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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Pacific Gas & Electric Company 20" Route L-147 Excavation Site T43A-B_L147_B_MP-1.89



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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Pacific Gas & Electric Company 20" Route L-147 Excavation Site T43A-B_L147_B_MP-1.89



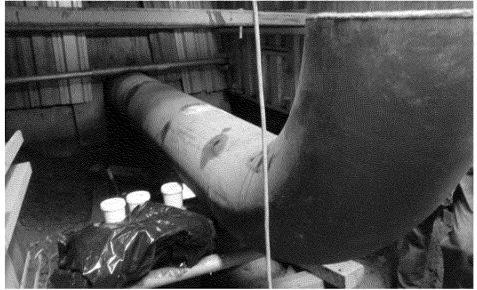
Overview of MPI layout -1ft to 2ft, 9:00 position



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



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



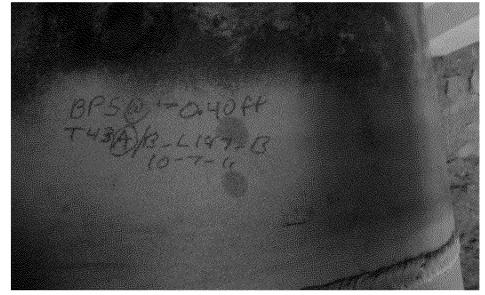
Overview of MPI layout 17ft to 20ft, 9:00 position

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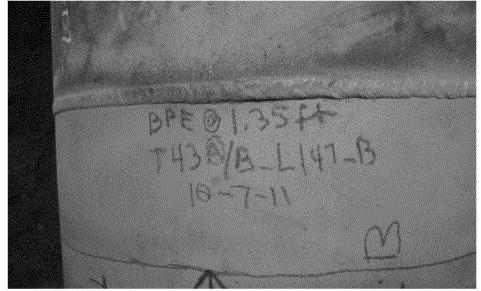
Pacific Gas & Electric Company 20" Route L-147 Excavation Site T43A-B_L147_B_MP-1.89



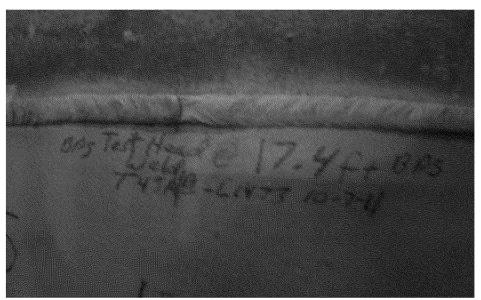
Overview of MPI layout 17ft to 20ft, 9:00 position



Overview of bare pipe start



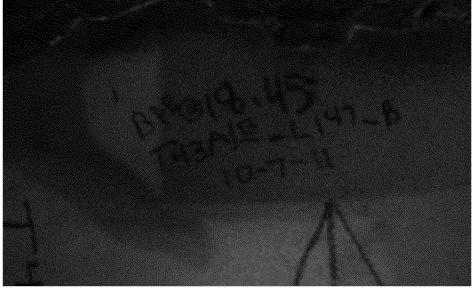
Overview of bare pipe end



Overview of bare pipe start

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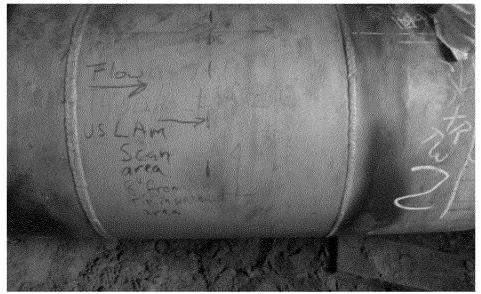
Pacific Gas & Electric Company 20" Route L-147 Excavation Site T43A-B_L147_B_MP-1.89



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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Pacific Gas & Electric Company 20" Route L-147 Excavation Site T43A-B_L147_B_MP-1.89

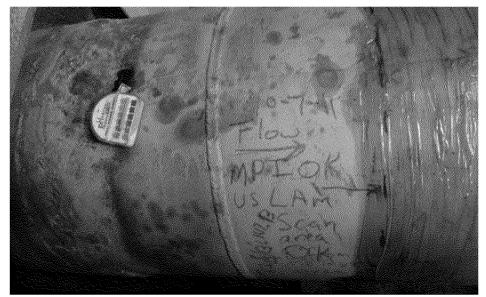
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Overview of US MPIOK and Lamination scan OK.



Overview DS of MPIOK and Lamination scan OK.



Overview of pipe Ph.



Closeup of pipe Ph.

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Pacific Gas & Electric Company 20" Route L-147 Excavation Site T43A-B_L147_B_MP-1.89



Removed pipe section coating assessment 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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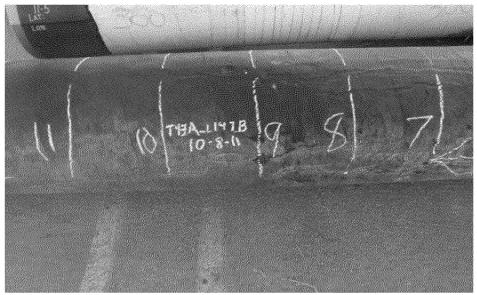
Pacific Gas & Electric Company 20" Route L-147 Excavation Site T43A-B_L147_B_MP-1.89



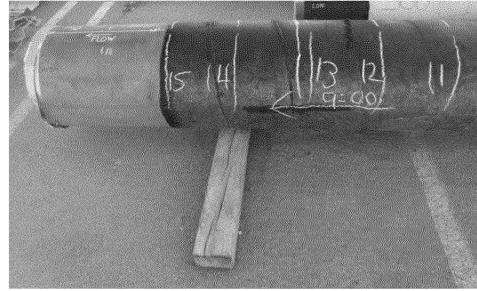
Removed pipe section coating assesment 9:00



Overview of coating condition 9:00 position



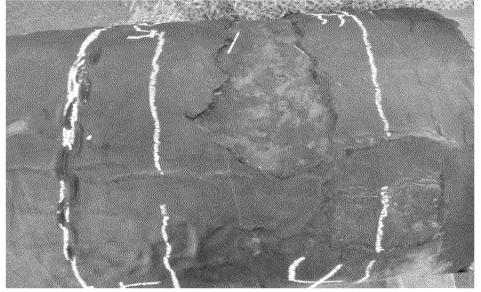
Overview of coating condition 9:00 position



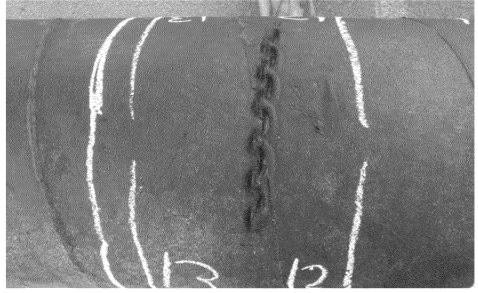
Overview of coating condition 9:00 position

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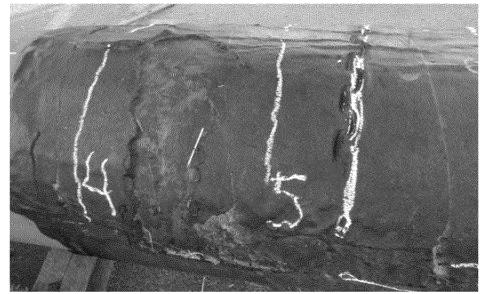
Pacific Gas & Electric Company 20" Route L-147 Excavation Site T43A-B_L147_B_MP-1.89



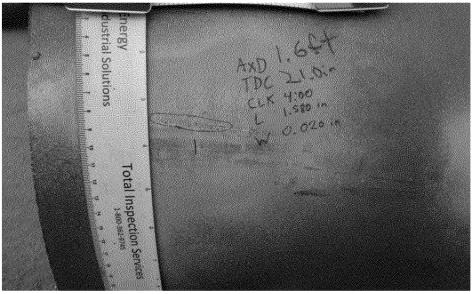
Coating damaged from removal process.



Coating damaged from removal process.



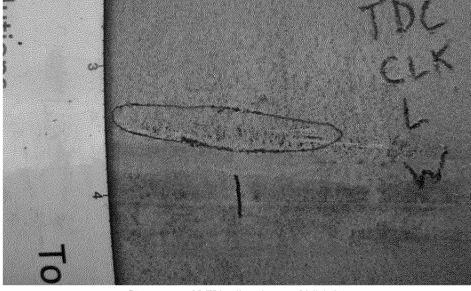
Coating damaged from removal process.



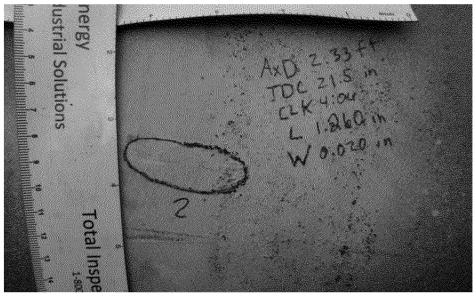
Removed pipe section linear indication-01

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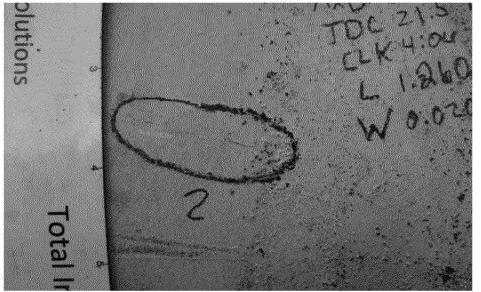
Pacific Gas & Electric Company 20" Route L-147 Excavation Site T43A-B_L147_B_MP-1.89



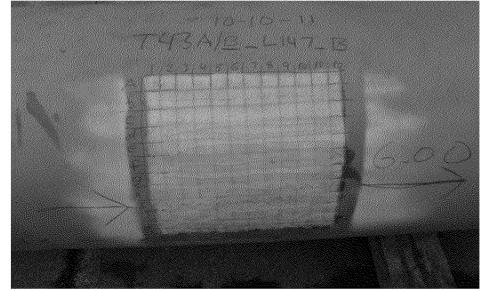
Close up of MT Indications of LIN-01



Removed pipe section linear indication-02



Close up of MT Indications of LIN-02

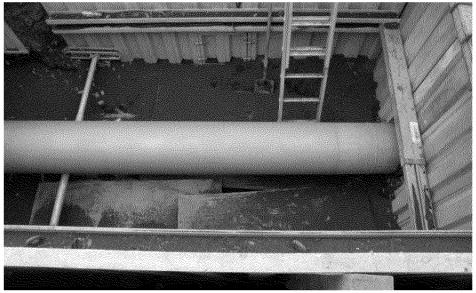


Overview of UT Grid.

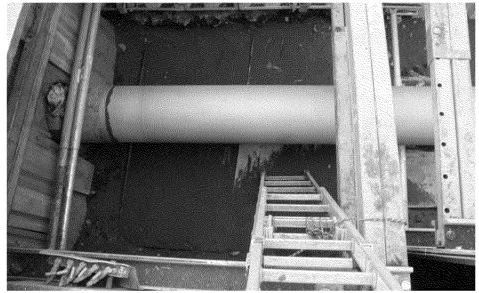
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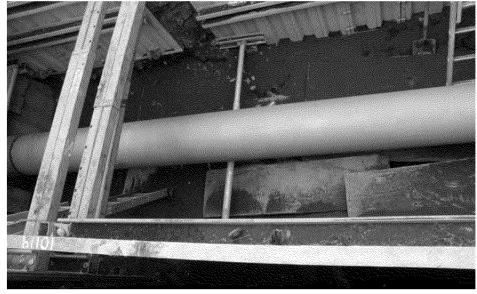
Pacific Gas & Electric Company 20" Route L-147 Excavation Site T43A-B_L147_B_MP-1.89



Overview of clean blasted inspection area prior to recoat activities



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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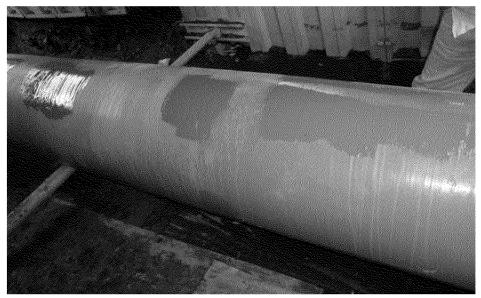
Page

Pacific Gas & Electric Company 20" Route L-147 Excavation Site T43A-B_L147_B_MP-1.89

Rev 1.0 (06-05-12)



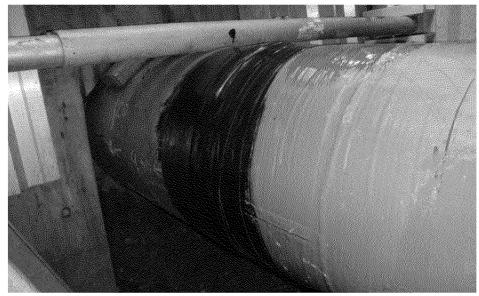
Overview of final coating condition 3:00



Overview of final coating condition 3:00



Overview of final coating condition 3:00



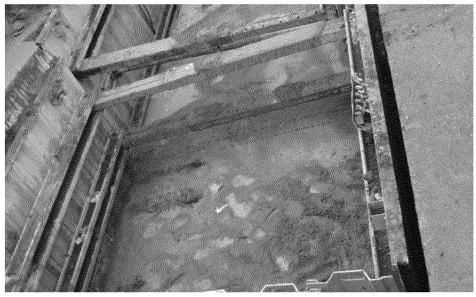
Overview of final coating condition US 3:00

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Page



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

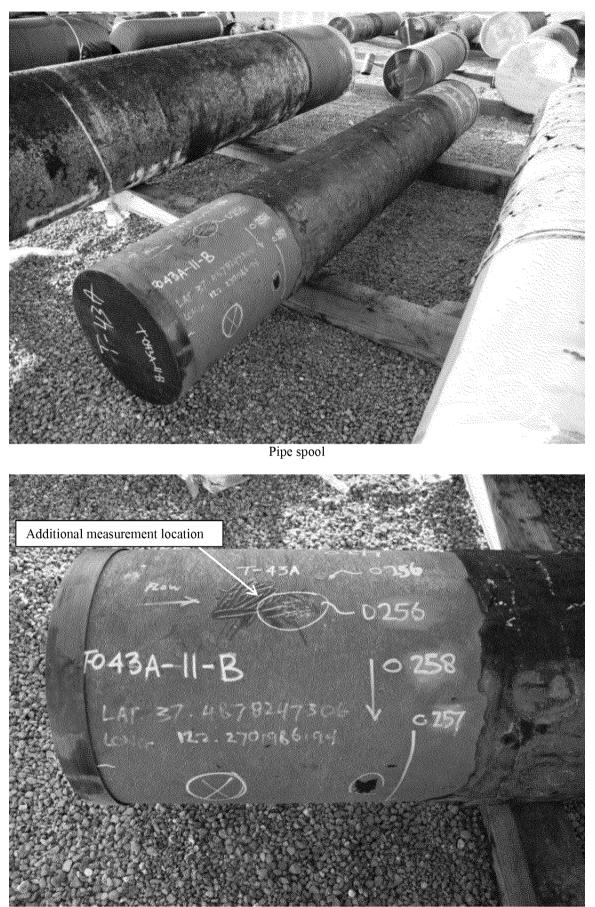
Non Destructive Examination

3400 Crow Canyon Road, San Ramon, CA 94583

Robert de Haas (925) 866-5849 Cell (209) 480-1063



	NONDESTRUC	CTIVE EXAMINAT	ION DATA		
Location and Unit No:	Modesto, Line 147 pipe spool	Examination Dat	e: 08/29/20	13 Job	08607-01K
Client Contact:	Joe Medina	Examiner(s):	Robert d	e Haas	
Manufacturer:	N/A				
INTRODUCTION:		Medina, Director Transmi nts were taken on a pipe s			
COMPONENT EXAMIN	ED: 20" Diameter pipe sp	ool removed from Line 14	7, (T-43A), M	P 1.951.	
	Pipe spool markings:	Line 147 T-43A-11-B, Loc B Lat. 37.4878247306	/ Lon. 122.270)1966194	
EXAMINATION METH	Procedure – ATS-UT Panametrics – EPOCI Aerotech Alpha HP -	H4, Sn. 21417606 0.25" diameter, 10 mHz t anametrics 2214E, Sn. 88		G10507	
EXAMINATION RESUL	four points on the pip	a pipe wall thickness rang e circumference, 90° apar pipe grade testing was perf	. One addition	al reading wa	is taken at a polished
	<u>U/S end</u>				
	<u>Clock position</u>	<u>12:00</u> <u>03</u>	:00	<u>06:00</u>	<u>09:00</u>
		0.256" 0.2	258"	0.257"	0.247"
	Polished area	0.256"			
	<u>D/S end</u>				
	<u>Clock position</u>	<u>12:00</u> 03	<u>:00</u>	<u>06:00</u>	<u>09:00</u>
		0.251" 0.2	253"	0.254"	0.247"



Upstream end on spool



Downstream end of spool

EXHIBIT D

INSPECTION SERVICES Pipeline Integrity Team CWA # 2500461774 GEIS Job # LAP10015

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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Form H: Dire	ct Examination Da	ta Sheet - Page	1 01 10								
	D/ Route Number:	<u>VILI</u> L-1	47	Site 1	<u>DA</u> Designation:	T43A/B_	в	11 1 1	og Distance:	NA	
	Date of Excavation:	10/7/		-	N-Segment:	143A/B_ NA	-		Ref. Section:	Table 5.	6.2
	Mile Point:	1.9		-	MA Number:	NA			e Girth Weld:	NA	
Examin	nation Performed By:	H. Mayer/		-					om Girth Weld:	NA	
PG	&E Project Manager:	Donova	an Fink	Regi	ion Number:	NA					
	Approved By:	Kenji (Subre	egion # (ICDA):	NA					
	Order Number:	4149	7360	-	Stationing:	NA					
Excava	ation Priority:					Excavation	Reason				
	mmediate	Scheduled (For	-iii.	1 Year	Other)	ECD4			ecoat		
ľ.	Aonitor	Effectiveness	X	Hydro Test		ICDA		Other NA			
If pract	tical, take P/S or CIS	reads before exca	avation:					NA			
Excavation Det	tails: U/S Ditch S	tart GPS Coordina		(Uncorrected Fie	eld Measurement						
	Northing: 37				PDOP	NA		Excavation Length		NA	
	Easting: -12	2.2701986194			Acc~:	NA	Actual	Excavation Length	(FL):	21.0ft	
		ine GPS Coordinat	es	(Uncorrected Fie	eld Measurement			GPS File N	ame:	Guida 148T43	13
	Northing: NA Easting: NA				PDOP	NA NA					
					Acc~:						
		ich End GPS Coord	dinates	(Uncorrected Fie	eld Measurement						
	Northing: 37.	48/8664944 2.2702163300			PDOP Acc~:	NA NA					
		2.2702100000									
1.0 Data Befo	ore Coating Remov	/al									
1.1	Native Soil Type:	Г	χ Clay	X Rock	X Sand	Loam	Wet	Other		NA	
	1.1A Backfill Mate		×,	Silt	Slurry	Native		of Cover (Ft.):		6.00ft	
							Dopui			0.0010	
	Comments:					NA					
1.2	Coating Type:	X HAA	s 🗌 s	iomastic	Plastic Ta	pe	Wax Tape	FBE	۲ ا	Powercrete	
	Bare/	None	Coal Tar	Other:	NA		Comments:		NA		
	Coating Thickness (I		0.250	」 ∩in		Number of Layers:			2		
	Coating Thickness (I	nches).	0.230			vullibel of Layers.			2		
1.3	Holiday Testing Pe	formed?:	Ο Υ	'es X N	lo	Voltage Used:	NA	M	ap Location of Ho	idays Below.	
		Device Us	ed: 🗖 C	x 🗌 lio	Vet Sponge		Comments		NA		
1.4	Pipe-to-Soil Potenti			US: 12		3:00	-530		35 9:00	-526	_
				DS: 12		3:00	-658		40 9:00	-663	-
	Comments:					very low, may be	urned off at time				_
1.5		itch (Ω-cm):						•			
1.5	Soil Resistivity in D	itch (Ω-cm):		24469.5 ohr			Soil Box	NA			
1.5	Soil Resistivity in D			24469.5 ohr NA				NA SRM-100	US: N/A	DS:	N/A
1.5	Soil Resistivity in D Method:	X 4-Pin	Comments				Soil Box	SRM-100		DS:	N/A
1.6	Soil Resistivity in D Method: Comments: Soil Sample Location	X 4-Pin	_	NA	m/cm		Soil Box	SRM-100 00 position under p	ipe.		
	Soil Resistivity in D Method: Comments: Soil Sample Location Ground Water Pres	X 4-Pin	Comments		m/cm	s) Collected?:	Soil Box	SRM-100			
1.6 1.7	Soil Resistivity in D Method: Comments: Soil Sample Location Ground Water Pres Comments:	X 4-Pin on ent?: [Yes	NA X No	m/cm	s) Collected?:	Soil Box Ditch end (DS) 6:	SRM-100 00 position under p X No	ipe. Sample pH		
1.6	Soil Resistivity in D Method: Comments: Soil Sample Location Ground Water Pres	X 4-Pin on ent?: [Yes X Good - Ad	NA X No Ihered to Pipe	m/cm Sample(s) Collected?: NA	Soil Box Ditch end (DS) 6:	SRM-100 00 position under p	ipe. Sample pH		
1.6 1.7	Soil Resistivity in D Method: Comments: Soil Sample Location Ground Water Pres Comments:	X 4-Pin on ent?: [Yes X Good - Ad Poor - Co	NA X No Ihered to Pipe ating Significantly	m/cm Sample(Disbonded or Mi	s) Collected?: NA Fair - Coa	Soil Box Ditch end (DS) 6: Yes ting Partially Disl	SRM-100 00 position under p X No bonded or Degrade	sample pH	: N	
1.6 1.7	Soil Resistivity in D Method: Comments: Soil Sample Location Ground Water Pres Comments:	X 4-Pin on ent?: [Yes X Good - Ad Poor - Con oating removed a	NA No Ihered to Pipe ating Significantly & tie in weld areas	m/cm Sample(Disbonded or Mi	s) Collected?: NA Fair - Coa ssing ction removed and	Soil Box Ditch end (DS) 6: Yes ting Partially Disi	SRM-100 00 position under p X No bonded or Degrade	ipe. Sample pH d section was also	: N	
1.6 1.7	Soil Resistivity in D Method: Comments: Soil Sample Locati Ground Water Press Comments: Coating Condition:	X 4-Pin on ent?: [Yes X Good - Ad Poor - Con oating removed a	NA No Ihered to Pipe ating Significantly & tie in weld areas	m/cm Sample(Disbonded or Mi	s) Collected?: NA Fair - Coa ssing ction removed and	Soil Box Ditch end (DS) 6: Yes ting Partially Disi	SRM-100 00 position under p X No bonded or Degrade	ipe. Sample pH d section was also	: N	
1.6 1.7	Soil Resistivity in D Method: Comments: Soil Sample Locati Ground Water Press Comments: Coating Condition:	X 4-Pin	Yes X Good - Ad Poor - Con oating removed a	NA No Ihered to Pipe ating Significantly & tie in weld areas	m/cm Sample(Disbonded or Mi s blasted. Pipe se for coating damag	s) Collected?: NA Fair - Coa ssing ction removed and	Soil Box Ditch end (DS) 6: Yes ting Partially Disl d test pipes insta d transportation	SRM-100 00 position under p X No bonded or Degrade lied. Removed pipe See comments pa	ipe. Sample pH d section was also	: N	
1.6 1.7	Soil Resistivity in D Method: Comments: Soil Sample Locati Ground Water Press Comments: Coating Condition: Comments:	X 4-Pin - on	Yes X Good - Ad Poor - Con oating removed a	NA No Ihered to Pipe ating Significantly & tie in weld areas	m/cm Sample(Disbonded or Mi s blasted. Pipe se for coating damag	s) Collected?: NA Fair - Coa ssing ction removed and e from removal ar	Soil Box Ditch end (DS) 6: Yes ting Partially Disl d test pipes insta d transportation	SRM-100 00 position under p X No bonded or Degrade lied. Removed pipe See comments pa	section was also ge 10.	: N	
1.6 1.7	Soil Resistivity in D Method: Comments: Soil Sample Locati Ground Water Press Coating Condition: Coating Condition: Map of Coating Deg	X 4-Pin - on	Yes X Good - Ad Poor - Coo oating removed a was in good	NA No Ihered to Pipe ating Significantly & tie in weld areas	m/cm Sample(Disbonded or Mi s blasted. Pipe se for coating damag	s) Collected?: NA Fair - Coa ssing ction removed and e from removal ar	Soil Box Ditch end (DS) 6: Yes ting Partially Disl d test pipes insta d transportation	SRM-100 00 position under p X No bonded or Degrade lied. Removed pipe See comments pa	section was also ge 10.	: N	
1.6 1.7 1.8 1.9	Soil Resistvity in D Method: Comments: Soil Sample Locati Ground Water Pres Comments: Coating Condition: Comments: Map of Coating Deg *Note any calcareou Holidays	X 4-Pin	Yes X Good - Ad Poor - Coo oating removed a was in good	NA No Ihered to Pipe ating Significantly & tie in weld areas	m/cm Sample(Disbonded or Mi s blasted. Pipe se for coating damag	s) Collected?: NA Fair - Coa ssing ction removed and e from removal ar	Soil Box Ditch end (DS) 6: Yes ting Partially Disl d test pipes insta d transportation Point:	SRM-100 00 position under p X No bonded or Degrade lied. Removed pipe See comments pa	section was also ge 10.	: N	
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1.6 1.7 1.8 1.9 12 or 6 or 3 or 7 2 or 12 or	Soil Resistvity in I Method: Comments: Soil Sample Location Ground Water Press Comments: Coating Condition: Comments: Map of Coating Deg *Note any calcareou Holidays clock	X 4-Pin on ent?: [Caracle of the second se	Yes Cooling removed a was in good dments	NA X No No No No Second to Pipe ating Significantly & tie in weld areas contition except for Continue except for Continue except for No No No No No No No No No No	Sample(Disbonded or Mi siblasted. Pipe se for coating damag	s) Collected?: NA Fair - Coa ssing ction removed and e from removel and Zero Reference I	Soil Box	SRM-100 00 position under p X No bonded or Degrade lied. Removed pipe See comments pa	ipe. Sample pH d section was also ge 10. IS Exposed Pipe 3	assesed and assesed and assesed and assesed and assesed and	A
1.6 1.7 1.8 1.9 12 or 6 or 3 or 7 2 or 12 or	Soil Resistivity in C Method: Comments: Soil Sample Location Ground Water Press Comments: Comments: Map of Coating Deg *Note any calcareou Map of Coating Deg *Note any calcareou Clock clock clock	X 4-Pin on ent?: [Caracle of the second se	Yes X Good - Ad Poor - Coo oating removed a was in good	NA No Ihered to Pipe ating Significantly & tie in weld areas	m/cm Sample(Disbonded or Mi s blasted. Pipe se for coating damag	s) Collected?: NA Fair - Coa ssing ction removed and e from removal ar	Soil Box Ditch end (DS) 6: Yes ting Partially Disl d test pipes insta d transportation Point:	SRM-100 00 position under p X No bonded or Degrade lied. Removed pipe See comments pa	section was also ge 10.	: N	
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1.6 1.7 1.8 1.9 12 or 6 or 3 or 7 2 or 12 or	Soil Resistvirty in I Method: Comments: Soil Sample Location Ground Water Press Comments: Coating Condition: Comments: Map of Coating Deg *Note any calcareou Map of Coating Deg total any calcareou Cock clock clock clock Feet 0	X 4-Pin on ent?:	Yes Coding removed a was in good dments	NA X No Ihered to Pipe ating Significantly & tie in weld areas a conition except for conition except for areas a conition except for a conition except	Sample(Disbonded or Mi siblasted. Pipe se for coating damage and	s) Collected?: NA Fair - Coa ssing ction removed and e from removel and Zero Reference I	Soil Box	SRM-100 00 position under p X No bonded or Degrade lied. Removed pipe See comments pa	ipe. Sample pH d section was also ge 10. IS Exposed Pipe 3	assesed and assesed and assesed and assesed and assesed and	A

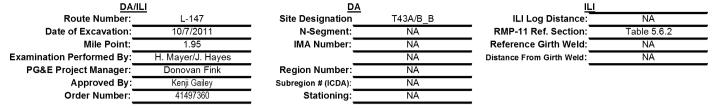
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	DA/IL	<u>_l</u>			Ĩ	DA				Ш		
	Route Number:	L-14		Site	Designation		T43A/B_	В		Log Distance:	NA	
	Date of Excavation:	10/7/2			N-Segment		NA			Ref. Section:	Table 5.	.6.2
Evenin	Mile Point:	1.9			IMA Number	:	NA NA			ce Girth Weld:	NA NA	
	hation Performed By: &E Project Manager:	H. Mayer/ Donova		Б	ogion Numbor		NA		Distance F	rom Girth Weld:	INA	
PG	Approved By:	Kenji G			egion Number bregion # (ICDA)		NA					
	Order Number:	41497		50	Stationing		NA					
					outoning		101					
1.10	Photos Taken?*: *See Photo Log for	X Yes additional infe	ormation.									
1.11	Coating Sample Ta	aken?:	Yes	X No	b L	ocation o	f Sample:			NA		
1.12	Liquid Underneath	Coating?:	Yes		o lf	Yes, pH	of Liquid:			NA		
1.13	Corrosion Product	t Present?:	Yes		o If	Yes, Wa	s Sample	Taken?:	Yes	X No		
	Comments:						NA					
1.14	Soil pH (Sb Electro	ode): l	Jpstream:	6.0	Do	ownstrea	m:	7.5	- P	ipe pH:	6.0	_
2.0 Data Af	ter Coating Remo	oval										
2.1	Pipe Temperature	(°F):	60.0° F			Measur	ed Pipe 🛛	Diameter (In.):	:	63" :	= 20.05"	
2.2	Weld Seam Type:		saw 🗖	SSAW		∾ Г	SML	.S				
		H ,	piral 🗖	Lap	Flas	ъ Г	X AOS	Smith			ALLY PERFORM	I
				·				Jinui	MACROETCH	H & LOCATE		
2.3	Girth Weld Coordin	hates & Iden		Table 5.7.	•							
	Northing: Easting:		NA NA			-	NA NA	IS Mold	Clock Positio	p(c)	8:55	
	Elevation:		NA				NA	L3 Weld	CIOCK FOSILIO	n(s).	0.00	
			101									
2.4	Damage Found: Corrosion Dama Other Damage	-	Yes	X No	lon relevant l		anical Dai s, no com	mage osion found gi	Teater than 20			
2.5	UT Wall Thickness	Moncuromo	ents: US/	De		US /	De		US / DS		US / E	
2.5	OT wait mickness	TD			1 O'clock	0.267"/(2 O'clock	0.267"/0.271	I" 3 O'cloc		
		4 O'clo			5 O'clock	0.266"/(6 O'clock	0.268"/0.273			
		8 O'clo	-		9 O'clock	0.261"/(10 O'clock	0.266"/0.264	-		
	UT Wall Thickness	Crid @ 6:00		Re sure to	attach grid	to H-For	n electro	nically See	nage 6 of 10		-	
2.6		•	•	Comme	-			•			T 0 Diana ana	n wh
2.0	Wet Fluorescent M	-	·								T & Photo repo	лι.
	Were there any line	ar indications	? X	Yes	No			•	• •	art of the H-For photos of indica		
2.7	Take Photos to Do	cument Cor	rosion and Otl	her Anom	alies*	report		black light an	a milito ngilit p		20010.	
	*See Photo Log for	additional infe	ormation.									
2.8	Overview Map of C	orroded Are	ea*:									
	*See Pit Depth Mea	surement Gri	id for additional	I Informatic	n	Zero	Reference	e Point:		US Exposed Pipe	360 degrees	
								Flow -			>	•
*Note any	calcareous deposits	i.										
12 o'cl	lock											
9 o'cl	look	ł								-		4
300	IOOK											
6 o'cl	lock											1
										1		1
3 o'cl	lock								 		+	4
300												
12 o'cl	lock											
	eet 0 1		2 3	3	4	5		6	7	8	9	10

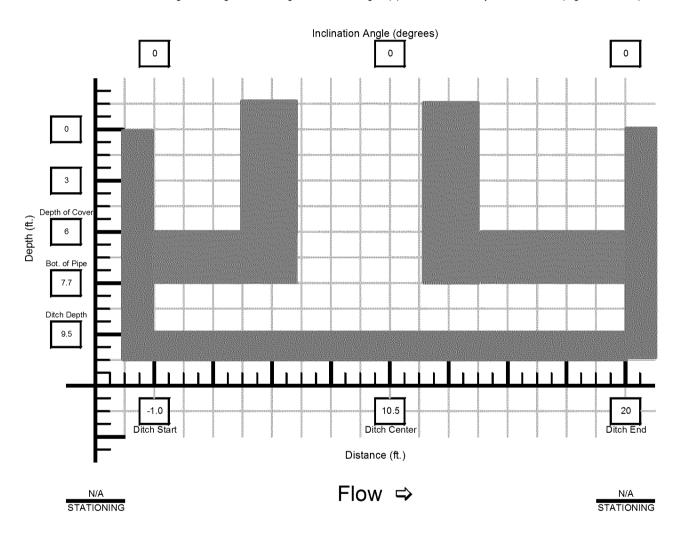
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Form H: Direct Examination Data Sheet - Page 3 of 10



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").



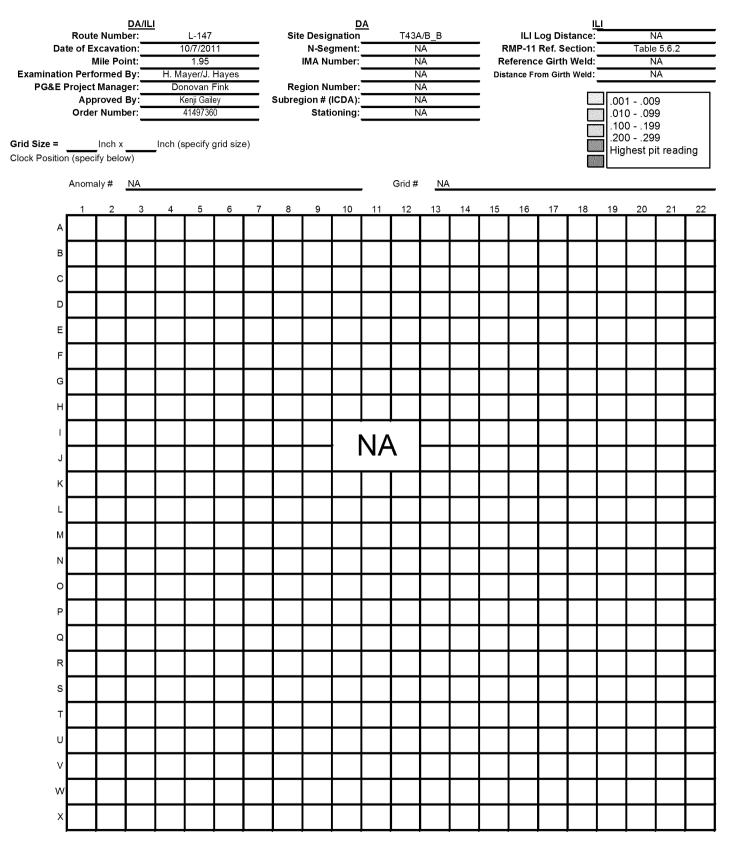
NOTES: (Record stationing and names of nearby landmarks such as creeks and roads. Provide any additional information that may help in spatially positioning pipe):

**See attached Delorme screen shot on page 11.

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

EXTERNAL PIT DEPTH MEASUREMENT GRID SHEETS

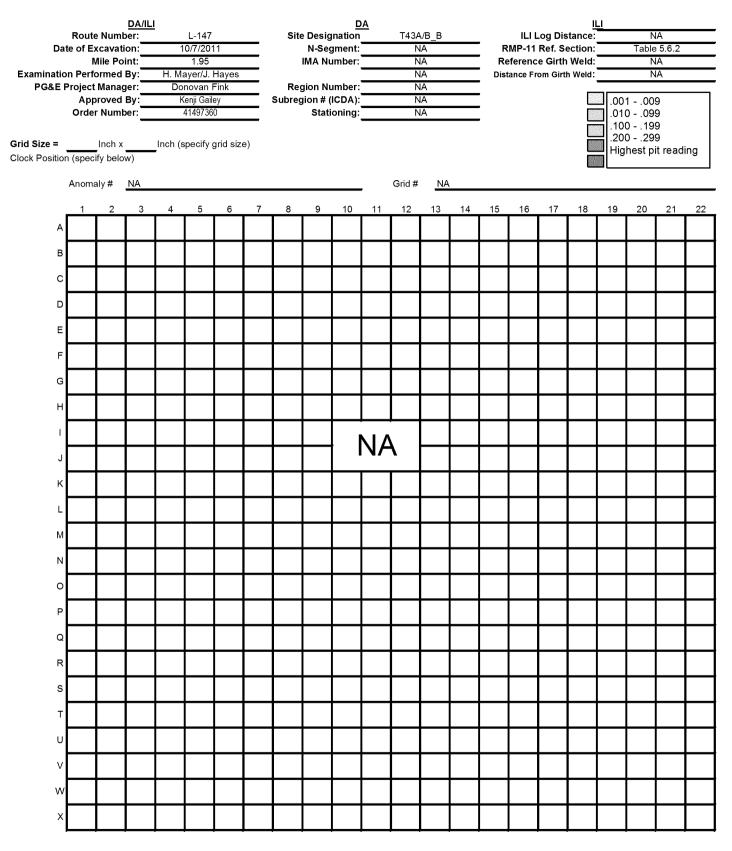


PIT DEPTH GRID 1 OF 2

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EXTERNAL PIT DEPTH MEASUREMENT GRID SHEETS



PIT DEPTH GRID 2 OF 2

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INTERNAL CORROSION WALL LOSS GRID

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	-	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		

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 \	/ 7	8	9	10	11	12
A	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"
E	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"
-	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

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SB_GT&S_0267462

Form H: Direct Examination Data Sheet - Page 7 of 10

COATING DAMAGE

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		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	_	

NO.	FEET FROM REFERENCE	O'CLOCK	MAX LENGTH (IN.)	MAX CIRC EXTENT (IN.)
NA	NA	NA	NA	NA
	+			
	<u>├ </u>			
	<u> </u>			
	↓			
	 			
	<u>├</u>			
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	+			

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CORROSION 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:	1.95	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
				+	

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PHOTO LOG

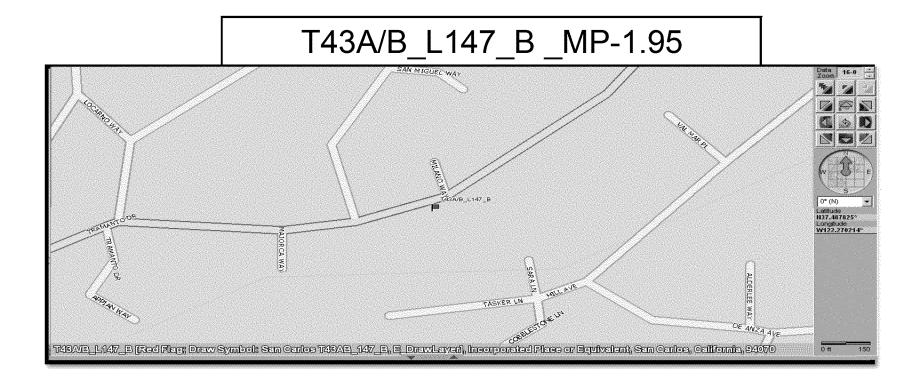
DA/II	<u>_1</u>	DA		ILI	
Route Number:	 L-147	Site Designation	T43A/B_B	ILI Log Distance:	NA
Date of Excavation:	10/7/2011	N-Segment:	NA	RMP-11 Ref. Section:	Table 5.6.2
Mile Point:	1.95	IMA Number:	NA	Reference Girth Weld:	NA
Examination Performed By:	H. Mayer/J. Hayes		NA	Distance From Girth Weld:	NA
PG&E Project Manager:	Donovan Fink	Region Number:	NA		
Approved By:	Kenji Gailey	Subregion # (ICDA):	NA		
Order Number:	41497360	Stationing:	NA		

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

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3.3 For Epoxy Coating Systems, Record Environmental Condition: Air Temperature: 62.4°F Pipe Temperature: 67.0°F Time of Day: 12:30 pm 3.4 Repair Coating Hardness (If ARC Coating:) US 3:00 - DS 3:00 - 79 9:00 - 79 12:00 - DS 3:00 - 79 6:00 - 79 9:00 - 79 12:00 - 81 3.5 Measured Coating Thickness: US 3:00 - 33.7 6:00 - 28.6 9:00 - 57.5 12:00 - 27.4 DS 3:00 - 37.3 6:00 - 28.6 9:00 - 57.5 12:00 - 29.3 Holiday Tested?: X Yes No No Device Used: Coil Wet Sponge Voltage Used: UNK Repair All Holidays. YES 3.6 Coupon Test Station Installed?: Yes No ETS Installed?: Yes No If Yes, Date Installed: NA Carsonite Other: NA 3.7 Backfill Materiai: Native Imported Sand Other: NA 3.8 Pipe-to-Soil Readings Over Bel	Route Number L1/17 Site Designation IL Log Distance: MA Magement RAME Bate designation IL Log Distance: MA Magement NA Bate designation IL Log Distance: MA Magement NA Magement NA Bate for a fix AMB Bate for a fix AMB Bate for a fix AMB Bate for a fix AMB Bate for a fix AMB Bate for a fix AMB Bate for a fix AMB Bate for a fix AMB Bate for a fix AMB Bate for a fix AMB Bate for a fix AMB Bate for a fix AMB Bate for a fix AMB Bate for a fix AMB Bate for a fix AMB Bate for a fix AMB Bate for a fix AMB Bate for a fix AMB Bate for a fix AMB Bate for a fix AMB Bate for a fix AMB Bate for a fix AMB Bate for a fix AMB Bate for a fix AMB Bate for a fix AMB <th c<="" th=""><th>Route Number: Date of Excavation: Mile Point: Examination Performed By: PG&E Project Manager: Approved By: Order Number: 3.0 RECOAT DATA 3.1 Sandblast Media 3.2 Pipe Recoated W Powercrete 3.3 For Epoxy Air Temperatu Pipe Temperatu Time of D: 3.4 Repair Coating H 3.5 Measured Coatin Holiday Tested?: Device Used: 3.6 Coupon Test If Yes, Date Instal Surface Configure 3.7 Backfill Material: Coating Protection</th><th>L-147 Site Designation T43A/B_B ILI Log Distance: NA 107/2011 N-Segment: NA RMP-11 Ref. Section: Table 5.6 1.95 IMA Number: NA Reference Girth Weld: NA H. Mayer/J. Hayes NA Distance From Girth Weld: NA Bonovan Fink Region Number: NA Distance From Girth Weld: NA Kenji Gailey Subregion # (ICDA): NA Distance From Girth Weld: NA 41497360 Stationing: NA Dev Tar 247 X Protal 7200 F Coating Systems, Record Environmental Condition: E 62.4°F Dev Point: 45.1°F re: 67.0°F Relative Humidity: 51.4% 9:00 - 79 12:00 - 79 g Thickness: US 3:00 - 33.7 6:00 - 79 9:00 - 79 12:00 - 81 g Thickness: US 3:00 - 33.7 6:00 - 28.6 9:00 - 57.5 12:00 - DS 3:00 - 33.7 6:00 - 28.6 9:00 - 57.5 12:00 - 81</th><th>27.4</th></th>	<th>Route Number: Date of Excavation: Mile Point: Examination Performed By: PG&E Project Manager: Approved By: Order Number: 3.0 RECOAT DATA 3.1 Sandblast Media 3.2 Pipe Recoated W Powercrete 3.3 For Epoxy Air Temperatu Pipe Temperatu Time of D: 3.4 Repair Coating H 3.5 Measured Coatin Holiday Tested?: Device Used: 3.6 Coupon Test If Yes, Date Instal Surface Configure 3.7 Backfill Material: Coating Protection</th> <th>L-147 Site Designation T43A/B_B ILI Log Distance: NA 107/2011 N-Segment: NA RMP-11 Ref. Section: Table 5.6 1.95 IMA Number: NA Reference Girth Weld: NA H. Mayer/J. Hayes NA Distance From Girth Weld: NA Bonovan Fink Region Number: NA Distance From Girth Weld: NA Kenji Gailey Subregion # (ICDA): NA Distance From Girth Weld: NA 41497360 Stationing: NA Dev Tar 247 X Protal 7200 F Coating Systems, Record Environmental Condition: E 62.4°F Dev Point: 45.1°F re: 67.0°F Relative Humidity: 51.4% 9:00 - 79 12:00 - 79 g Thickness: US 3:00 - 33.7 6:00 - 79 9:00 - 79 12:00 - 81 g Thickness: US 3:00 - 33.7 6:00 - 28.6 9:00 - 57.5 12:00 - DS 3:00 - 33.7 6:00 - 28.6 9:00 - 57.5 12:00 - 81</th> <th>27.4</th>	Route Number: Date of Excavation: Mile Point: Examination Performed By: PG&E Project Manager: Approved By: Order Number: 3.0 RECOAT DATA 3.1 Sandblast Media 3.2 Pipe Recoated W Powercrete 3.3 For Epoxy Air Temperatu Pipe Temperatu Time of D: 3.4 Repair Coating H 3.5 Measured Coatin Holiday Tested?: Device Used: 3.6 Coupon Test If Yes, Date Instal Surface Configure 3.7 Backfill Material: Coating Protection	L-147 Site Designation T43A/B_B ILI Log Distance: NA 107/2011 N-Segment: NA RMP-11 Ref. Section: Table 5.6 1.95 IMA Number: NA Reference Girth Weld: NA H. Mayer/J. Hayes NA Distance From Girth Weld: NA Bonovan Fink Region Number: NA Distance From Girth Weld: NA Kenji Gailey Subregion # (ICDA): NA Distance From Girth Weld: NA 41497360 Stationing: NA Dev Tar 247 X Protal 7200 F Coating Systems, Record Environmental Condition: E 62.4°F Dev Point: 45.1°F re: 67.0°F Relative Humidity: 51.4% 9:00 - 79 12:00 - 79 g Thickness: US 3:00 - 33.7 6:00 - 79 9:00 - 79 12:00 - 81 g Thickness: US 3:00 - 33.7 6:00 - 28.6 9:00 - 57.5 12:00 - DS 3:00 - 33.7 6:00 - 28.6 9:00 - 57.5 12:00 - 81	27.4
Date of Exavation: 107/2011 N-Segment: NA RHP-11 Ref. Section: Table 5.6.2 Main Performed By: H. Mayer0. Hayes NA NA Reference Girth Weld: NA PG&E Project Manager: Donovan Fink Region Number: NA NA Distance From Girth Weld: NA PG&E Project Manager: Manger0. Hayes NA Reference Girth Weld: NA Approved By: Kanji Galley Subregion # (CDA); NA NA Distance From Girth Weld: NA 3.0 RECOAT DATA Stationing: NA NA NA Reference Girth Weld: NA 3.1 Sandblast Media: Sharp Shot 30/60 Anchor Profile Measurement: Average: 3.2 mils Stationing: NA 3.3 For Epoxy Coating Systems, Record Environmental Condition: Air Temperature: 62.4°F Dew Point: 45.1°F Pipe Temperature: 62.4°F Dew Vint: Dew Point: 45.1°F Pipe Temperature: 62.4°F No Dew Point: 45.1°F Pipe Temperature: 62.4°F Dew Noint: 51.4% 12:00 - 27.4 State Coating Hardness (If ARC Coating:) <t< td=""><td>Date of Excavation: 107/2011 NS generic NA RAP-11 Ref. Section: Table 5.62 Bite Point 155 NA NA NA Reference Citrit Weld: NA PGE Project Manager: Docroar Fink NA NA NA Distance Prom Girth Weld: NA Order Number: 41497360 NA NA NA Distance Prom Girth Weld: NA 3.0 RECOAT DATA 3.1 Sandblast Media: Sharp Shot 30.60 Anchor Profile Measurement: Average: 3.2 mills 3.1 Sandblast Media: Sharp Shot 30.60 Anchor Profile Measurement: Average: 3.2 mills 3.2 Pipe Recoated With: Provertrels Ba-Rust 235 Dev Grip 238 Dev Tar 247 Protal 7200 PE 3.3 For Epoxy Coating Systems, Record Environmental Condition: Ari Temperature: 62.4°F Relative Humidity: 51.4% Pipe Temperature: 62.4°F NB Solo - 22 9.00 - 73 12.00 - 79 3.4 Repair Coating Hardness (If ARC Coating:) US 3:00 - 337 6:00 - 38.7 9:00 - 75.5 12:00 - 22 Bovice Used: Coli D No Distance Contiguration: Na 20.0 - 27.5</td><td>Date of Excavation: Mile Point Examination Performed By: PG&E Project Manager: Approved By: Order Number: 3.0 RECOAT DATA 3.1 Sandblast Media 3.2 Pipe Recoated W Powercrete 3.3 For Epoxy Air Temperatu Pipe Temperatu Time of D: 3.4 Repair Coating H 3.5 Measured Coatin Holiday Tested?: Device Used: 3.6 Coupon Test If Yes, Date Instal Surface Configure 3.7 Backfill Material: Coating Protection</td><td>10/7/2011 N-Segment: NA RMP-11 Ref. Section: Table 5.6 1.95 1.95 IMA Number: NA Reference Girth Weld: NA Donovan Fink Region Number: NA Distance From Girth Weld: NA Donovan Fink Region Number: NA Distance From Girth Weld: NA MA Subregion # (ICDA): NA Distance From Girth Weld: NA 41497360 Stationing: NA Dev Tar 247 X Protal 7200 F Ith: Image: Station ing: Image: Station ing: Dev Grip 238 Dev Tar 247 X Protal 7200 F Coating Systems, Record Environmental Condition: Envintan Condition:</td><td>27.4</td></t<>	Date of Excavation: 107/2011 NS generic NA RAP-11 Ref. Section: Table 5.62 Bite Point 155 NA NA NA Reference Citrit Weld: NA PGE Project Manager: Docroar Fink NA NA NA Distance Prom Girth Weld: NA Order Number: 41497360 NA NA NA Distance Prom Girth Weld: NA 3.0 RECOAT DATA 3.1 Sandblast Media: Sharp Shot 30.60 Anchor Profile Measurement: Average: 3.2 mills 3.1 Sandblast Media: Sharp Shot 30.60 Anchor Profile Measurement: Average: 3.2 mills 3.2 Pipe Recoated With: Provertrels Ba-Rust 235 Dev Grip 238 Dev Tar 247 Protal 7200 PE 3.3 For Epoxy Coating Systems, Record Environmental Condition: Ari Temperature: 62.4°F Relative Humidity: 51.4% Pipe Temperature: 62.4°F NB Solo - 22 9.00 - 73 12.00 - 79 3.4 Repair Coating Hardness (If ARC Coating:) US 3:00 - 337 6:00 - 38.7 9:00 - 75.5 12:00 - 22 Bovice Used: Coli D No Distance Contiguration: Na 20.0 - 27.5	Date of Excavation: Mile Point Examination Performed By: PG&E Project Manager: Approved By: Order Number: 3.0 RECOAT DATA 3.1 Sandblast Media 3.2 Pipe Recoated W Powercrete 3.3 For Epoxy Air Temperatu Pipe Temperatu Time of D: 3.4 Repair Coating H 3.5 Measured Coatin Holiday Tested?: Device Used: 3.6 Coupon Test If Yes, Date Instal Surface Configure 3.7 Backfill Material: Coating Protection	10/7/2011 N-Segment: NA RMP-11 Ref. Section: Table 5.6 1.95 1.95 IMA Number: NA Reference Girth Weld: NA Donovan Fink Region Number: NA Distance From Girth Weld: NA Donovan Fink Region Number: NA Distance From Girth Weld: NA MA Subregion # (ICDA): NA Distance From Girth Weld: NA 41497360 Stationing: NA Dev Tar 247 X Protal 7200 F Ith: Image: Station ing: Image: Station ing: Dev Grip 238 Dev Tar 247 X Protal 7200 F Coating Systems, Record Environmental Condition: Envintan Condition:	27.4	
Mile Point 1.95 MA Reference Girth Weld: NA PG&E Project Manager: Docoram Fink Region Number: NA Distance From Girth Weld: NA PG&E Project Manager: Approved By: Kenji Galley Stationing: NA Distance From Girth Weld: NA Order Number: 41497360 Stationing: NA NA Stationing: NA 3.0 Recont Data	Mile Poinc 155 INA Number: HA Reference Girth Weld: NA PG&E Project Managr: Danovan Frik Region Number: HA Distance From Girth Weld: NA PG&E Project Managr: Carl Mark Region Number: HA Distance From Girth Weld: NA Stationing: INA Stationing: INA Distance From Girth Weld: NA 3.0 Recoart DATA Stationing: INA Stationing: INA Distance From Girth Weld: NA 3.1 Sandblast Media:	Mile Point: Examination Performed By: PG&E Project Manager: Approved By: Order Number: 3.0 RECOAT DATA 3.1 Sandblast Media 3.2 Pipe Recoated W Pipe Recoated W Pipe Temperatu Time of D: 3.4 Repair Coating H 3.5 Measured Coatin Holiday Tested?: Device Used: 3.6 Coupon Test If Yes, Date Instal Surface Configure 3.7 Backfill Material: Coating Protection	1.95 IMA Number: NA Reference Girth Weld: NA Donovan Fink Region Number: NA Distance From Girth Weld: NA MA Subregion # (ICDA): NA Distance From Girth Weld: NA 41497360 Stationing: NA Dev Grip 238 Dev Tar 247 X Protal 7200 F ith: U X Poly Tape Bar-Rust 235 Dev Grip 238 Dev Tar 247 X Protal 7200 F re: 62.4°F Bar-Rust 235 Dev Grip 238 Dev Tar 247 X Protal 7200 F re: 67.0°F Relative Humidity: 51.4% ay: 12:30 pm Ds 3:00 - 82 6:00 - 79 9:00 - 79 12:00 - 81 g Thickness: US 3:00 - 33.7 6:00 - 28.6 9:00 - 57.5 12:00 - 81 g Thickness: US 3:00 - 37.3 6:00 - 28.6 9:00 - 57.5 12:00 - 91 Max Yes No ETS Installed?: Yes No eet: NA No ETS Installed?: Yes No	27.4	
P6&E Project Manager: Donovan Fink Approved By: Region Number: NA 3.0 RecoArt Datta Stationing: NA 3.1 Sandblast Media: Sharp Shot 30/60 Anchor Profile Measurement: Average: 3.2 mils 3.2 Pipe Recoated With: Powercrete J Stationing: NA 3.3 For Epoxy Coating Systems, Record Environmental Condition: Air Temperature: 62.4°F Pipe Temperature: 67.0°F Relative Humidity: 51.4% Time of Day: 12.30 pm US 3:00 - 28.6 9:00 - 79 12:00 - 79 3.4 Repair Coating Hardness (If ARC Coating:) US 3:00 - 33.7 6:00 - 28.6 9:00 - 79 12:00 - 27.4 Ds 3:00 - 37.3 = 6:00 - 28.6 9:00 - 39.0 12:00 - 27.4 DS 3:00 - 28.6 9:00 - 39.0 12:00 - 27.4 Station Installed?: Yes No ETS Installed?: Yes No It?:00 - 27.5 12:00 - 27.4 Station Installed?: Yes No ETS Installed?: Yes No If ves, Date Installed?: Yes No ETS Installed?: Yes No If ves, Date Installed: Native Imported Sand Other: NA	PG&E Project Manager: Dervised Fix Maproved By: Region Number: NA NA 3.0 RECOAT DATA Stationing: NA 3.1 Sandblast Media: Sharp Shot 30/60 Anchor Profile Measurement: Average: 3.2 mils 3.1 Sandblast Media: Sharp Shot 30/60 Anchor Profile Measurement: Average: 3.2 mils 3.1 Sandblast Media: Sharp Shot 30/60 Anchor Profile Measurement: Average: 3.2 mils 3.1 For post Costing Systems, Record Environmental Condition: Air Temperature: 62.4 F Dew Point: 45.1 °F Pie Temperature: 67.0 °F Relative Humidity: 51.4 % Time of Day: 79 12:00 ° 79 3.4 Repair Coating Hardness (f ARC Coating:) US 3:00 ° 33.7 6:00 ° 75 9:00 ° 79 12:00 ° 27 3.5 Measured Coating Thickness: US 3:00 ° 37.3 6:00 ° 28.6 9:00 ° 75.5 12:00 ° 27 3.6 Coupon Test Station Installed?: Yes No ETS Installed?: UNK Repair All Holidays. YES 3.6 Coupon Test Station Installed?: Yes No ETS Installed?: NA 3.7 Backfill Material:	PG&E Project Manager: Approved By: Order Number: 3.0 RECOAT DATA 3.1 Sandblast Media 3.2 Pipe Recoated W □ Powercrete 3.3 For Epoxy Air Temperatu Pipe Temperatu Time of D 3.4 Repair Coating H 3.5 Measured Coatin Holiday Tested?: Device Used: 3.6 Coupon Test If Yes, Date Instal Surface Configure 3.7 Backfill Material: Coating Protection	Donovan Fink Region Number: NA Kenji Gailey Subregion # (ICDA): NA 41497360 Stationing: NA stationing: NA 41497360 Stationing: NA stationing: NA ith: Anchor Profile Measurement: Average: 3.2 mils ith: Dev Grip 238 Dev Tar 247 X v Coating Systems, Record Environmental Condition: Protal 7200 F v Coating Systems, Record Environmental Condition: Protal 7200 F re: 67.0°F Relative Humidity: 51.4% ay: 12:30 pm Dev 3:00 - 79 9:00 - 79 g Thickness: US 3:00 - 33.7 6:00 - 79 9:00 - 79 g Thickness: US 3:00 - 33.7 6:00 - 28.6 9:00 - 39.0 12:00 - S 3:00 - 37.3 6:00 - 28.6 9:00 - 39.0 12:00 - g Thickness: US 3:00 - 33.7 6:00 - <t< td=""><td>27.4</td></t<>	27.4	
Approved By: Kenji Gailey Subregion # (ICDA): NA 3.0 RECOAT DATA 3.1 Sandblast Media:	Approved By: Kenii Cailey Stationing: NA 3.0 RECOAT DATA 3.1 Sandblast Media: Sharp Shot 30/60 Anchor Profile Measurement: Average: 3.2 mils 3.2 Pipe Recoated With: Boy Tar 247 Protal 7200 PE 3.3 For Epoxy Coating Systems, Record Environmental Condition: Air Temperature: 62.41F Pewerorete J Dev Yorit 45.11F Pipe Temperature: 62.41F Relative Humidity: 51.496 Time of Day: 12:00 - 79 12:00 - 79 12:00 - 79 12:00 - 79 12:00 - 79 12:00 - 79 12:00 - 79 12:00 - 27 Ds 3:00 - 32.6 9:00 - 79 12:00 - 79 12:00 - 27 Ds 3:00 - 32.6 9:00 - 39.0 12:00 - 27 28 3:00 - 32.6 9:00 - 39.0 12:00 - 27 Ds 3:00 - 37.3 6:00 - 28.6 9:00 - 57.5 12:00 - 27 28 3:00 - 32.6 9:00 - 39.0 12:00 - 27 Ds 3:00 - 37.3 6:00 - 28.6 9:00 - 59.6 12:00 - 27 28 3:00 - 32.6 9:00 - 59.6 12:00 - 27 28 3:00 - 32.6 9:00 - 39.0 12:00 - 27 28 3:00 - 32.6 9:00 - 50.6 12:00 - 27 28 3:00 - 37.3 6:00 - 28.6 9:00 -	Approved By: Order Number: 3.0 RECOAT DATA 3.1 Sandblast Media 3.2 Pipe Recoated W Powercrete 3.3 For Epoxy Air Temperatu Pipe Temperatu Time of D 3.4 Repair Coating H 3.5 Measured Coatin Holiday Tested?: Device Used: 3.6 Coupon Test If Yes, Date Instal Surface Configure 3.7 Backfill Material: Coating Protection	Kenji Gailey Subregion # (ICDA): NA 41497360 Stationing: NA Stationing: NA Stationing: NA Max Anchor Profile Measurement: Average: 3.2 mils Ith: Anchor Profile Measurement: Average: 3.2 mils Ith: Dev Grip 238 Dev Tar 247 Protal 7200 F Coating Systems, Record Environmental Condition: Dev Point: 45.1°F re: 62.4°F Dew Point: 45.1°F Relative Humidity: 51.4% ay: 12:30 pm Ds 3:00 - 82 6:00 - 79 9:00 - 79 12:00 - 79 Barchess: US 3:00 - 33.7 6:00 - 75 9:00 - 79 12:00 - 81 g Thickness: US 3:00 - 33.7 6:00 - 28.6 9:00 - 57.5 12:00 - S 3:00 - 37.3 6:00 - 28.6 9:00 - 39.0 12:00 - 12:00 - S 3:00 - 37.3 6:00 - 28.6 9:00 - 39.0 12:00 - Ds 3:00 -	27.4	
Order Number: 41497360 Stationing: NA 3.0 RECOAT DATA 3.1 Sandblast Media:	Order Number: 41497380 Stationing: NA 3.1 Sandblast Media:	Order Number: 3.0 RECOAT DATA 3.1 Sandblast Media 3.2 Pipe Recoated W Powercrete 3.3 For Epoxy Air Temperatu Pipe Temperatu Pipe Temperatu Time of D 3.4 Repair Coating H 3.5 Measured Coating Holiday Tested?: Device Used: 3.6 Coupon Test If Yes, Date Instal Surface Configure 3.7 Backfill Material: Coating Protection	41497360 Stationing: NA Sharp Shot 30/60 Anchor Profile Measurement: Average: 3.2 mils ith: Anchor Profile Measurement: Average: 3.2 mils ith: Dev Grip 238 Dev Tar 247 Protal 7200 F Coating Systems, Record Environmental Condition: Dew Point: 45.1°F re: 62.4°F Dew Point: 45.1°F re: 67.0°F Relative Humidity: 51.4% av: 12:30 pm US 3:00 - 82 6:00 - 79 9:00 - 79 12:00 - 79 g Thickness: US 3:00 - 33.7 6:00 - 75 9:00 - 57.5 12:00 - Station Installed?: US 3:00 - 33.7 6:00 - 28.6 9:00 - 57.5 12:00 - Station Installed?: Yes No ETS Installed?: UNK Repair All Holidays. YES	27.4	
3.0 RECOAT DATA 3.1 Sandblast Media: Sharp Shot 30/60 Anchor Profile Measurement: Average: 3.2 mils 3.2 Pipe Recoated With: Powerorete J Poly Tape Bar-Rust 235 Dev Grip 238 Dev Tar 247 Y Protal 7200 PE Tar 3.3 For Epoxy Coating Systems, Record Environmental Condition: Air Temperature: 62.4'F Bev Point: 45.1'F Pipe Temperature: 67.0'F Relative Humidity: 51.4% Time of Day: 12:30 pm Ds 3:00 - 82 6:00 - 79 9:00 - 79 12:00 - 79 3.4 Repair Coating Thickness: US 3:00 - 33.7 6:00 - 38.7 9:00 - 57.5 12:00 - 27.4 3.5 Measured Coating Thickness: US 3:00 - 33.7 6:00 - 38.7 9:00 - 57.5 12:00 - 27.4 Ds 3:00 - 28.6 9:00 - 38.7 9:00 - 57.5 12:00 - 27.4 28.5 3.6 Coupon Test Station Installed?: Yes No ETS Installed?: Yes No If Yes, Date Installed?: NA Imported Sand Other: NA NA 3.7 Gool Other: NA Suface Configuration:: NA <td>3.1 Sandbi Media: </td> <td>3.0 RECOAT DATA 3.1 Sandblast Media 3.2 Pipe Recoated W □ Powercrete 3.3 For Epoxy Air Temperatu Pipe Temperatu Time of Dir 3.4 Repair Coating H 3.5 Measured Coating Holiday Tested?: Device Used: 3.6 Coupon Test If Yes, Date Instal Surface Configure 3.7 Backfill Material: Coating Protection</td> <td>Sharp Shot 30/60 Anchor Profile Measurement: Average: 3.2 mils ith: Image: Systems, Record Environmental Condition: Image: Systems, Record Environmental Condition: re: 62.4°F Image: Systems, Record Environmental Condition: re: 67.0°F Image: Systems, Record Environmental Condition: re: 67.0°F Image: Systems, Record Environmental Condition: re: 67.0°F Image: Systems, Record Environmental Condition: re: 12:30 pm Image: Systems, Record Environmental Condition: re: 12:30 pm Image: Systems, Record Environmental Condition: re: 12:30 pm Image: System System</td> <td>27.4</td>	3.1 Sandbi Media:	3.0 RECOAT DATA 3.1 Sandblast Media 3.2 Pipe Recoated W □ Powercrete 3.3 For Epoxy Air Temperatu Pipe Temperatu Time of Dir 3.4 Repair Coating H 3.5 Measured Coating Holiday Tested?: Device Used: 3.6 Coupon Test If Yes, Date Instal Surface Configure 3.7 Backfill Material: Coating Protection	Sharp Shot 30/60 Anchor Profile Measurement: Average: 3.2 mils ith: Image: Systems, Record Environmental Condition: Image: Systems, Record Environmental Condition: re: 62.4°F Image: Systems, Record Environmental Condition: re: 67.0°F Image: Systems, Record Environmental Condition: re: 67.0°F Image: Systems, Record Environmental Condition: re: 67.0°F Image: Systems, Record Environmental Condition: re: 12:30 pm Image: Systems, Record Environmental Condition: re: 12:30 pm Image: Systems, Record Environmental Condition: re: 12:30 pm Image: System	27.4	
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3.2 Pipe Recoated With: □ Powercrete J X Poly Tape Bar-Rust 235 □ Dev Grip 238 □ Dev Tar 247 X Protal 7200 □ PE Ta 3.3 For Epoxy Coating Systems, Record Environmental Condition: 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 US 3:00 - 82 6:00 - 79 9:00 - 79 12:00 - 79 3.4 Repair Coating Hardness (If ARC Coating:) US 3:00 - 82 6:00 - 79 9:00 - 79 12:00 - 79 3.5 Measured Coating Thickness: US 3:00 - 33.7 6:00 - 38.7 9:00 - 57.5 12:00 - 27.4 Jos 3:00 - 33.7 6:00 - 38.7 9:00 - 57.5 12:00 - 28.3 Holiday Tested?: X Yes No Ds 3:00 - 38.7 9:00 - 57.5 12:00 - 28.4 Jos Coupon Test Station Installed?: Yes No ETS Installed?: Yes No If Yes, Date In	3.2 Pipe Recoated With:	 3.2 Pipe Recoated W Powercrete 3.3 For Epoxy Air Temperatu Pipe Temperatu Time of Divide and the second secon	ith: Image: Coating Systems, Record Environmental Condition: re: 62.4°F imade: Coating Systems, Record Environmental Condition: re: 67.0°F re: 67.0°F imade: Coating: US 3:00 - 82 6:00 - 79 9:00 - 79 12:00 - 79 12:00 - 81 imade: DS 3:00 - 33.7 6:00 - 79 9:00 - 79 12:00 - 81 imade: DS 3:00 - 33.7 6:00 - 28.6 9:00 - 57.5 12:00 - 05.39.0 12:0	27.4	
Powercrete J X Poly Tape Bar-Rust 235 Dev Grip 238 Dev Tar 247 X Protal 7200 PT E poxy Coating Systems, Record Environmental Condition: Air Temperature: 62.4*F Pipe Temperature: 67.0*F Relative Humidity: 51.4% 3.4 Repair Coating Hardness (If ARC Coating:) US 3:00 - 8:00 - 79 9:00 - 79 9:00 - 79 12:00 - 8:1 Measured Coating Thickness: US 3:00 - 3:00 - 8:1 0:1 US 3:00 - 8:2 6:00 - 79 9:00 - 79 12:00 - 79 9:00 - 79 12:00 - 79 12:00 - 79 12:00 - 79 9:00 - 79 9:00 - 79 9:00 - 79 12:00 - 8:1 Measured Coating Thickness: US 3:00 - 3:00 - 8:1 0:1 0:1 0:1 0:1 0:1 0:1 0:1 0:1 0:1 10:1 <	Powercrete J ∑Poly Tape Bar-Rust 235 Dev Grip 238 Dev Tar 247 ∑Protal 7200 PE 3.3 For Epoxy Coating Systems, Record Environmental Condition: Air Temperature: 62.4*F Dew Point: 45.1*F Pipe Temperature: 62.4*F Dew Point: 45.1*F Pipe Temperature: 12:30 pm Statuse Humidity: 51.4% 3.4 Repair Coating Hardness (If ARC Coating:) US 3:00 - 82 6:00 - 79 9:00 - 79 12:00 - 79 12:00 - 79 US 3:00 - 33.7 6:00 - 33.7 6:00 - 38.6 9:00 - 37.5 9:00 - 79 12:00 - 27 3.5 Measured Coating Thickness: US 3:00 - 33.7 6:00 - 38.6 9:00 - 39.0 12:00 - 27 Device Used: Coil Wet Sponge Voltage Used: UNK Bevice Used: Coil Wet Sponge Voltage Used: UNK Repair All Holidays. YES 3.6 Coupon Test Station Installed?: Yes No ETS Installed?: Yes No If Yes, Date Installed: Maive Imported Sand Coher: NA Surface Configuration:: NA 3.7 Backfill Material: Native Imported Sand Coher: NA Surface Configuration sonly) 3.7 Backfill Material: </td <td> Powercrete 3.3 For Epoxy Air Temperatu Pipe Temperatu Time of Dial 3.4 Repair Coating F 3.5 Measured Coating Holiday Tested?: Device Used: 3.6 Coupon Test If Yes, Date Instal Surface Configura 3.7 Backfill Material: Coating Protection </td> <td>Image: Second Environmental Condition: re: $62.4^{\circ}F$ $67.0^{\circ}F$ ardness (If ARC Coating:) US $3:00 - \frac{82}{79} 6:00 - \frac{79}{75} 9:00 - \frac{79}{9:00} 12:00 - \frac{79}{81}$ g Thickness: US $3:00 - \frac{33.7}{37.3} 6:00 - \frac{38.7}{9:00} - \frac{9:00}{39.0} 12:00 - \frac{57.5}{12:00} 12:00 - \frac{12:00}{81}$ Image: Second Environmental Condition:</td> <td>27.4</td>	 Powercrete 3.3 For Epoxy Air Temperatu Pipe Temperatu Time of Dial 3.4 Repair Coating F 3.5 Measured Coating Holiday Tested?: Device Used: 3.6 Coupon Test If Yes, Date Instal Surface Configura 3.7 Backfill Material: Coating Protection 	Image: Second Environmental Condition: re: $62.4^{\circ}F$ $67.0^{\circ}F$ ardness (If ARC Coating:) US $3:00 - \frac{82}{79} 6:00 - \frac{79}{75} 9:00 - \frac{79}{9:00} 12:00 - \frac{79}{81}$ g Thickness: US $3:00 - \frac{33.7}{37.3} 6:00 - \frac{38.7}{9:00} - \frac{9:00}{39.0} 12:00 - \frac{57.5}{12:00} 12:00 - \frac{12:00}{81}$ Image: Second Environmental Condition:	27.4	
3.3 For Epoxy Coating Systems, Record Environmental Condition: Air Temperature: 62.4°F Pipe Temperature: 67.0°F Relative Humidity: 51.4% 3.4 Repair Coating Hardness (If ARC Coating:) US 3:00 - 82 6:00 - 79 9:00 - 79 12:00 - 79 3.4 Repair Coating Hardness (If ARC Coating:) US 3:00 - 82 6:00 - 79 9:00 - 79 12:00 - 79 3.5 Measured Coating Thickness: US 3:00 - 33.7 6:00 - 28.6 9:00 - 57.5 12:00 - 27.4 Ds 3:00 - 37.3 6:00 - 28.6 9:00 - 57.5 12:00 - 29.3 Holiday Tested?: X Yes No Ds 3:00 - 37.3 6:00 - 28.6 9:00 - 39.0 12:00 - 29.3 Holiday Tested?: X Yes No Ds Xest Solution Installed?: Yes X No ETS Installed?: Yes No If Yes, Date Installed?: NA Surface Configuration:: Fink G-5 Box Carsonite Other: NA <td>3.3 For Epoxy Casting Systems, Record Environmental Condition: Air Temperature: 62.4*F Pipe Temperature: 67.0*F Repair Coating Hardness (If ARC Coating:) US 3:00 - 82 - 6:00 - 79 - 9:00 - 79 - 12:00 - 27 - 9:00 - 75.5 - 12:00 - 28 - 9:00 - 38.7 - 9:00 - 38.7 - 9:00 - 38.7 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 38.7 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 10:00 - 10:00 - 0:</td> <td> 3.3 For Epoxy Air Temperatu Pipe Temperatu Time of D. 3.4 Repair Coating H 3.5 Measured Coatin Holiday Tested?: Device Used: 3.6 Coupon Test If Yes, Date Instal Surface Configura 3.7 Backfill Material: Coating Protection </td> <td>P Coating Systems, Record Environmental Condition: re: 62.4°F if ardness (If ARC Coating:) US 3:00 - BS 3:00 - 82 6:00 - 79 DS 3:00 - 79 6:00 - 79 12:00 - g Thickness: US 3:00 - 33.7 6:00 - 75 9:00 - 57.5 12:00 - BS 3:00 - 37.3 6:00 - 28.6 9:00 - 57.5 12:00 - Image: US 3:00 - 37.3 6:00 - 28.6 9:00 - 57.5 12:00 - Image: US 3:00 - 37.3 6:00 - 28.6 9:00 - 57.5 12:00 - Image: No UNK Repair All Holidays. YES 12:00 - 12:00 - 12:00 - Image: No ETS Installed?: Yes No No Image: NA Image: Yes X No</td> <td>27.4</td>	3.3 For Epoxy Casting Systems, Record Environmental Condition: Air Temperature: 62.4*F Pipe Temperature: 67.0*F Repair Coating Hardness (If ARC Coating:) US 3:00 - 82 - 6:00 - 79 - 9:00 - 79 - 12:00 - 27 - 9:00 - 75.5 - 12:00 - 28 - 9:00 - 38.7 - 9:00 - 38.7 - 9:00 - 38.7 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 38.7 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 28.6 - 9:00 - 39.0 - 12:00 - 29 - 10:00 - 10:00 - 10:00 - 0:	 3.3 For Epoxy Air Temperatu Pipe Temperatu Time of D. 3.4 Repair Coating H 3.5 Measured Coatin Holiday Tested?: Device Used: 3.6 Coupon Test If Yes, Date Instal Surface Configura 3.7 Backfill Material: Coating Protection 	P Coating Systems, Record Environmental Condition: re: 62.4°F if ardness (If ARC Coating:) US 3:00 - BS 3:00 - 82 6:00 - 79 DS 3:00 - 79 6:00 - 79 12:00 - g Thickness: US 3:00 - 33.7 6:00 - 75 9:00 - 57.5 12:00 - BS 3:00 - 37.3 6:00 - 28.6 9:00 - 57.5 12:00 - Image: US 3:00 - 37.3 6:00 - 28.6 9:00 - 57.5 12:00 - Image: US 3:00 - 37.3 6:00 - 28.6 9:00 - 57.5 12:00 - Image: No UNK Repair All Holidays. YES 12:00 - 12:00 - 12:00 - Image: No ETS Installed?: Yes No No Image: NA Image: Yes X No	27.4	
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Device Used: Coil Wet Sponge Voltage Used: UNK Repair All Holidays. YES 3.6 Coupon Test Station Installed?: Yes X No ETS Installed?: Yes X No If Yes, Date Installed: NA NA Surface Configuration:: Fink G-5 Box Carsonite Other: NA 3.7 Backfill Material: Native Imported Sand Other: NA Coating Protections?: X Yes No If Yes, Check One: STACguard (transitions only) 3.8 Pipe-to-Soil Readings Over Bell Hole After Backfill: NA	Device Used: Coil Wet Sponge Voltage Used: UNK Repair All Holidays. YES 3.6 Coupon Test Station Installed?: Yes No ETS Installed?: Yes No If Yes, Date Installed: NA Surface Configuration:: Fink G-5 Box Carsonite Other: 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 Pipe-to-Soil Readings Over Bell Hole After Backfill: NA "If specified, a CIS should be done for approximately 100' on either side of the bell hole. Attach data. Comments: NA	Device Used: 3.6 Coupon Test If Yes, Date Instal Surface Configura 3.7 Backfill Material: Coating Protection	Station Installed?: Yes X No ETS Installed?: Yes X No		
3.6 Coupon Test Station Installed?: Yes X No ETS Installed?: Yes X No If Yes, Date Installed: NA NA Surface Configuration:: Fink G-5 Box Carsonite Other: 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 Pipe-to-Soil Readings Over Bell Hole After Backfill: NA	3.6 Coupon Test Station Installed?: Yes X No ETS Installed?: Yes X No If Yes, Date Installed: NA NA Surface Configuration:: Fink G-5 Box Carsonite Other: NA 3.7 Backfill Material: Native Imported Sand Other: NA 3.7 Backfill Material: Native Imported Sand Other: NA Coating Protections?: X Yes No If FE-Nuf Conwed Other: STACguard (transitions only) 3.8 Pipe-to-Soil Readings Over Bell Hole After Backfill: NA NA NA "If specified, a CIS should be done for approximately 100' on either side of the bell hole. Attach data. Comments: NA NA 3.9 Attach site sketch of excavation site. 4.1 Repair Made: Yes No 4.2 Number of Repair Made: Replacement "In-Kind configuration"	If Yes, Date Instal Surface Configura 3.7 Backfill Material: Coating Protection	Station Installed?: Yes X No ETS Installed?: Yes X No		
If Yes, Date Installed: NA Surface Configuration:: Fink G-5 Box Carsonite Other: NA 3.7 Backfill Material: Native Imported Sand Coating Protections?: X Yes No If Yes, Check One: Rockguard Tuf-E-Nuf Conwed Other: STACguard (transitions only) 3.8 Pipe-to-Soil Readings Over Bell Hole After Backfill:	If Yes, Date Installed: NA Surface Configuration:: Fink G-5 Box Carsonite Other: NA 3.7 Backfill Material: Native Imported Sand Coating Protections?: X Yes No If Yes, Check One: Rockguard Tuf-E-Nuf Conwed Other: STACguard (transitions only) 3.8 Pipe-to-Soil Readings Over Bell Hole After Backfill: "If specified, a CIS should be done for approximately 100' on either side of the bell hole. Attach data. Comments: NA 3.9 Attach site sketch of excavation site. 4.1 Repair Made: Yes No 4.1 Repair Made:	If Yes, Date Instal Surface Configura 3.7 Backfill Material: Coating Protection			
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If Yes, Check One: Rockguard Tuf-E-Nuf Conwed Other: STACguard (transitions only) 3.8 Pipe-to-Soil Readings Over Bell Hole After Backfill: NA	If Yes, Check One: Rockguard Tuf-E-Nuf Conwed Other: <u>STACguard (transitions only)</u> 3.8 Pipe-to-Soil Readings Over Bell Hole After Backfill: <u>NA</u> "If specified, a CIS should be done for approximately 100' on either side of the bell hole. Attach data. Comments: <u>NA</u> 3.9 Attach site sketch of excavation site. 4.0 REPAIR DATA 4.1 Repair Made: Yes X No 4.2 Number of Repair Made: <u>Replacement "In-Kind configuration"</u>	-			
3.8 Pipe-to-Soil Readings Over Bell Hole After Backfill: NA	3.8 Pipe-to-Soil Readings Over Bell Hole After Backfill: NA *If specified, a CIS should be done for approximately 100' on either side of the bell hole. Attach data. Comments: NA 3.9 Attach site sketch of excavation site. 4.0 REPAIR DATA Yes Yes X No 4.2 Number of Repair Made: Replacement "In-Kind configuration"				
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	4.0 REPAIR DATA 4.1 Repair Made: Yes Yes Yes Yes <				
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3.3 Allach she shelli of excavation she.	4.1 Repair Made: Yes X No 4.2 Number of Repair Made: Replacement "In-Kind configuration"	3.5 Allach she skeld	n of excavation site.		
4.1 Repair Made: Yes X No 4.2 Number of Repair Made: Replacement "In-Kind configuration"		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 Replace Can Filler Metal Other	4.3 Repair Type 🔲 Metallic Sleeve 🔲 Non Metallic Sleeve 🔲 Replace 🔲 Can 🔲 Filler Metal 🔲 Oth	4.3 Repair Type	Metallic Sleeve Non Metallic Sleeve Replace Can Filler Metal	Xther	
4.4 Damage Repaired: Corrosion Mechanical Other	4.4 Damage Repaired: Corrosion Mechanical Other	4.4 Damage Repaire	d: Corrosion Mechanical Other		
4.4 Damage Repaired:	4.4 Damage Repaired:	4.4 Damage Repaire	u. Li Corrosion Li Mechanical Li Other		

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GE Energy INSPECTION & LIFE EXTENSION SERVICES

MAGNETIC PARTICLE EXAMINATION REPORT								Nuclear	Non-N	hualaan		
To:):							Date:		luclear		
Pacific Gas & Electric Company					H. Mayer/J. Hayes				10/7/2011			
Project:												
			T	43A/B_L14		-1.95						
Purchase Order No		7000		G	EIS Job No:							
	41497360 Weld Structural Casting			Machine	chinery Mach. Parts Pipe			LAPI0015				
Item			Casting		iy iviac		Pipe	N/A	Other:	N/A		
	Non-Weld	Plate	Pipe	Bar	Ca	Isting	 Mach. Parts	N/A	Other:	IN/A		
]	7	П			N/A		
88-4	Size	Material Th	ickness	Type of Base	Material	Type of Filler Material			Weld V/A			
Material	20"	20" 0.250"		Carbon	Steel	C/S			Smooth As Welded			
Location	70.6 Ft SW of	f the intersed Way in San (Milano	System			L-147			
Acceptance		-				Procedur	re		,			
Standards	Customer Specifications						GEIS QCP # 500 Rev 17					
Type of Check	Initial	Plate Edge	In Process	Back Gou	ige Roc	ot Pass	Repair	12	Hour 2	4 Hour	Final	
	\checkmark										\checkmark	
	Longitudinal Coil				XC Probe	[Continuou	IS	Other:			
	Wet Dry				Direct Contact 🗹 Residual							
Type of Inspection	Circular		AC Prod	✓ Y	′oke		Other					
	MT Yoke & Model - Serial No. / Blacklight Model - Serial No.						Surface Preparation Method					
	Parker DA-400 - S# 18830 / Spectroline BIP - S# 1597251						Abrasive Blasting (Kleen Blast) - NACE 2 Finish					
	Inspection Medium / Color / Batch No.						Demagnetization Method / Equipment					
					N/A	N/A						
Reference: Summa	•	tad ta ba ina	naatadi	~	See Attac	hment			Results of	Inspectior	n	
	eas were request 1.35' from original							No relevar	nt indications found	@ time of insp		
Bare pipe : 17.4' to 18.45' from original U/S ditch start.						- No rel			elevant indications found @ time of insp.			
Removed pipe sect Summary:	ion.						2	2 Linear ind	ications were found	1.		
Lin-01: Axial Start												
	=2.33' (From U/S en emoved pipe section		=1.20", CW=0.	020", CLK Po	sition= 4:06		ŀ					
	8.8.	-					Ľ					
Indications were on t	he removed nine sect	ion. Please see	attached photo	report for add	itional inform	nation						
Indications were on the removed pipe section. Please see attached photo report for add Copy To:						Requested By:				Reported By (Technician):		
Pacific Gas & Electric Company					David Aguiar				H. Mayer/J. Hayes			
GE Inspection Services (Los Angeles)					Customer Specifications				NDT supervisor:			
					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.



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GE Energy Inspection & Life Extension Services

		ULTRAS		□ _{Nuclear}	Non-Nuclear						
To:							From:				
Pacific Gas & Electric Company						H. Mayer	& J. Hayes	10/7/2011			
Project:				T43A/B_L	_147_B_MP	-1.95					
Purchase Order N	No:				GEIS Job No:						
41497360						LAPI0015					
ltem	Weld	Structural	Casting	Machinery	Mach.Parts	Pipe	N/A	Other:			
	Non-Weld	Plate	Pipe	Bar	Casting	Mach. Parts	N/A	Other			
Material	Size:	Size: No. of Pieces			Type of Base Metal		er Material	Weld	✓N/A		
	20" 1			Carbon Steel		C/S		Smooth	As Welded		
Location	70.6 Ft SV	0.6 Ft SW of the intersection of Brittan Ave and Milano					m				
	Way in San Carlos, CA 94070						L-147				
Acceptance		Custo	mor Specifie	ations		Procedure QCP-601					
Standards	Customer Specific Soundness Thickness Bond				Transducer		QUF-001	Transducer Serial No.:			
					Single Crystal		Dual Crysta	1	020HFC		
	Pulse Echo	Research Income		Frequency		Size		igle	Couplant / Batch #		
	ы п			5 MHz		0.375"	0°		Sonatest Ultragel II		
Type of		Equipment/Model		Flat		Concave	Convex		/ 25-901 07225 AF		
Inspection		USN-60									
	Serial # 01NLKN			Standard		Material	Notch Depth		Serial No.:		
	Calibration Date:										
	10/5/2011			Step Wedge 🗸		Material	Thickness Range		Serial No.:		
Calibration Due: 1/5/2012		Tube Wedge		C/S	0.200" - 0.500"		V34693				
Reference: Sum	nmary				See .	Attachment		Results of I	nenostion:		
The following	g areas wei	re requeste	d to be inspe	ected:				Results of i	nspection.		
12" x 12" (1"x 1	1" grid) at a r	andom 6:00	position on t	he pipe.			 No relevant 	indications @ t	ime of inspection.		
12" lamination	12" lamination scans at cut-line locations.							 No relevant indications @ time of 			
Thickness rea	dings US & [DS inspectior	n areas at the	clock positi	ons.		 No relevant 	indications@t	ime of inspection.		
** Please see attached reports for additional information.											
Copy To: Requested By: Reported By (Technician):											
Pacific Gas & Electric Company					· ·	,. David Aguia					
						er Specification		NDT Supervisor:			
✓ Accept						•		Andre J. Filiatrault			
NOTICE								Andre	e J. Fillatrault		

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.



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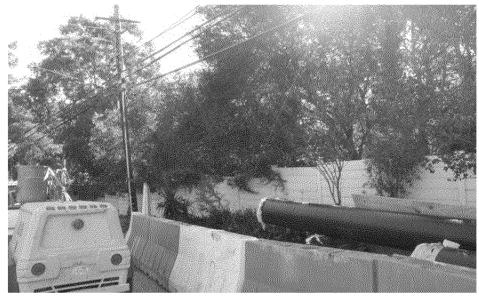
Topography looking upstream



Topography looking downstream



Typical surrounding topography

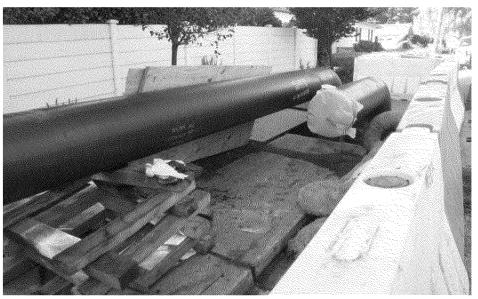


Typical surrounding topography

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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

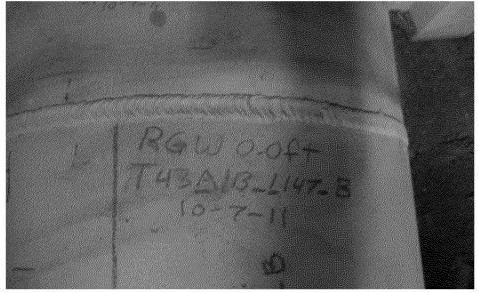


Overview of T43A(US) & T43B(DS) in same excavation.



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

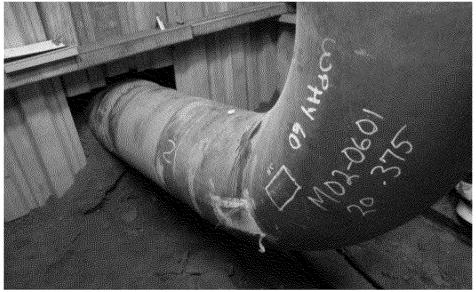
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Overview of Reference Girth Weld measurments were taken from.



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

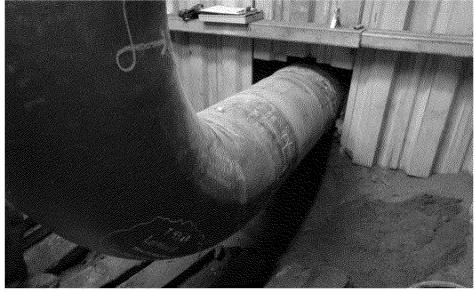


Overview of coating condition -1ft to 2ft, 3:00 position



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

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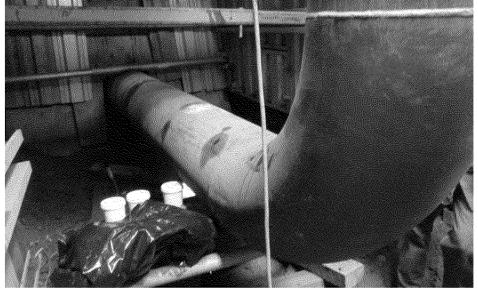
Overview of coating condition -1ft to 2ft, 9:00 position



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



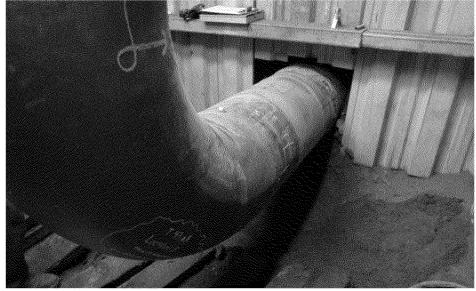
Overview of MPI layout -1ft to 2ft, 3:00 position



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

9

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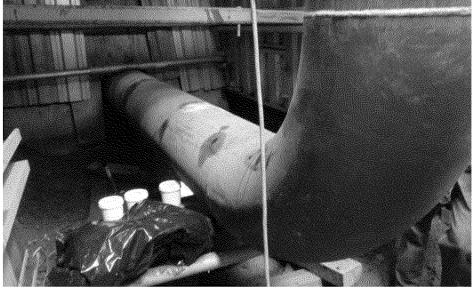
Overview of MPI layout -1ft to 2ft, 9:00 position



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



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

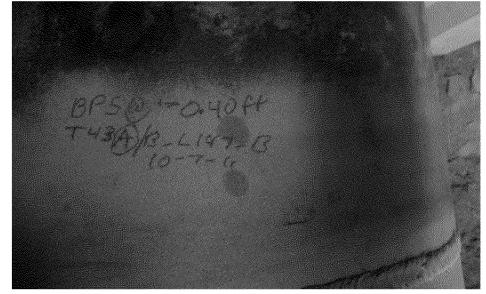


Overview of MPI layout 17ft to 20ft, 9:00 position

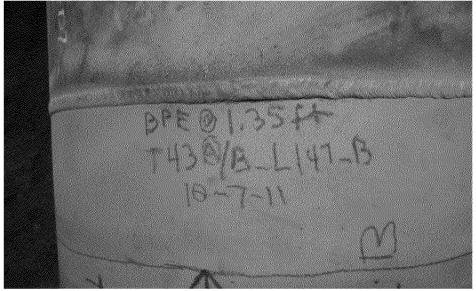
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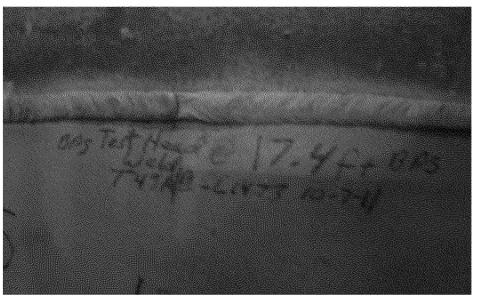
Overview of MPI layout 17ft to 20ft, 9:00 position



Overview of bare pipe start

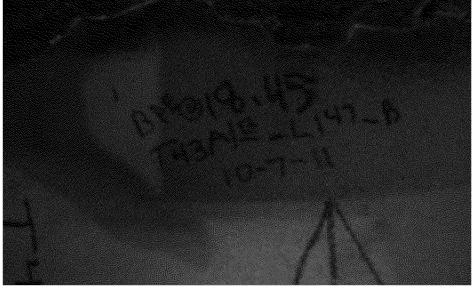


Overview of bare pipe end



Overview of bare pipe start

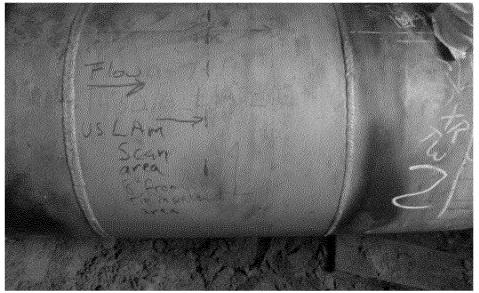
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Overview of bare pipe end



Overview of feature joint long seam @8:55



Overview of US lamination scan area.



Overview of DS lamination scan area.

9

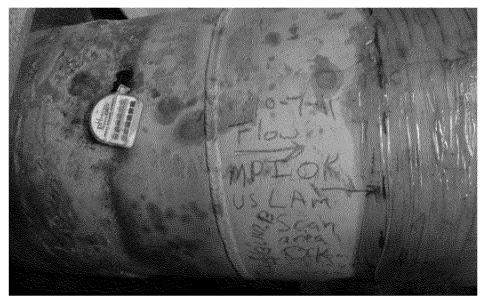
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Overview of US MPIOK and Lamination scan OK.



Overview DS of MPIOK and Lamination scan OK.



Overview of pipe Ph.



Closeup of pipe Ph.

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Removed pipe section coating assessment 3:00



Overview of coating condition 3:00 position



Overview of coating condition 3:00 position



Overview of coating condition 3:00 position

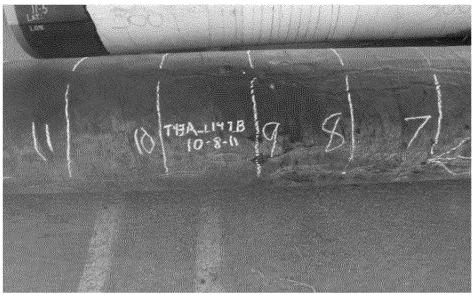
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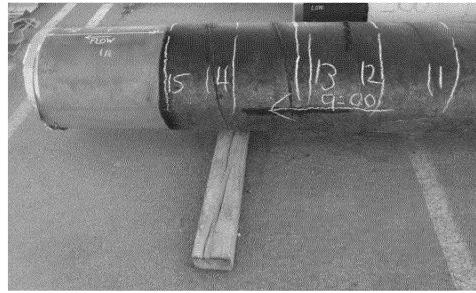
Removed pipe section coating assesment 9:00



Overview of coating condition 9:00 position

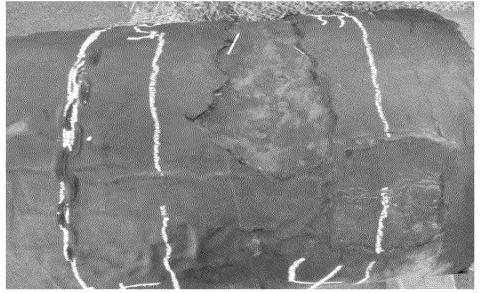


Overview of coating condition 9:00 position

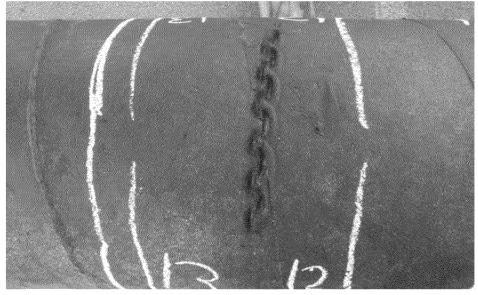


Overview of coating condition 9:00 position

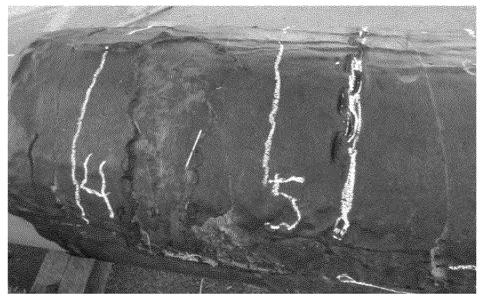
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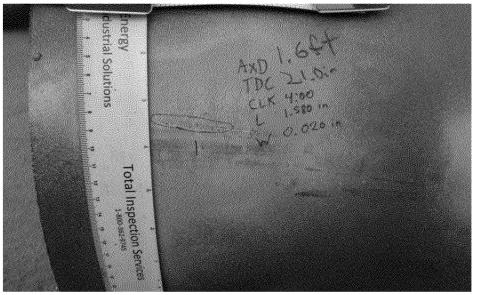
Coating damaged from removal process.



Coating damaged from removal process.

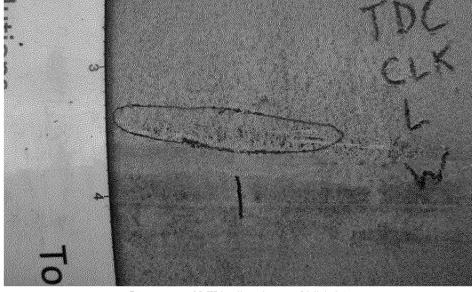


Coating damaged from removal process.

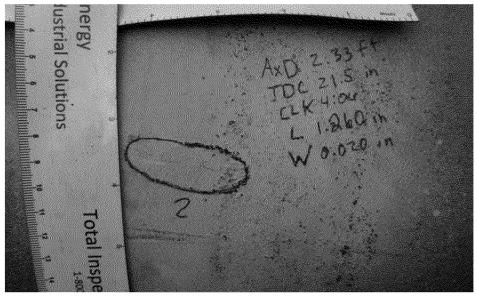


Removed pipe section linear indication-01

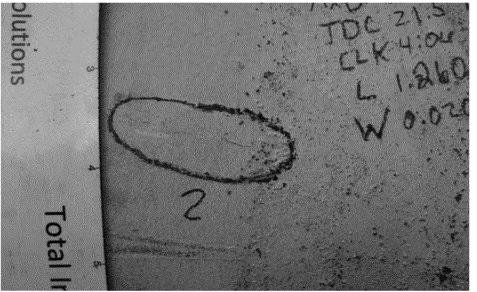
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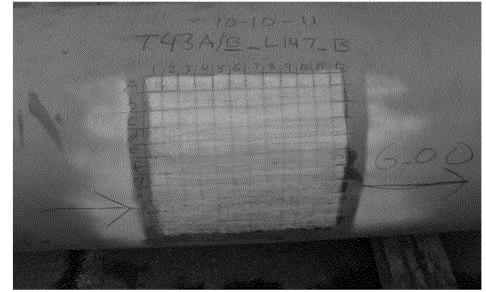
Close up of MT Indications of LIN-01



Removed pipe section linear indication-02

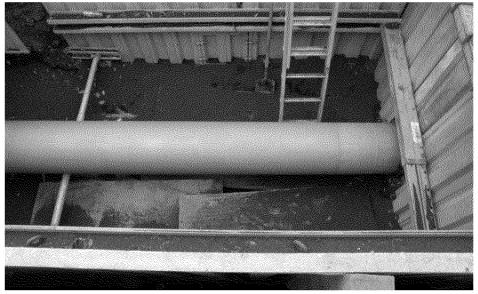


Close up of MT Indications of LIN-02

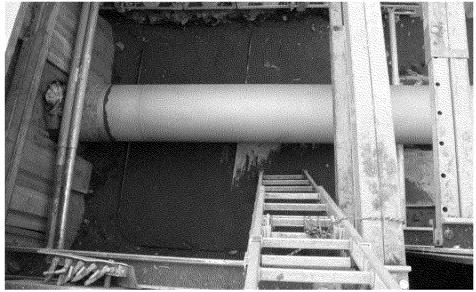


Overview of UT Grid.

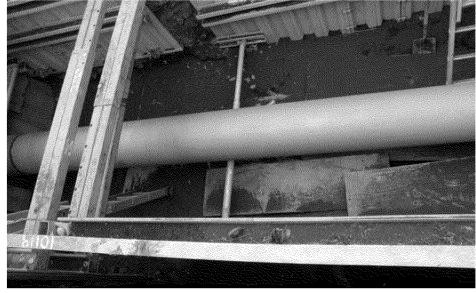
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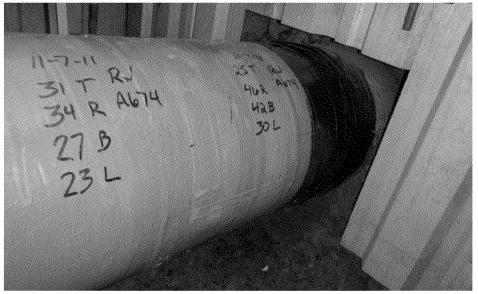
Overview of clean blasted inspection area prior to recoat activities



Overview of clean blasted inspection area prior to recoat activities



Overview of clean blasted inspection area prior to recoat activities



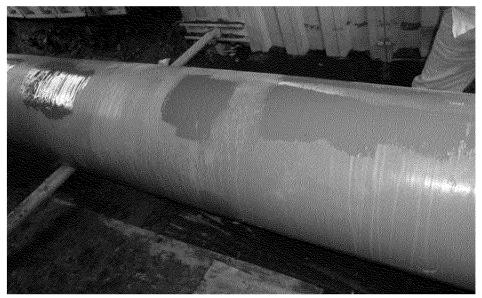
Overview of final coating condition US 3:00

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Pacific Gas & Electric Company 20" Route L-147 Excavation Site T43A-B_L147_B_MP-1.95



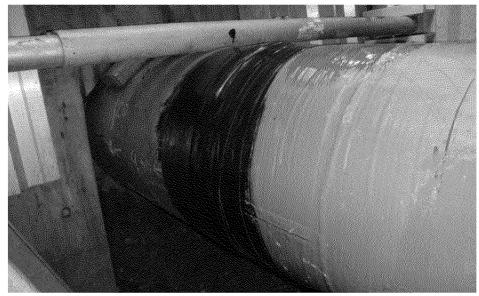
Overview of final coating condition 3:00



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®

Failure Analysis Associates

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

Exponent

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

Prepared by:

- Agames

Brad James, Ph.D., P.E., FASM Exponent Failure Analysis Associates 149 Commonwealth Drive Menlo Park, CA 94025

October 2013

• Exponent, Inc.

Doc. no. 1306838.000 A0T0 1013 RE15

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Metallographic Analysis	12
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Discussion	21
Conclusions	22
Limitations	23

Appendix A Microhardness Testing

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.¹ The portion of Line 147 that contained the leak was installed in 1957.²

On October 24, 2011, Line 147 was hydrotested between mile posts 1.95 and 3.4.¹ 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.¹ 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.

¹ RCP Inc., Hydrostatic Test Certification, March 15, 2012.

² 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.

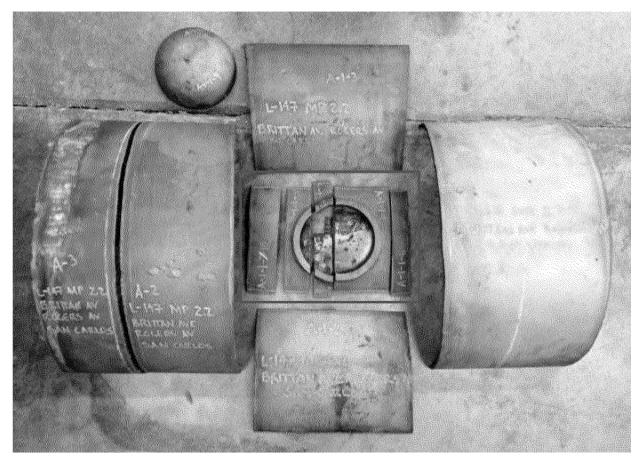


Figure 1. Photograph of the section of L-147 containing the crack and the PLIDCO cap welded over it to stop the gas leak. The red box shows the area magnified in Figure 3. Note the sectioning of the pipe and the yellow markings were made by Anamet.



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.

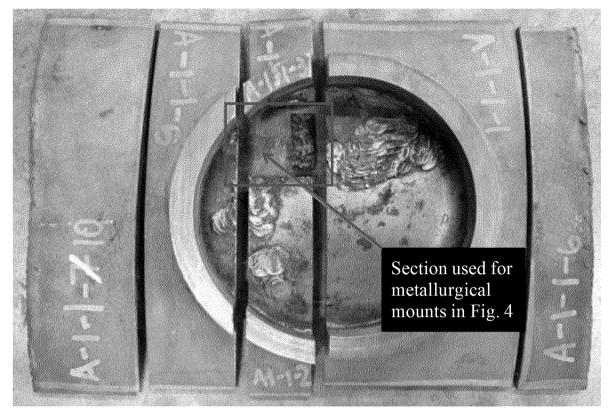


Figure 3. Photograph of the section of L-147 (boxed in red in Figure 1) containing the crack and the PLIDCO cap. Note the sectioning of the pipe and the yellow markings were made by Anamet.

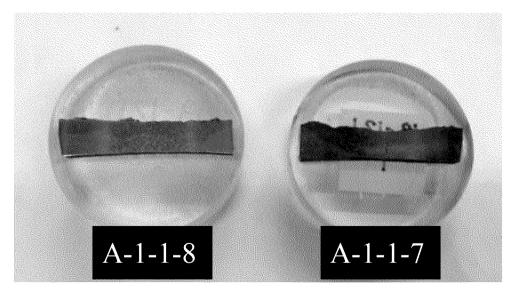


Figure 4. Photograph of the metallurgical mounts of the area containing the crack in L-147 under the PLIDCO cap. Note the metallurgical mounts were made by Anamet: Exponent retained Anamet's sample ID numbers A-1-1-8 (left); A-1-1-7 (right).

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.

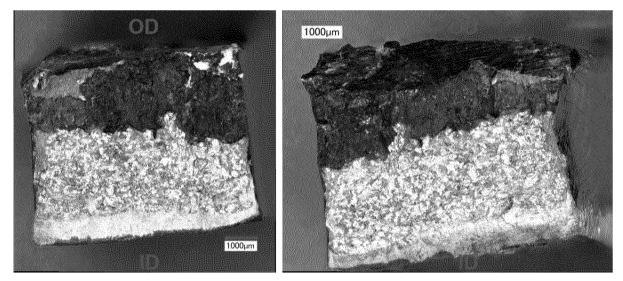


Figure 5. Optical micrographs of the leak surface after opening Anamet's A-1-1-8 metallurgical mount.

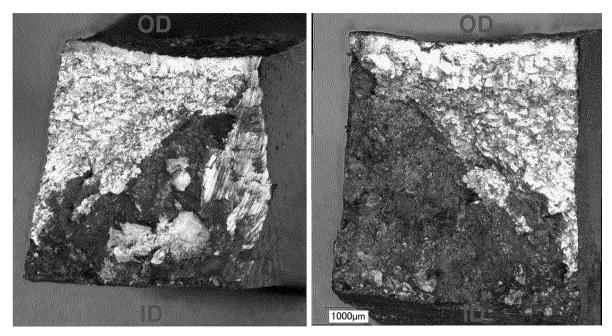


Figure 6. Optical micrographs of the leak surface after opening Anamet's A-1-1-7 metallurgical mount.

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 through-wall (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.³ 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 fracture 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

³ 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.

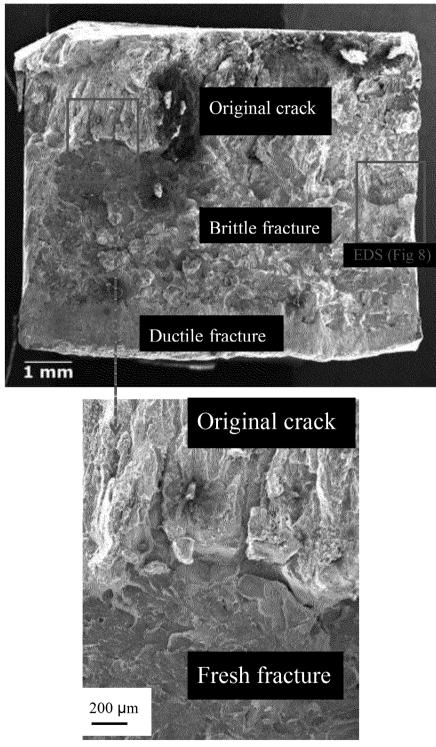


Figure 7. SEM images of Sample A-1-1-8 fracture surface (left side of Figure 5). Top image shows the entire surface with one red box magnified (bottom image) and another red box for the area analyzed with EDS in Figure 8.

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.

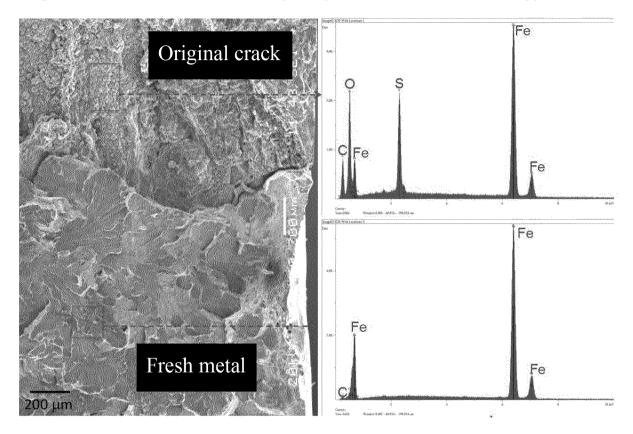


Figure 8. EDS analysis of the area in the red box in the right side of the top image in Figure 7. The lower portion is the freshly cracked surface; the top is the surface of the original crack composed of iron oxide with a large amount of sulfur, likely from the mercaptans added to give scent to the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

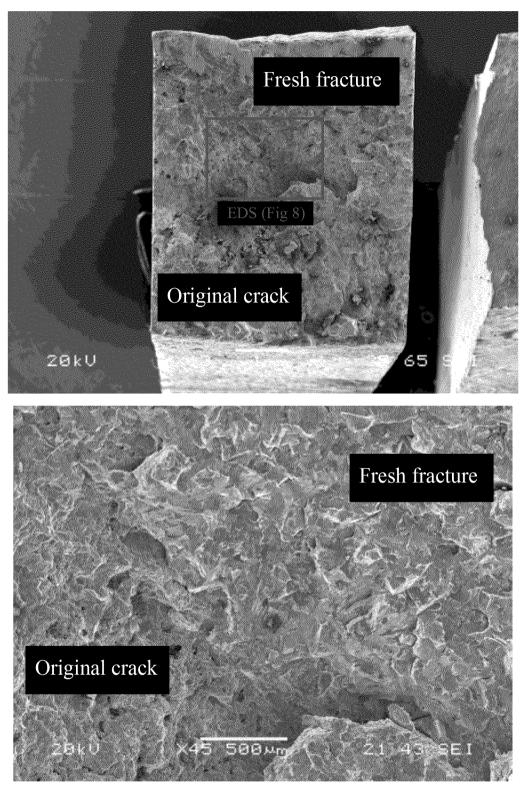


Figure 9. One side of the crack surface in Sample A-1-1-7 (right side of Figure 6). The red box shows the area analyzed with EDS in Figure 10.

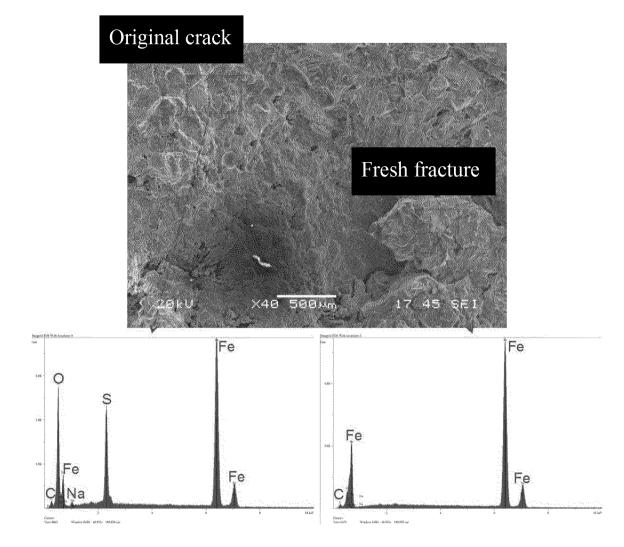


Figure 10. EDS analysis of the area in the red box in the top image in Figure 9. The right side is the freshly cracked surface; the left side is the surface of the original crack composed of iron oxide with significant sulfur.

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.

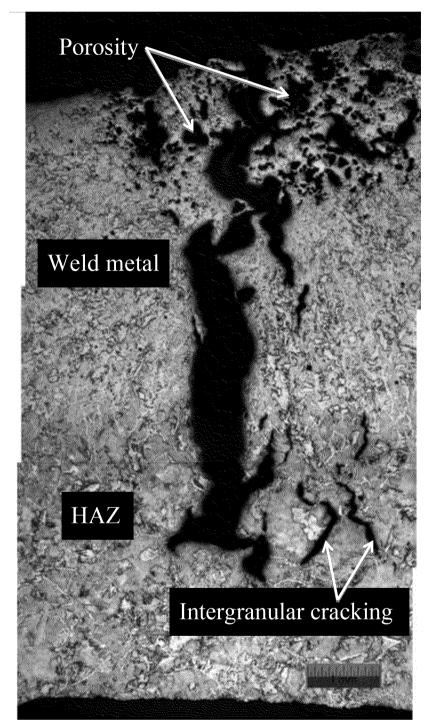


Figure 11. Composite optical micrograph of a metallurgical mount prepared by Anamet. Image reproduced from the September 6, 2013 Anamet report with permission from Anamet.

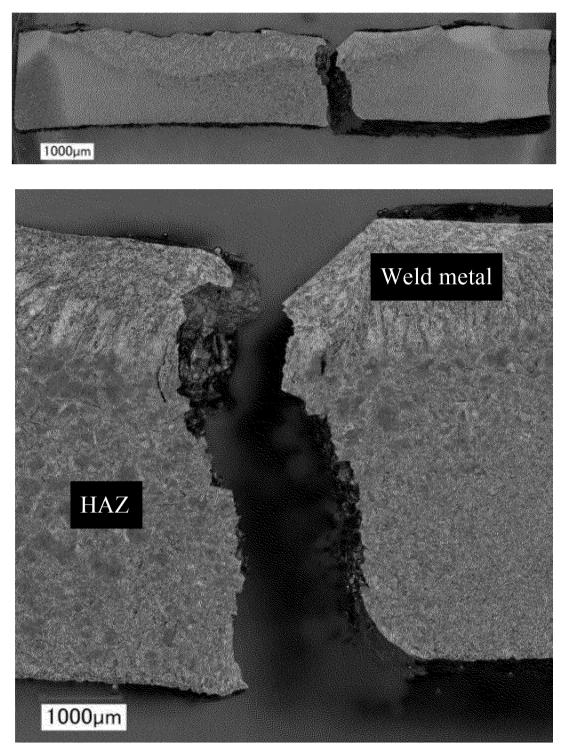


Figure 12. Images of Sample A-1-1-8, re-mounted following fractographic examination.

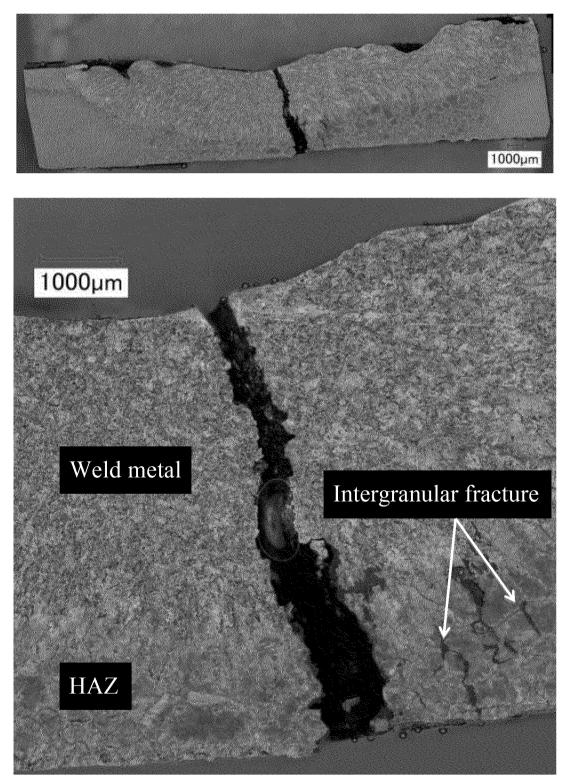


Figure 13. Images of Sample A-1-1-7, remounted following fractographic examination.

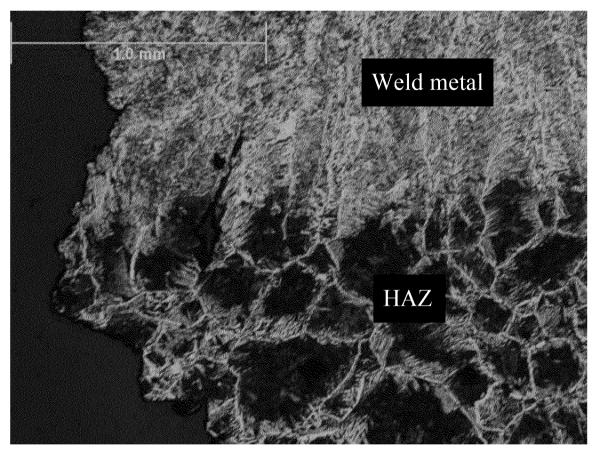


Figure 14. Metallographic image that shows significant grain coarsening beneath the weld in Sample A-1-1-8, with Widmanstatten ferrite at the prior-austenite grain boundaries in the heat-affected zone (HAZ).

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.

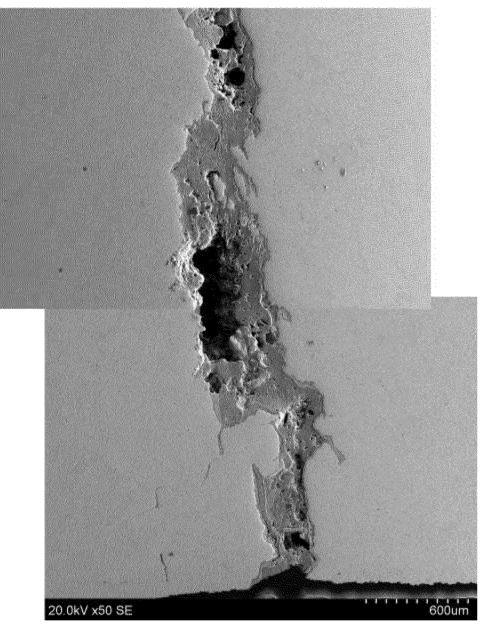


Figure 15. Composite SEM micrograph of the metallographic mount prepared by Anamet. Image reproduced from the September 6, 2013 Anamet report with permission from Anamet.

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.^{4, 5}

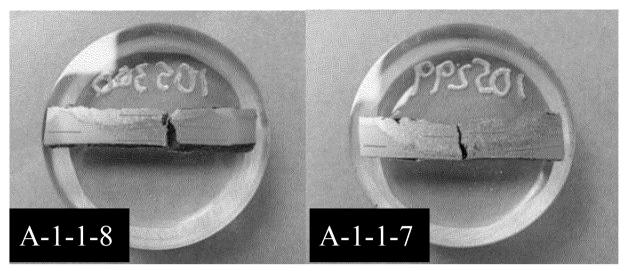


Figure 16. Metallurgical mounts of samples A-1-1-8 and A-1-1-7 made subsequent to opening the crack and examining it via optical microscopy and SEM/EDS. The red lines show where strings of microhardness testing points.

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

⁵ ASM Metals Handbook, Volume 6, Welding, Brazing and Soldering, pg. 648.

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.

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

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

The carbon equivalents of the pipe base and weld metal were calculated using the equation:⁶

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

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,⁷ and are not particularly susceptible to cracking from hydrogen embrittlement.

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

⁷ J.F. Lancaster, <u>Metallurgy of Welding</u>, 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.

	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**

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

* Upper Yield Strength (formerly Y.P.) 0.5% E.U.L.

** 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.

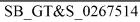
Limitations

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.

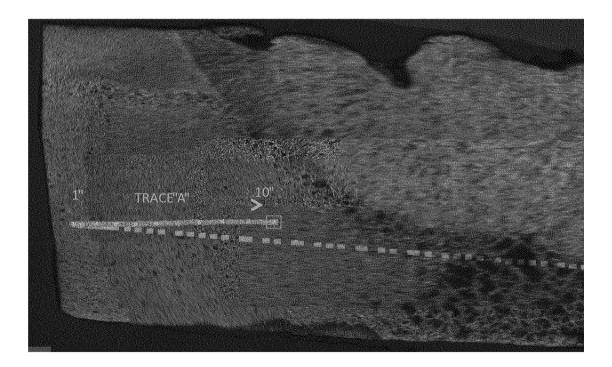
Appendix A

Microhardness Testing



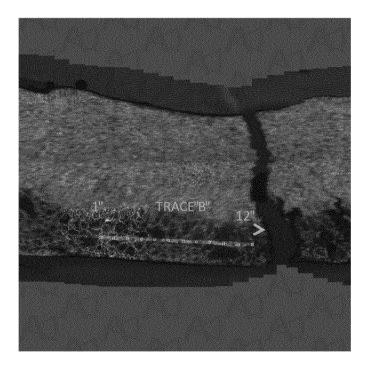
Job Number	Item Number	Comments	Operator
1306838	105299	Kevin Moore	C. Jewett

	500 gm		
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	



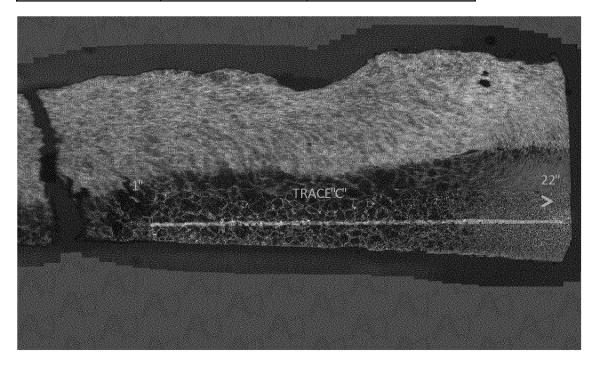
Job Number	Item Number	Comments	Operator
1306838	105299	Kevin Moore	C. Jewett

		500 gm
Trace B Loc	Mean Length	Hardness (HV)
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



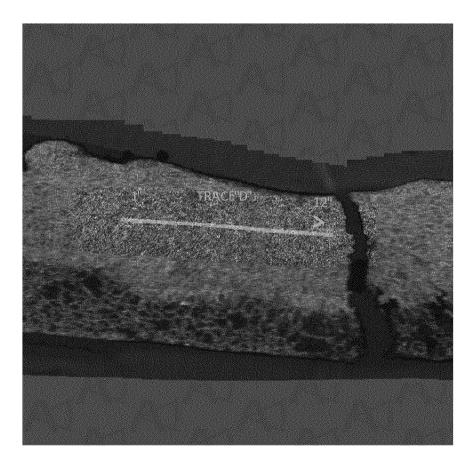
Job Number	Item Number	Comments	Operator
1306838	105299	Kevin Moore	C. Jewett

	500 gm		
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	



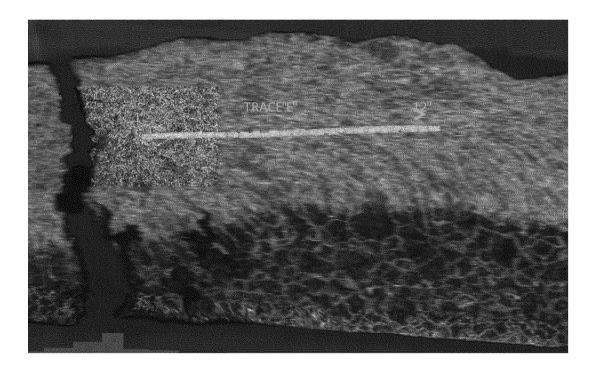
Job Number	Item Number	Comments	Operator
1306838	105299	Kevin Moore	C. Jewett

	500 gm		
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	



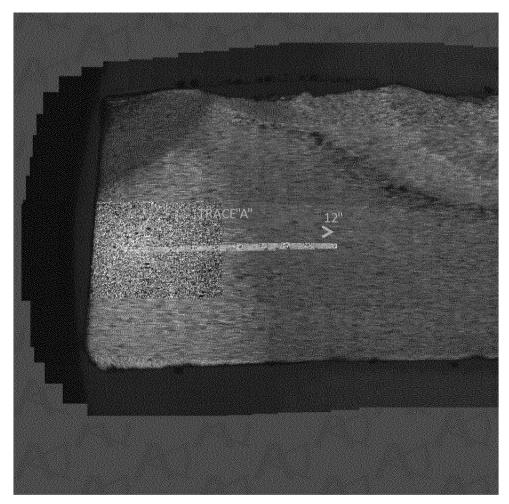
Job Number	Item Number	Comments	Operator
1306838	105299	Kevin Moore	C. Jewett

		500 gm
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



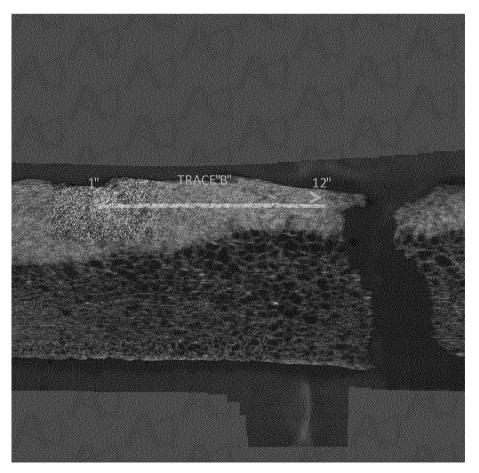
Job Number	Item Number	Comments	Operator
1306838	105300	Kevin Moore	C. Jewett

		500 gm
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



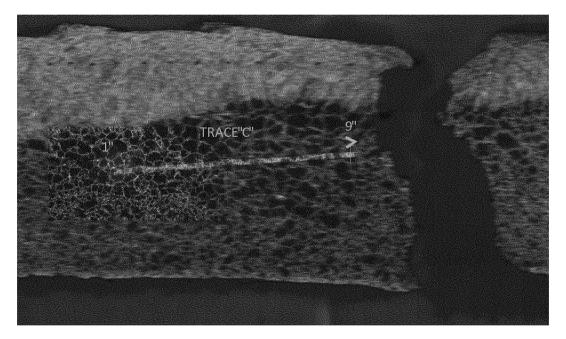
Job Number	Item Number	Comments	Operator
1306838	105300	Kevin Moore	C. Jewett

500 gm			
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	



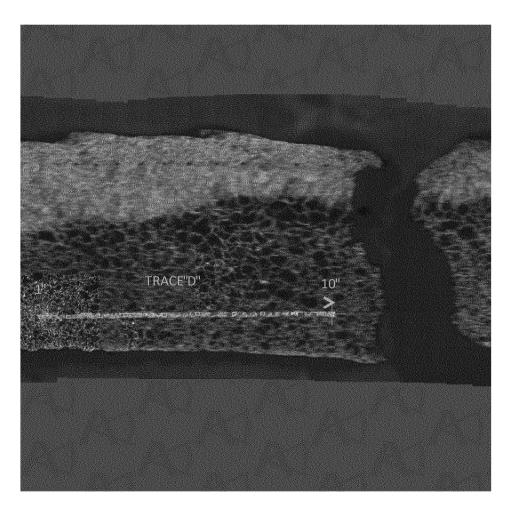
Job Number	Item Number	Comments	Operator
1306838	105300	Kevin Moore	C. Jewett

	500 gm		
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	



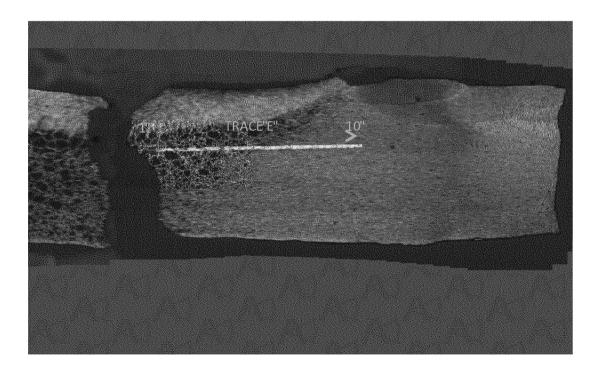
Job Number	Item Number	Comments	Operator
1306838	105300	Kevin Moore	C. Jewett

	500 gm		
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

	500 gm		
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

		500 gm
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

