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

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

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

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

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Dated: October 18, 2013

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

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#### I, SUMEET SINGH, do declare:

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

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

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

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

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

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

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

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

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

SUMEET SINGH, Senior Director

shows dings

**Integrity Management** 

PACIFIC GAS AND ELECTRIC COMPANY

## **EXHIBIT A**

#### DEPARTMENT OF GAS OPERATIONS

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

Date October 2, 1957

. Pro	ject Description: Relo	cato 24º Main 14	7, Erittan Avenue	, San Carlos
-				
. Pipe	eline Data:	Size	Wall Thickness	Steel Specifications
(a)	Mainline		0:3125	API 51X,Gr x 42
<b>(</b> b)	Design Operating Pres	sure, maximum		osi osi
(c)	Stress at Max. D.O.P.	16,000 psi psi		38.7.
(d)	Location class 3	Type co	onstruction	
(e)	Test pressure	0 psi; flu	id Vater	Period of test1 hour
(f)	Stress at Test Pressu	re <u>24,000</u> p	si; as % of yield	5762
. Test	Data			
(a)	Date and time started	test_10_21_57	1:20 py , flu	i.d used <u>later</u>
<b>(</b> b)	Date and time reached	test pressure	0-21 <b>-574:0</b> 9-I	
(c)				al test pressure750 #
(a)	Date and time Purging			
(e)	Date and time Pipelin		* * * *	YO PW
(f)	Date and time Pipelin		20 13 y 3 1 104 4.	CO DV
(g)	Name of PG&E Supervise			
(h)	Who made test? p.c.	& E. Co.	vicino (Traditi vicino vicino como como	
.vision		t <u>xxx</u>		
ntract	or (Indicate Name) -	Security and the Charles of the Char		
ontract nstruct		n to V.P. in Char	test report in Prege of Gas Operat	roject file. ions and to

## **EXHIBIT B**



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

#### **IN-FIELD SERVICES**

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

### Pacific Gas & Electric Company

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

T43A/B\_L147\_B \_MP-1.89

**Documents Contained Within:** 

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

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



Page 1 of 30

Form H: Dire	ct Examination Data S	heet - Page 1 of	10										
	DA/ILI Route Number:	L-147	Site	DA Designation:	T43A/B_B		ILI Log Distance: NA						
	Date of Excavation:	10/7/2011		N-Segment:	NA		RMP-11	Ref. Section:	Table 5.6	Table 5.6.2			
Evami	Mile Point: nation Performed By:	1.89 H. Mayer/J. Hay		IMA Number:	NA			e Girth Weld: om Girth Weld:	NA NA				
	6&E Project Manager:	Donovan Finl		gion Number:	NA		Distance F1	om Girai Weia.	INA				
	Approved By:	Kenji Gailey	Subr	region # (ICDA):	NA								
	Order Number:	41497360		Stationing:	NA								
Excava	ation Priority:				Excavation R	<u>Reason</u>							
=	=	cheduled (For ILI -	1 Year  X Hydro Test	Other)	ECDA ICDA		ther NA	ecoat					
If pract	tical, take P/S or CIS read	s before excavation					NA						
Excavation Det	tails: U/S Ditch Start of Northing: 37.4878 Easting: -122.27		(Uncorrected Fi	eld Measurement) PDOP: Acc~:	NA NA		xcavation Length xcavation Length		NA 21.0ft				
	Centerline G Northing: NA	GPS Coordinates	(Uncorrected Fi	eld Measurement) PDOP:	NA		GPS File N	ame:	Guida 148T4313	3			
	Easting: NA			Acc~:	NA								
	D/S Ditch E Northing: <u>37.4878</u> Easting: <u>-122.27</u>		s (Uncorrected Fi	eld Measurement) PDOP: Acc~:	NA NA								
1.0 Data Befo	ore Coating Removal												
1.1	Native Soil Type:	Х	Clay X Rock	X Sand	Loam	Wet	Other		NA				
	1.1A Backfill Material F	<u> </u>	Silt	Slurry	Native	Depth o	f Cover (Ft.):		6.00ft				
	Comments:		—		MA NA								
1.2	Coating Type:	X HAA	Somastic	Plastic Tap	ре	Wax Tape	FBE	ПР	owercrete				
	Bare/None	— e	Tar Other:	<b>→</b> NA	—	Comments:	—	<b>—</b> NA					
	Coating Thickness (Inche	es):	0.250in	N	umber of Layers:	_		2					
1.3	Holiday Testing Perforn	ned?:	Yes X	No V	oltage Used:	NA	Ma	ap Location of Holio	davs Below				
	, ,	Device Used:	=	Wet Sponge		Comments:	•	NA	,				
1.4	Pipe-to-Soil Potentials i	n Ditch (-mV):	US: 12	2:00526		-530		9:00	-526	_			
			DS: 12		3:00	-658		9:00	-663	_			
	Comments:		(	Panneare to he w	ary low may he tur	ned off at time o	f inenaction			_			
1.5	Comments:  Soil Resistivity in Ditch	(Ω-cm):	(	CP appears to be v	ery low, may be tur	ned off at time o	f inspection.						
1.5	Soil Resistivity in Ditch Method:	(Ω-cm): 4-Pin	24469.5 oh		ery low, may be tur	ned off at time of	NA	Alfa.					
	Soil Resistivity in Ditch Method: X Comments:	4-Pin	24469.5 oh NA			Soil Box	NA SRM-100	US: N/A	DS:	N/A			
1.6	Soil Resistivity in Ditch Method: X Comments: Soil Sample Location	4-Pin Comn	24469.5 oh NA nents	m/cm	Dit	Soil Box	NA SRM-100 ) position under pi	pe.					
	Soil Resistivity in Ditch Method: X Comments:	4-Pin Comn	24469.5 oh NA	m/cm		Soil Box	NA SRM-100	-					
1.6	Soil Resistivity in Ditch Method: X Comments: Soil Sample Location Ground Water Present?	Comn	24469.5 oh NA nents	m/cm	Ditr ) Collected?:	Soil Box ch end (DS) 6:00	NA SRM-100 ) position under pi	pe. Sample pH:					
1.6 1.7	Soil Resistivity in Ditch Method: X  Comments:  Soil Sample Location  Ground Water Present?  Comments:  Coating Condition:	Comn :	24469.5 oh  NA  nents  Yes X No  Good - Adhered to Pipe  Poor - Coating Significantly	Sample(s	Ditu ) Collected?: NA NA Fair - Coatir	Soil Box ch end (DS) 6:00 Yes  g Partially Disb	NA SRM-100 ) position under pi X No onded or Degrade	Sample pH:	NA				
1.6 1.7	Soil Resistivity in Ditch Method: X  Comments:  Soil Sample Location  Ground Water Present?  Comments:	Comm  X  Coating r	24469.5 ch  NA ments  Yes X No  Good - Adhered to Pipe Poor - Coating Significantly emoved & tie in weld areas	Sample(s y Disbonded or Mis blasted. Pipe secti	Dite  Collected?:  NA  Fair - Coating  on removed and te	Soil Box ch end (DS) 6:00 Yes ng Partially Disb	NA SRM-100 Diposition under pi X No Diponded or Degrade  d. Removed pipe	Sample pH:	NA				
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1.6 1.7 1.8 1.9	Soil Resistivity in Ditch Method: X Comments: Soil Sample Location Ground Water Present? Comments: Coating Condition:  Comments:  Map of Coating Degrada *Note any calcareous degrada *Note any calcareous degrada *Clock clock	Comm  Comm  X  Coating n  wa  ation*:	24469.5 oh  NA  nents  Yes X No  Good - Adhered to Pipe  Poor - Coating Significantly emoved & tie in weld areas as in good conition except for	Sample(s  y Disbonded or Mis blasted. Pipe section coating damage	Dite  Collected?: NA  Fair - Coatin sing on removed and te from removal and	Soil Box ch end (DS) 6:00 Yes ng Partially Disboust pipes installer transportation. Soint:	NA SRM-100 Diposition under pi X No Diponded or Degrade  d. Removed pipe the comments page	Sample pH:  d section was also a ge 10.	NA ssesed and				
1.6 1.7 1.8 1.9	Soil Resistivity in Ditch Method: X Comments: Soil Sample Location Ground Water Present? Comments: Coating Condition:  Map of Coating Degrada *Note any calcareous degrada *Note any calcareous degrada *Output Holidays  clock  clock  clock	Coating r  Coating r  We  ation*:  Disbondmen	24469.5 oh  NA  nents  Yes X No  Good - Adhered to Pipe  Poor - Coating Significantly emoved & tie in weld areas as in good conition except for	Sample(s  y Disbonded or Mis blasted. Pipe section coating damage	Diturn Diturn Diturn Diturn Pair NA  Fair - Coating Sing On removed and tear from removal and tear from removal and tear Poor Reference Poor District Pair National Pair N	Soil Box ch end (DS) 6:00 Yes ng Partially Disboust pipes installer transportation. Soint:	NA SRM-100 Diposition under pi X No Diponded or Degrade  d. Removed pipe the comments page	Sample pH:  d section was also a ge 10.	NA ssesed and				
1.6 1.7 1.8 1.9	Soil Resistivity in Ditch Method: X Comments: Soil Sample Location Ground Water Present? Comments: Coating Condition:  Map of Coating Degrada *Note any calcareous degrada the Holidays  Clock Clock Clock Clock	Comm  Comm  X  Coating n  wa  ation*:	24469.5 oh NA nents Yes X No  Good - Adhered to Pipe Poor - Coating Significantly emoved & tie in weld areas as in good conition except for ts	Sample(s  y Disbonded or Mis blasted. Pipe section coating damage	Diturn Diturn Diturn Diturn Pair NA  Fair - Coating Sing On removed and tear from removal and tear from removal and tear Poor Reference Poor District Pair National Pair N	Soil Box ch end (DS) 6:00 Yes ng Partially Disbo est pipes installe transportation. S pint: Flow	NA SRM-100 Diposition under pi X No Diposition under pi Diposition	Sample pH:  d  section was also a ge 10.  S Exposed Pipe 36	ssesed and 60 degrees				
1.6 1.7 1.8 1.9	Soil Resistivity in Ditch Method: X Comments: Soil Sample Location Ground Water Present? Comments: Coating Condition:  Map of Coating Degrada *Note any calcareous degrada *Note any calcareous degrada *Clock clock clock clock clock clock clock	Comm  Comm  Comm  Coating r  Wa  ation*:  posit locations  Disbondmen	24469.5 oh NA nents Yes X No  Good - Adhered to Pipe Poor - Coating Significantly emoved & tie in weld areas as in good conition except for ts	Sample(s  y Disbonded or Mis blasted. Pipe section coating damage	Diturn Diturn Diturn Diturn Pair NA  Fair - Coating Sing On removed and tear from removal and tear from removal and tear Poor Reference Poor District Pair National Pair N	Soil Box ch end (DS) 6:00 Yes ng Partially Disbo est pipes installe transportation. S pint: Flow	NA SRM-100 Diposition under pi X No Diposition under pi Diposition	Sample pH:  d  section was also a ge 10.  S Exposed Pipe 36	ssesed and 60 degrees				
1.6 1.7 1.8 1.9	Soil Resistivity in Ditch Method: X Comments: Soil Sample Location Ground Water Present? Comments: Coating Condition:  Map of Coating Degrada *Note any calcareous degrada *Note any calcareous degrada *Note any calcareous degrada *Output *	Comm  Comm  Comm  Coating r  Wa  ation*:  posit locations  Disbondmen	24469.5 oh NA nents Yes X No  Good - Adhered to Pipe Poor - Coating Significantly emoved & tie in weld areas as in good conition except for ts  3 osits containing calcium	Sample(s  y Disbonded or Mis blasted. Pipe section coating damage	Diturn Diturn Diturn Diturn Pair NA  Fair - Coating Sing On removed and tear from removal and tear from removal and tear Poor Reference Poor District Pair National Pair N	Soil Box ch end (DS) 6:00 Yes ng Partially Disbo est pipes installe transportation. S pint: Flow	NA SRM-100 Diposition under pi X No Diposition under pi Diposition	Sample pH:  d  section was also a ge 10.  S Exposed Pipe 36	ssesed and 60 degrees				

Form H: Di	rect Examination	Data Sheet - I	Page 2 of	10										
	DA/IL	-		Cita Da	<u>DA</u>	T 40 A /D	D	11.1.1.	Distance	<b>316</b>				
	Route Number: L-147				esignation N-Segment:	T43A/B_ NA	_В	RMP-11 Ref. Section: NA Table 5.6.2						
	Date of Excavation:	10/7/2011 1.89			MA Number:	NA NA				NA				
Evamin	ation Performed By:	H. Mayer/J. Ha	20/05	117	IIA Ituliibel.	NA NA								
	&E Project Manager:	Donovan Fir		Dogi	on Number	NA NA		Distance Prof	ii Girai Weid.	NA				
FG	Approved By:	Kenji Gaile		Region Number: NA Subregion # (ICDA): NA										
	Order Number:	41497360		อนมายุ	Stationing:	NA NA								
1.10	Photos Taken?*: *See Photo Log for a	X Yes	No											
1.11	Coating Sample Ta	ken?:	Yes	X No	Loca	ition of Sample			NA					
1.12	Liquid Underneath	Coating?:	Yes	X No	If Ye	s, pH of Liquid:			NA					
1.13	Corrosion Product Comments:	Present?:	Yes	X No	If Ye	s, Was Sample NA	Taken?:	Yes	X No					
1.14	Soil pH (Sb Electro	de): Upst	ream:	6.0	Dow	nstream:	7.5	_ Pip	e pH:	6.0	_			
2 0 Data Δf	ter Coating Remo	val	<u> </u>					=	•		_			
2.1	Pipe Temperature (		80.0° F		8.6	easured Pipe I	Diameter (In )		62" -	20.05"				
				<b>-</b>				•	03 =	20.03				
2.2	Weld Seam Type:	X DSAV	=	SSAW Lap	ERW Flash	☐ AO	Smith	IF CAN'T DETE		LLY PERFORM				
2.3	Northing: Easting: Elevation:	ates & Identify	NA NA NA	Table 5.7.3):	PDOF	P: NA NA	LS Weld	Clock Position(	s):	8:55				
2.4	Damage Found: Corrosion Dama Other Damage:	· 🛏	Yes X	→	relevant too	Mechanical Da I marks, no cori	-	Yes reater than 20%	X No					
2.5	UT Wall Thickness	Measurements TDC: 4 O'clock 8 O'clock	: US/E 0.270"/0. 0.268"/0. 0.269"/0.	.275" 1 C .270" 5 C	O'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'clock	US / D 0.265"/0. 0.266"/0. 0.269"/0.	271" 272			
	UT Wall Thickness	Grid @ 6:00 is	required. Bo	e sure to at	tach grid to	H-Form electro	onically. See	page 6 of 10.						
2.6	Wet Fluorescent Ma	ag. Part. Is Req	uired.	Comments	s:	2 linear indica	itions on the re	moved pipe sec	ction. See MT	& Photo repo	rt.			
	Were there any linear	r indications?	X	Yes			•	onically as part d white light ph						
2.7	Take Photos to Doc *See Photo Log for a			er Anomalie	es*									
2.8	Overview Map of Co *See Pit Depth Meas		r additional l	Information		Zero Referen			S Exposed Pipe 3	360 degrees				
*Note any	calcareous deposits.						Flow -			-	•			
12 o'cl		I				1				ı	7			
,200														
9 o'cl	ock										_			
6 o'cl	ock		$\dashv$								-			
3 o'cl	ock		+								-			
12 o'cle	ock Feet 0 1				4	5	6	7	8	9	10			
1	1	_	J		•	J	~		_	-	10			

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

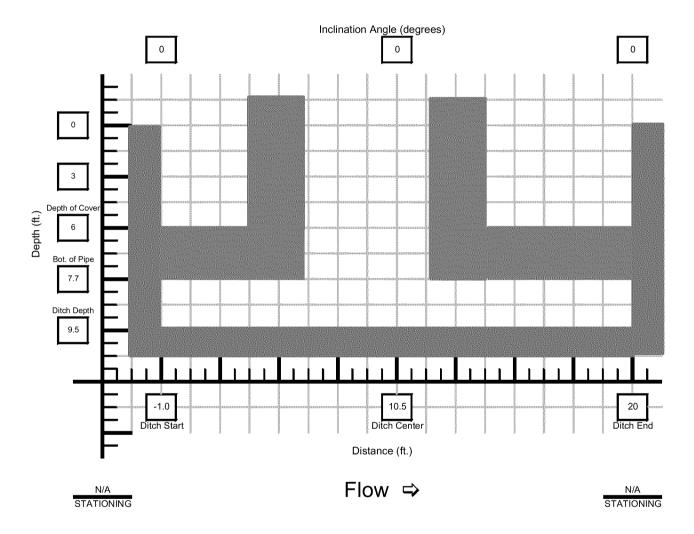
DA	<u>/ILI</u>
Route Number:	L-147
Date of Excavation:	10/7/2011
Mile Point:	1.89
Examination Performed By:	H. Mayer/J. Hayes
PG&E Project Manager:	Donovan Fink
Approved By:	Kenji Gailey
Order Number:	41497360

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

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

#### **Excavation Drawing:**

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



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

**See attached Delorme screen shot on page 11.

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

			DA/IL	I						п	PΑ								LI			
Route Number:				•	L-147			Site	e Desid	<u>⊔</u> nation		T43A	VB_B		ILI ILI Log Distance: NA							
			10/7/2011					, gment:		NA					Ref. Se			Table 5.6.2				
Mile Point: 1.89					IMA Number: N									e Girth			NA					
Examination					ayer/J.			_					A		Dist	ance Fr	om Girtl	h Weld:		N	A	
PG&E					novan I			Reg Subreg		ımber:			IA IA					100	عا ا			
		proved er Num			(enji Gail 4149736			Subreg		oning:			A A		•			1000 1000	010	1009 100 0	g G	
	•				1110100		_		• 1011	·g.			., .		•					019! 19: - 0		
Grid Size = Clock Position	d Size = Inch x Inch (specify grid size) ck Position (specify below)																	<b></b>	0299	9 it readi	ng	
	Anom	aly#	NA								•	Grid #	NA									—
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
А																						
В																						
С																						Щ
D																						Щ
Ε	<u> </u>																		Ш			$\square$
F																						
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1										.	NΑ	\										$\square$
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0		_				_																$\square$
Р		_	<u> </u>																			$\square$
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U																						Щ
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W		$oxed{oxed}$																				Щ
X		1																				

PIT DEPTH GRID 1 OF 2

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

												VIENI										
	<u>DA/ILI</u> Route Number: L-147				<u>DA</u> Site Designation T43A/B_B						ILI Log Distance: NA											
Da	Date of Excavation: 10/7/2011				N-Segment:			143A N			R		Ref. Se				5.6.2					
	Mile Point: 1.89					IMA Number:				NA			Reference Girth Weld:					N				
Examination					ayer/J.							N			Dist	ance Fr	om Girtl	h Weld:		NA		
PG&E					novan				gion Nu			N						100	31			
	App	roved r Numb	ъу:		enji Gail 4149736			Subreg		oning:		N N							.00°	00 1 09 0	9 0	
	0.40	· ···			1110100		_		Otati	omig.		.,,	, ,		•					000 019		
Grid Size = Clock Position	Grid Size = Inch x Inch (specify grid size) Clock Position (specify below)																		<b></b>	029	9 it readi	ng
	Anoma	aly#	NA								-	Grid#	NA									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
А																						
В		$\vdash$																				
С																						
D																						
E		<del>                                     </del>																				
F		┝		_		_																$\dashv$
		-																				
G																						
Н																						
J						_					NΑ	\										
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U																						
٧																						
w																						$\sqcap$
X																						

PIT DEPTH GRID 2 OF 2

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

#### INTERNAL CORROSION WALL LOSS GRID

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

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

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

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

All measurements are in inches.

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

	1	2	3	4	5	6 \	/ 7	8	9	10	11	12
Α	0.251"	0.251"	0.249"	0.249"	0.249"	0.249"	0.249"	0.248"	0.248"	0.248"	0.248"	0.248"
В	0.251"	0.254"	0.251"	0.251"	0.249"	0.249"	0.249"	0.249"	0.248"	0.248"	0.248"	0.249"
С	0.253"	0.251"	0.251"	0.251"	0.251"	0.251"	0.251"	0.249"	0.249"	0.248"	0.249"	0.249"
D	0.251"	0.251"	0.251"	0.251"	0.251"	0.249"	0.250"	0.249"	0.249"	0.248"	0.247"	0.249"
Ε	0.251"	0.251"	0.251"	0.251"	0.251"	0.251"	0.251"	0.251"	0.247"	0.248"	0.247"	0.248"
F	0.251"	0.251"	0.251"	0.251"	0.249"	0.249"	0.251"	0.249"	0.249"	0.247"	0.248"	0.249"
G	0.251"	0.251"	0.247"	0.246"	0.249"	0.248"	0.247"	0.247"	0.246"	0.247"	0.248"	0.247"
Н	0.248"	0.249"	0.249"	0.249"	0.248"	0.247"	0.247"	0.247"	0.246"	0.246"	0.246"	0.246"
1	0.249"	0.249"	0.249"	0.249"	0.247"	0.246"	0.244"	0.247"	0.244"	0.244"	0.247"	0.246"
J	0.247"	0.247"	0.247"	0.246"	0.246"	0.246"	0.242"	0.244"	0.244"	0.243"	0.244"	0.246"
К	0.247"	0.247"	0.247"	0.246"	0.246"	0.246"	0.244"	0.244"	0.244"	0.244"	0.244"	0.246"
L	0.249"	0.247"	0.247"	0.247"	0.248"	0.248"	0.248"	0.242"	0.244"	0.244"	0.246"	0.244"

INTERNAL CORROSION GRID

1 of 1

#### **COATING DAMAGE**

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

<u>ILI</u>	
ILI Log Distance:	NA
RMP-11 Ref. Section:	Table 5.6.2
Reference Girth Weld:	NA
Distance From Girth Weld:	NA
Distance From Onth Weld.	11/7

NO.	FEET FROM REFERENCE	O'CLOCK	MAX LENGTH (IN.)	MAX CIRC EXTENT (IN.)
NA	NA NA	NA NA		
NA	INA	NA	NA	NA
	+			
	+			
	<del>                                     </del>			
	+			
	+ +			
	+ +			
	1			
	1			
	+ +			
	+ +			
	+			
	<del>                                     </del>			
	+ +			
	+ +			
	+			
	<b>_</b>			
	+ +			

#### **CORROSION LOG**

DA/I	I <u>LI</u>	DA		<u>ILI</u>		
Route Number: L-147		Site Designation	T43A/B_B	ILI Log Distance:	NA	
Date of Excavation:	10/7/2011	N-Segment:	NA	RMP-11 Ref. Section:	Table 5.6.2	۰
Mile Point:	1.89	IMA Number:	NA	Reference Girth Weld:	NA	
Examination Performed By:	H. Mayer/J. Hayes	<del>-</del>	NA	Distance From Girth Weld:	NA	•
PG&E Project Manager:	Donovan Fink	Region Number:	NA			•
Approved By:	Kenji Gailey	Subregion # (ICDA):	NA			
Order Number:	41497360	Stationing:	NA			

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
10/	10.0	1473		107	197
-					
T					

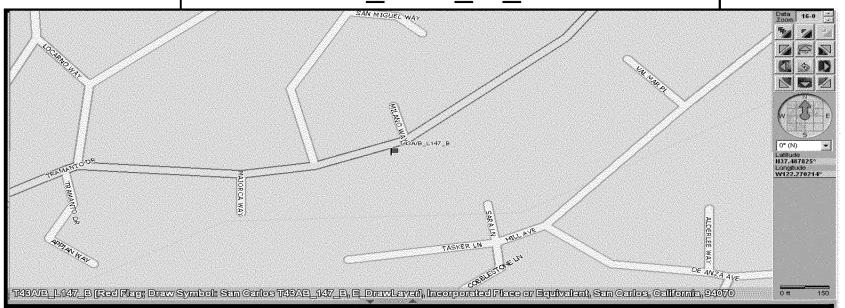
#### **PHOTO LOG**

DA/	<u>ILI</u>	DA		<u>ILI</u>	
Route Number: L-147		Site Designation	T43A/B_B	ILI Log Distance:	NA
Date of Excavation:	10/7/2011	N-Segment:	NA	RMP-11 Ref. Section:	Table 5.6.2
Mile Point:	1.89	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	<del></del>	

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

Form H: D		)ata Sheet - Page 10				·
	DA/ILI Route Number:	L-147	<u>D</u> Site Designation	<u>A</u> T43A/B_B	ILI Log Distance:	NA
	Date of Excavation:	10/7/2011	N-Segment:	NA		able 5.6.2
	Mile Point:	1.89	IMA Number:	NA	Reference Girth Weld:	NA
Exami	nation Performed By:	H. Mayer/J. Hayes	-	NA	Distance From Girth Weld:	NA
	6&E Project Manager:	Donovan Fink	Region Number:	NA		
	Approved By:	Kenji Gailey	Subregion # (ICDA):	NA	_	
	Order Number:	41497360	Stationing:	NA		
3.0 REC	OAT DATA					
3.1	Sandblast Media:	Sharp	Shot 30/60	Anchor Profile Me	asurement: Average: 3.2 mils	
3.2	Pipe Recoated With:					
	Powercrete J	X Poly Tape	Bar-Rust 235	Dev Grip 238	Dev Tar 247 X Protal 7200	PE Tape
3.3	For Epoxy Co	oating Systems, Recor	d Environmental Conditi	on:		
	Air Temperature:	62.4°F		Dew Point:	45.1°F	
	Pipe Temperature:	67.0°F		Relative Humidity:	51.4%	
	Time of Day:	12:30 pm				
3.4	Repair Coating Hard	Iness (If ARC Coating:	) US 3:00 -	82 6:00 - 79	9:00 - 79 12:00 - 79	)
	<b>,</b>	<b>.</b>	DS 3:00 -	79 6:00 - 75	9:00 - 79 12:00 - 81	
3.5	Measured Coating T	hickness !	JS 3:00 - 33.7	6:00 - 38.7	9:00 - 57.5 12:00 -	 27.4
5.5	measured Coating 1		OS 3:00 - 37.3	6:00 - 28.6	9:00 - 39.0 12:00 -	29.3
	<del></del> <b></b>					
	Holiday Tested?:	X Yes No				
	Device Used:	Coil Wet	Sponge Voltage	Used: UNK	Repair All Holidays. YES	
3.6	Coupon Test Sta	ation Installed?:	Yes X No	ETS Installed?:	Yes X No	
	If Yes, Date Installed:	NA	<u> </u>			
	Surface Configuration	:: Fink	G-5 Box Cars	onite Other:	NA	
3.7	Backfill Material:	Native	Imported Sand	Other:	NA	
	Coating Protections?:	<b>-</b>	<b>1</b> No	<b>—</b> –		
	If Yes, Check One:	Rockguard	Tuf-E-Nuf	Conwed Other:	STACguard (transitions	only)
• •		—		<b>—</b>	31Acguard (transitions	only)
3.8		gs Over Bell Hole After ould be done for approx		NA of the bell hole. Attach da	ata.	
	Comments:	,,	•	NA		
3.9	Attach site sketch of	f excavation site.				
4.0 BED.4	ID DATA					
4.0 REPA 4.1	Repair Made:	Yes X N	lo 4.2 Numbe	r of Repair Made:	Replacement "In-Kind configuration	n"
4.3	Repair Type	Metallic Sleeve	Non Metall	ic Sleeve Replac	ce Can Filler Metal	Other
4.4	Damage Repaired:		rrosion	Mechanical Oth		—
				Д •		
Misc. Co	mments/Information:	T43A had coatin	g removed, area for inspec	ction was blasted from coa	ting up to test pipe tie in weld. About 1 ft	of coating
was inspecte	ed. T43B had coating re		•		ld. About 1.5 ft of coating was inspected.	
pipe section	was inspected at the Po	G&E yard.			-	
	·					

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



### GE Energy

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

	MAGN	NETIC PART	ICLE EXA	MINATION I	REPORT			Nuclear	√ Non-	-Nuclear
To:	Pacific G	as & Electric	Company		Fron	n: <b>H. Mayer/J.</b>	Haues	Date:	0/7/2011	
Project:			<u> </u>		I			_	<u>-,,,_</u>	
			٦	T43A/B_L147_E	3_MP-1.8	19				
Purchase Order No	):			GEIS J	ob No:					
	414	497360					LAPI00	)15		
	Weld	Structural	Casting	Machinery	Mach. Pc	ırts Pipe	N/A	Other:		
Item	V					7			N/A	
iceiii	Non-Weld	Plate	Pipe	Bar	Casting	g Mach. P	arts N/A	Other:		
	V		V						N/A	
Material	Size	Material Thi		Type of Base Mat		Type of Filler	Material	Weld	✓ N//	A
riaterial	20"	0.250	)"	Carbon Ste	el	C/S	Smooth	n SnAncokoktha	lded As	Welded
Location	70.6 Ft SW			an Ave and Mila	i <b>no</b> Syst	em				
20001011		Way in San (	Carlos, CA	94070				L-147		
Acceptance		Customer	Specificat	ions	Proc	edure				
Standards								P # 500 Rev		
Type of Check	Initial	Plate Edge	In Process	Back Gouge	Root Pa	ss Repai	r 1	2 Hour 2	24 Hour	Final
J 1	$\square$									<b>V</b>
	Longitudin	nal 🔲 (	Coil	DC Pro	obe	✓ Continu	uous	Other:		
	✓ Wet		Ory	Direct	Contact	✓ Residu	al			
Type of Inspection	☐ Circular		AC Prod	✓ Yoke		Other				
mopeomon	MT Voke	& Model - Serial	No / Blacklia	ht Model - Serial N	<u> </u>		C	D		
	MT Yoke & Model - Serial No. / Blacklight Model - Serial No.  Parker DA-400 - S# 18830 / Spectroline BIP - S# 1597251					Surface Preparation Method				
	Fulker	Inspection Med			,,	Abrasive Blasting (Kleen Blast) - NACE 2 Finish  Demagnetization Method / Equipment				
	Magne	•		Green / 09M12	,	1				
Reference: Summo		1910 14A / 110	urescent		e Attachme	N/A N/A				
The following ar	3	sted to be insu	nected:	<u> </u>	e Attuciine	111	-	Results of	Inspectio	'n
Bare pipe: -0.40' to							- No releva	int indications found	@ time of ins	p.
Bare pipe : 17.4' to	-	al U/S ditch start						int indications found		p.
Removed pipe sect Summary:	tion.						2 Linear in	dications were foun	<u>a.</u>	
Lin-01: Axial Start:				0.020" , CLK Positio						
Lin-02: Axial Start: These are on the r			:1.20", CW=0	.020", CLK Positio	า= 4:06					
mese are on the	cinovca pipe see									
	.,	15 ml		, e	11.6					
Indications were on t Copy To:	tne removed pipe se	ction. Please see	attached photo			n.		Reported By (T	ochnisies!	
Pacific Gas & Electr	ric Company			Keque	ested By:	udal Aarriaa		'		
						ıvid Aguiar			ıyer/J. Ho	ages
GE Inspection Servi	ices (Lus Angeles)					Specifications		NDT superviso		•
NOTICE: THIS EXAM	UNIATIONI DEDODT IC	A DEDONT OF THE	ב מבכנון דר כי	THE NDT DROCEDII	Accept	Reject	/ TUIC COMP		J. Filiat	
OF THE TESTING SP	ECIFICATIONS AND									



#### GE Energy

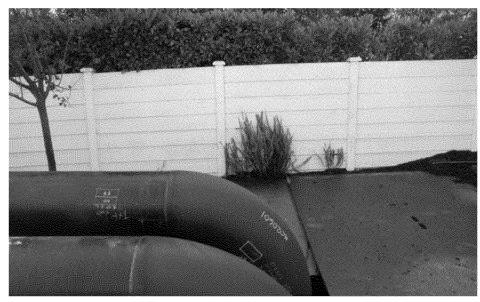
### **Inspection & Life Extension Services**

-	Į	JLTRAS(		Nuclear	✓ Non-Nuclear					
To:	Pacific G	ias & Ele	ctric Compa	ny		From: <b>H. Mayer</b> :	& J. Hayes	Date: <b>10/7/2011</b>		
Project:				T43A/B_L	147_B _MP-	1.89				
Purchase Order N		97360			GEIS Job No:		LAPIC	015		
ltem	Weld Str ✓	ructural	Casting	Machinery	Mach. Parts	Pipe	N/A	Other:		
	Non-Weld	Plate	Pipe	Bar	Casting	Mach. Parts	N/A	Other		
Material	Size: <b>20"</b>		No. of Pieces <b>1</b>	Type of Be <b>Carbo</b> t	n Steel	Ű,	ler Material <b>/S</b>	Weld Smooth	☑N/A ☑As Welded	
Location	70.6 Ft SW of t		rsection of B an Carlos, C		nd Milano	System		L-147		
Acceptance Standards		Custor	mer Specifico	ations		Procedure		QCP-601		
	Soundness Thickness Bond			Frequ	Single Crystal	Transducer Size	Dual Crystal	gle	Transducer Serial No.: 020HFC Couplant / Batch #	
	Pulse Echo Ang	lle-Beam	Other	5 MHz		0.375"	0°		Sonatest Ultragel II	
Type of Inspection	UT Equipment/Mod ∪	lel ISN-60		Flat ✓		Concave	Convex		/ 25-901 07225 AF	
		# 01NLK ation Dat		Standard		Material	Notch	Depth	Serial No.:	
	10/	/5/2011 n Due: 1/5/		Step Wedge Tube Wedge	<u></u>	Material C/S		ss Range - 0.500"	Serial No.: V34693	
Reference: Sum	<u> </u>			_	✓ See	Attachment		Results of I		
12" x 12" (1"x1 12" laminatior	L" grid) at a rando n scans at cut-lin dings US & DS ins	om 6:00 ¡ ne locatio	position on th ons.	ne pipe.	ons.		- No relevant	indications @ t	ime of inspection. ime of inspection. ime of inspection.	
** Please see	e attached repor	rts for ac	lditional info	rmation.						
Copy To: Pacific Gas & Ele	·				Requested By	<sub>v:</sub> David Aguia	r	Reported By H. M	(Technician): 1ayer/J. Hayes	
GE Inspection Se	ervices (Los Angele	es)			Custome Accept	er Specification	ns	NDT Supervis Andre	or: e J. Filiatrault	

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



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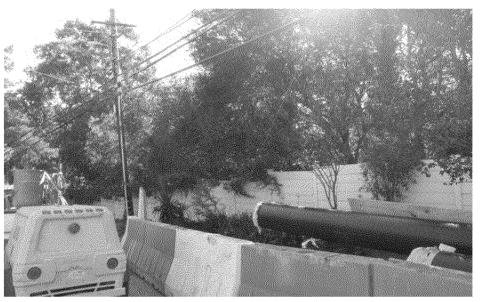
Topography looking upstream



Topography looking downstream



Typical surrounding topography



Typical surrounding topography



Page 15 of 30



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



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



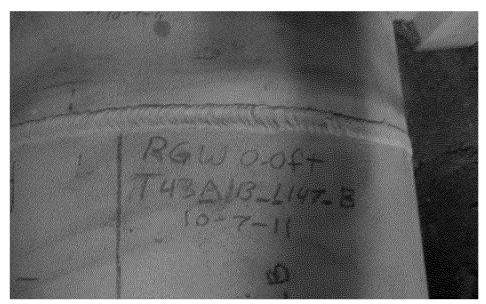
Overview of T43A(US) & T43B(DS) in same excavation.



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



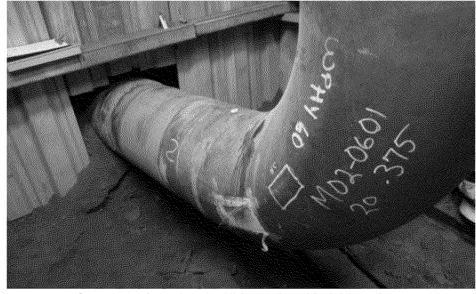
Page 16 of 30



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



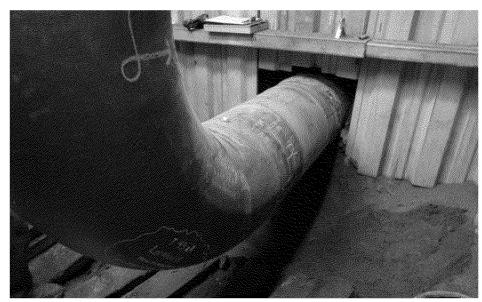
Page 17 of 30

Pacific Gas & Electric Company

20" Route L-147

Excavation Site T43A-B\_L147\_B\_MP-1.89

# GE Energy Inspection Services



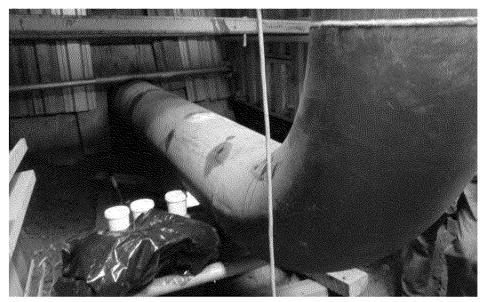
Overview of coating condition -1ft to 2ft, 9:00 position



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



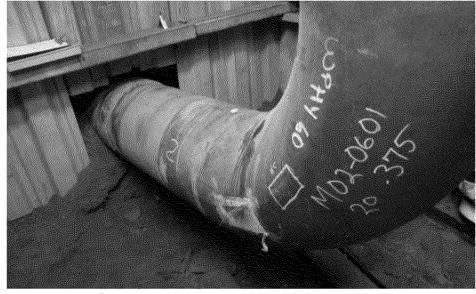
Page 18 of 30



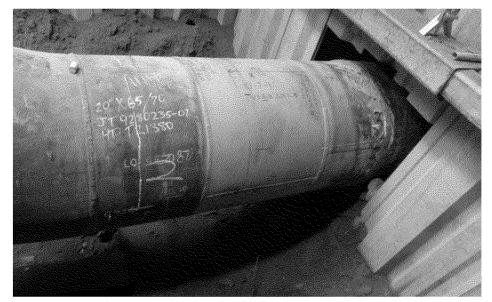
Overview of coating condition 17ft to 20ft, 9:00 position



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



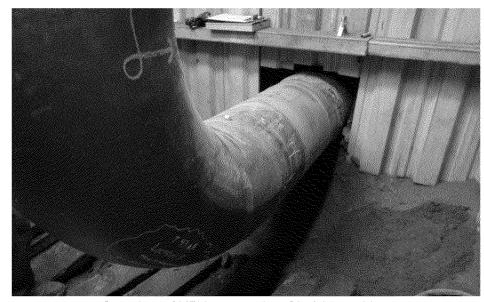
Overview of MPI layout -1ft to 2ft, 3:00 position



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



Page 19 of 30



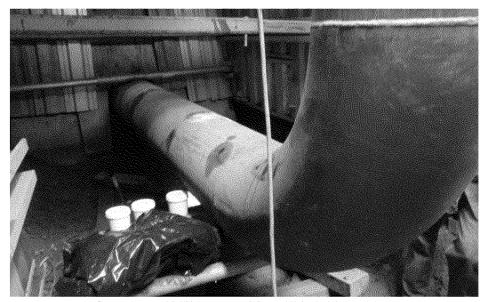
Overview of MPI layout -1ft to 2ft, 9:00 position



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



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



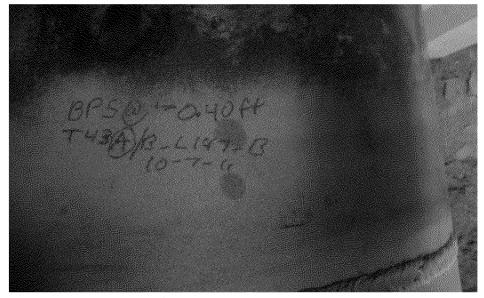
Overview of MPI layout 17ft to 20ft, 9:00 position



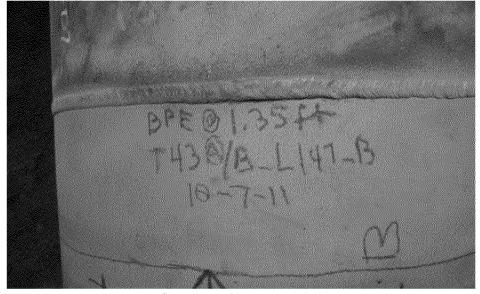
Page 20 of 30



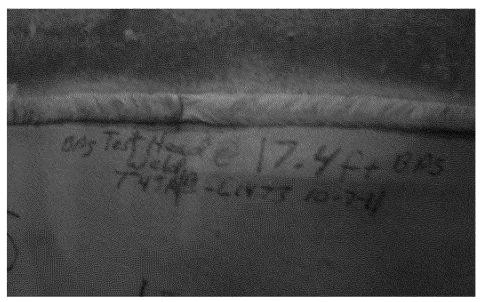
Overview of MPI layout 17ft to 20ft, 9:00 position



Overview of bare pipe start



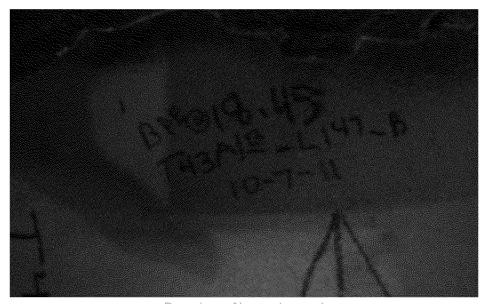
Overview of bare pipe end



Overview of bare pipe start



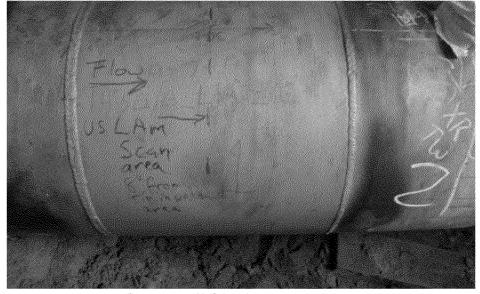
Page 21 of 30



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.



Page 22 of 30



Overview of US MPIOK and Lamination scan OK.



Overview DS of MPIOK and Lamination scan OK.



Overview of pipe Ph.



Closeup of pipe Ph.



Page 23 of 30



Removed pipe section coating assesment 3:00



Overview of coating condition 3:00 position



Overview of coating condition 3:00 position



Overview of coating condition 3:00 position



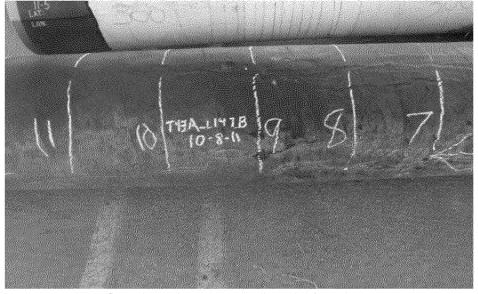
Page 24 of 30



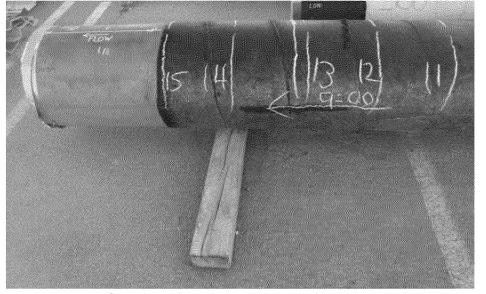
Removed pipe section coating assesment 9:00



Overview of coating condition 9:00 position



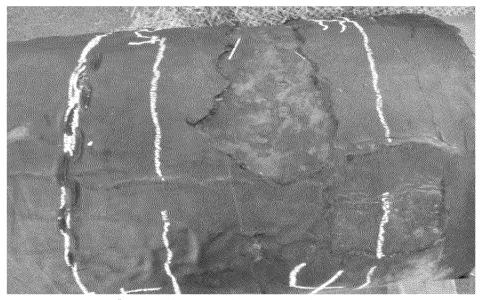
Overview of coating condition 9:00 position



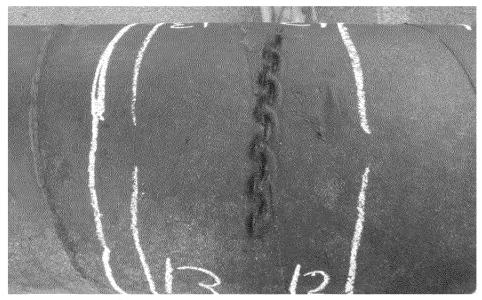
Overview of coating condition 9:00 position



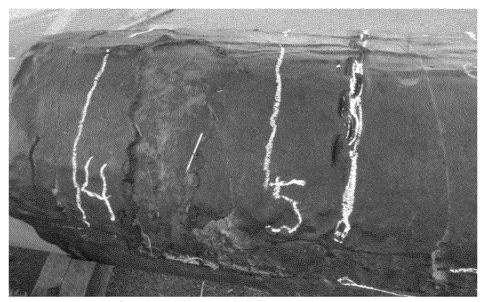
Page 25 of 30



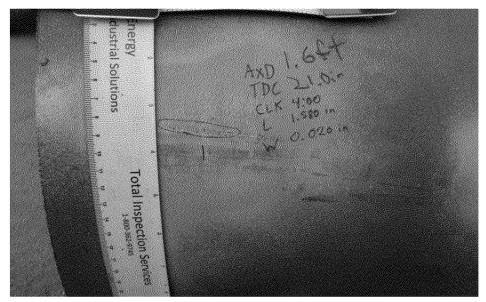
Coating damaged from removal process.



Coating damaged from removal process.



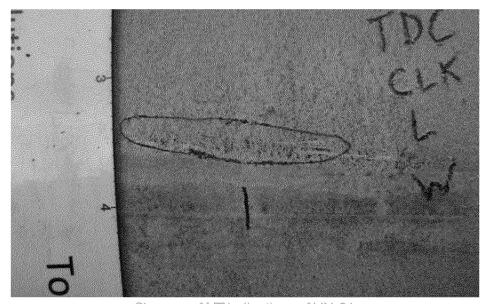
Coating damaged from removal process.



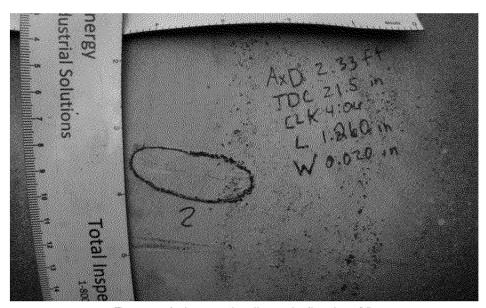
Removed pipe section linear indication-01



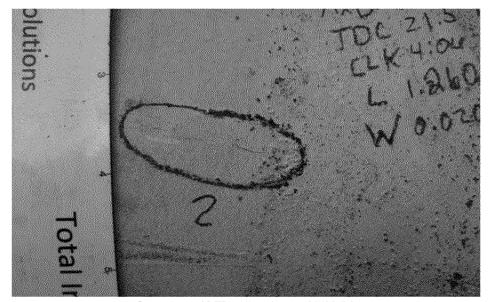
Page 26 of 30



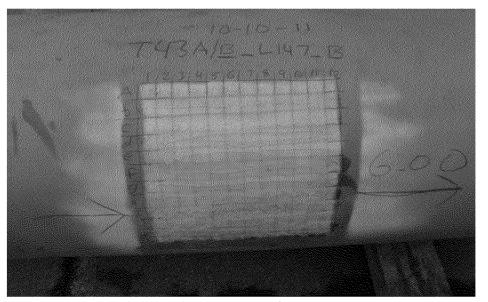
Close up of MT Indications of LIN-01



Removed pipe section linear indication-02



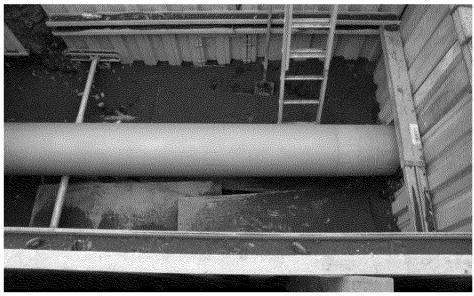
Close up of MT Indications of LIN-02



Overview of UT Grid.

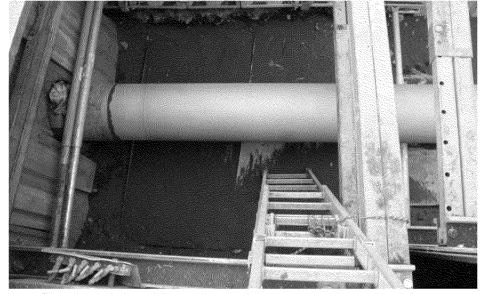


Page 27 of 30



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



Page 28 of 30



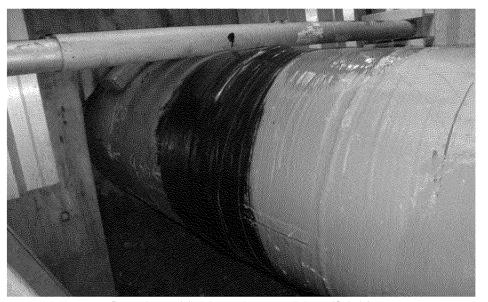
Overview of final coating condition 3:00



Overview of final coating condition 3:00



Overview of final coating condition 3:00



Overview of final coating condition US 3:00



Page 29 of 30



Overview of completed Slurry



Overview of completed Slurry



Overview of completed Cover looking upstream



Overview of completed Cover looking downstream



Page 30 of 30

## **EXHIBIT C**



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

Prepared by

Robert de Haas Sr. Engineering Technician Welding & NDE Services

Prepared for

Joe Medina Director Transmission Process & MAOI August 29, 2013

Report No.: 413.61-13.327

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



### APPLIED TECHNICAL SERVICES

### **Non Destructive Examination**

3400 Crow Canyon Road, San Ramon, CA 94583

#### Robert de Haas

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



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

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

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

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

Pipe spool markings: Line 147

T-43A-11-B, Loc B

Lat. 37.4878247306 / Lon. 122.2701966194

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

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

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

Calibration block – Panametrics 2214E, Sn. 8840

Pipe surface condition – Flash rust

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

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

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

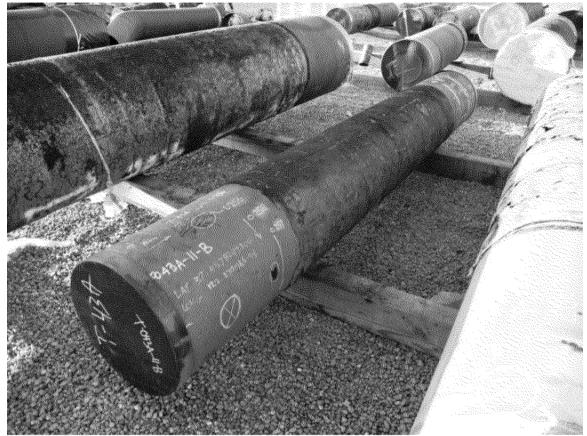
U/S end

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

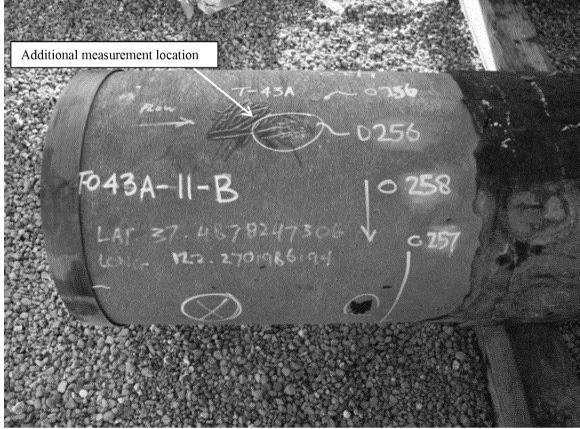
Polished area 0.256"

D/S end

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



Pipe spool



Upstream end on spool



Downstream end of spool

### **EXHIBIT D**



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

### IN-FIELD SERVICES

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

### Pacific Gas & Electric Company

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

T43A/B\_L147\_B\_MP-1.95

Documents Contained Within:

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

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



Page 1 of 31

Form H: Dire	ct Examination Da	ta Sheet - Page	1 of 10									
	DA Route Number:	<u>VILI</u> L-1	47	Site I	DA Designation:	T43A/B	B	ILI Log Distance: NA				
	Date of Excavation:			- 31.6	N-Segment:	NA		RMP-11		Table 5.6.2		
	Mile Point:	1.9		- 1	MA Number:	NA			e Girth Weld:	NA		
	nation Performed By:				=	***		Distance Fi	rom Girth Weld:	NA		
PG	&E Project Manager: Approved By:	Donova Kenji (		_	on Number:	NA NA						
	Order Number:	4149		-	Stationing:	NA NA						
Excava	ation Priority:					Excavation	Reason					
in	mmediate	Scheduled (For	·ILI-	1 Year	Other)	ECDA	\	LI 🔲 R	ecoat			
N	/lonitor	Effectiveness	Х	Hydro Test		ICDA		Other NA				
If pract	tical, take P/S or CIS	reads before exca	avation:					NA				
Excavation Det		start GPS Coordina	ites	(Uncorrected Fie	ld Measurement		Diamed	Funguation ( an eth	(E)	MA		
	Northing: 37.	2.2701986194			PDOP Acc~:	NA NA		Excavation Length Excavation Length		NA 21.0ft		
		ine GPS Coordinat		(I Innormated Fig	ld Measurement					Guida 148T431	•	
	Northing: NA		<b>c</b> 5	(Olicollected Fie	PDOP			GPS File N	anc.	Guida 1401451		
	Easting: NA				Acc~:	NA						
	D/S Dit	tch End GPS Coord	dinates	(Uncorrected Fie	ld Measurement							
	Northing: 37.				PDOP Acc~:	NA NA						
	Easung12	2.2702163300			Acc~.	- IVA						
1.0 Data Befo	ore Coating Remov	<u>/al</u>										
1.1	Native Soil Type:	[	χ Clay	χ Rock	χ Sand	Loam	Wet	Other		NA		
	1.1A Backfill Mater	rial Found:		Silt	Slurry	Native	Depth	of Cover (Ft.):		6.00ft		
	Comments:					NA						
1.2	Coating Type:	X HAA	Пѕ	Somastic	Plastic Ta	ipe	Wax Tape	FBE	П	owercrete		
	Bare/I		Coal Tar	Other:	NA NA	· <u>L</u>	Comments:	Ш	NA NA			
			_	-			Comments.					
	Coating Thickness (In	nches):	0.250	Din		Number of Layers:			2			
1.3	Holiday Testing Per	formed?:	□ Y	es X N	0	Voltage Used:	NA	_ M	ap Location of Hol	idays Below.		
		Device Us	ed:	oil V	/et Sponge		Comments	:	NA			
1.4	Pipe-to-Soil Potenti	als in Ditch (-mV):	: <b>–</b>	US: 12	:00 -526	3:00	-530	6:00 -5	9:00	-526	_	
				DS: 12	:00 -661	3:00	-658	6:00 -6	9:00	-663	_	
								0.00			_	
	Comments:					very low, may be t						
1.5	Soil Resistivity in D			C	P appears to be		urned off at time	of inspection.				
1.5	Soil Resistivity in D	itch (Ω-cm):  X 4-Pin		24469.5 oh	P appears to be			of inspection.		DS:	N/A	
	Soil Resistivity in D Method: Comments:	X 4-Pin	Comments	C	P appears to be	very low, may be t	urned off at time	of inspection.  NA  SRM-100	US: N/A	DS:	N/A	
1.6	Soil Resistivity in D Method: Comments: Soil Sample Location	X 4-Pin	Comments	24469.5 ohi NA	P appears to be	very low, may be t	Soil Box	of inspection.  NA  SRM-100  00 position under p	US: N/A			
	Soil Resistivity in D Method: Comments:	X 4-Pin	Comments Yes	24469.5 oh	P appears to be	very low, may be t	urned off at time	of inspection.  NA  SRM-100	US: N/A			
1.6	Soil Resistivity in D Method: Comments: Soil Sample Location Ground Water President	X 4-Pin	Yes	24469.5 ohi NA	P appears to be	very low, may be t	Soil Box Ditch end (DS) 6:0	of inspection.  NA  SRM-100  00 position under p	US: N/A ipe. Sample pH:			
1.6 1.7	Soil Resistivity in D Method: Comments: Soil Sample Locatio Ground Water Presi Comments:	X 4-Pin	Yes  X Good - Ad	24469.5 ohi NA X No	P appears to be n/cm Sample(	s) Collected?:  NA  Fair - Coa	Soil Box Ditch end (DS) 6:0	NA SRM-100 00 position under p	US: N/A ipe. Sample pH:			
1.6 1.7	Soil Resistivity in D Method: Comments: Soil Sample Locatio Ground Water Presi Comments:	x 4-Pin	Yes  X Good - Ad  Poor - Coo	24469.5 ohr NA  X No  Whered to Pipe ating Significantly & tie in weld areas	Pappears to be  n/cm  Sample(  Disbonded or Mi	s) Collected?:  NA  Fair - Coassing  ction removed and	Soil Box  Soil Box  Oitch end (DS) 6:0  Yes  ting Partially Disk	of inspection.  NA SRM-100  10 position under p  X No onded or Degrade	US: N/A ipe. Sample pH:	· NA		
1.6 1.7	Soil Resistivity in D Method: Comments: Soil Sample Locatic Ground Water Presi Comments: Coating Condition:	x 4-Pin	Yes  X Good - Ad  Poor - Coo	24469.5 ohr NA  X No  Whered to Pipe ating Significantly & tie in weld areas	Pappears to be  n/cm  Sample(  Disbonded or Mi	s) Collected?:  NA  Fair - Coassing  ction removed and	Soil Box  Soil Box  Oitch end (DS) 6:0  Yes  ting Partially Disk	of inspection.  NA SRM-100  Do position under p  X No  No	US: N/A ipe. Sample pH:	· NA		
1.6 1.7	Soil Resistivity in D Method: Comments: Soil Sample Locatic Ground Water Presi Comments: Coating Condition:	X 4-Pin	Yes  X Good - Ad  Poor - Coo	24469.5 ohr NA  X No  Whered to Pipe ating Significantly & tie in weld areas	Pappears to be  n/cm  Sample(  Disbonded or Mi	s) Collected?:  NA  Fair - Coassing  ction removed and	Soil Box Soil Box Soil Box Ves Ves Sting Partially Disk Stept place instal did transportation.	of inspection.  NA SRM-100 00 position under p  X No conded or Degrade	US: N/A ipe. Sample pH:	N/		
1.6 1.7 1.8	Soil Resistivity in D Method: Comments: Soil Sample Locatic Ground Water Presi Comments: Coating Condition:	A 4-Pin on [ Contradation*:	X Good - Ad Poor - Coo oating removed a was in good	24469.5 ohr NA  X No  Whered to Pipe ating Significantly & tie in weld areas	Pappears to be  n/cm  Sample(  Disbonded or Mi	very low, may be to the state of the state o	Soil Box Soil Box Soil Box Ves Ves Sting Partially Disk Stept place instal did transportation.	of inspection.  NA SRM-100 00 position under p  X No conded or Degrade	US: N/A ipe.  Sample pH:  d	N/		
1.6 1.7 1.8	Soil Resistivity in D Method: Comments: Soil Sample Locatic Ground Water Presi Comments: Coating Condition:  Comments:  Map of Coating Deg	A 4-Pin on [ Contradation*:	Yes  X Good - Ad  Poor - Coo oating removed a was in good	24469.5 ohr NA  X No  Whered to Pipe ating Significantly & tie in weld areas	Pappears to be  n/cm  Sample(  Disbonded or Mi	very low, may be to the state of the state o	Soil Box Soil Box Soil Box Ves Ves Sting Partially Disk Stept place instal did transportation.	of inspection.  NA SRM-100 00 position under p  X No conded or Degrade	US: N/A ipe.  Sample pH:  d	N/		
1.6 1.7 1.8	Soil Resistivity in D Method: Comments: Soil Sample Locatic Ground Water Presi Comments: Coating Condition:  Comments:  Map of Coating Deg *Note any calcareous Holidays	A-Pin on ent?:  [ Contradation*: s deposit locations	Yes  X Good - Ad  Poor - Coo oating removed a was in good	24469.5 ohr NA  X No  Whered to Pipe ating Significantly & tie in weld areas	Pappears to be  n/cm  Sample(  Disbonded or Mi	very low, may be to the state of the state o	Soil Box Soil Box Soil Box Ves Sting Partially Dist. Stest pipes instal d transportation.	of inspection.  NA SRM-100 00 position under p  X No conded or Degrade	US: N/A ipe.  Sample pH:  d	N/		
1.6 1.7 1.8	Soil Resistivity in D Method: Comments: Soil Sample Locatic Ground Water Presi Comments: Coating Condition:  Comments:  Map of Coating Deg *Note any calcareous Holidays	A-Pin on ent?:  [ Contradation*: s deposit locations	Yes  X Good - Ad  Poor - Coo oating removed a was in good	24469.5 ohr NA  X No  Whered to Pipe ating Significantly & tie in weld areas	Pappears to be  n/cm  Sample(  Disbonded or Mi	very low, may be to the state of the state o	Soil Box Soil Box Soil Box Ves Sting Partially Dist. Stest pipes instal d transportation.	of inspection.  NA SRM-100 00 position under p  X No conded or Degrade	US: N/A ipe.  Sample pH:  d	N/		
1.6 1.7 1.8	Soil Resistivity in D Method: Comments: Soil Sample Locatic Ground Water Presi Comments: Coating Condition:  Comments:  Map of Coating Deg *Note any calcareous Holidays	A-Pin on ent?:  [ Contradation*: s deposit locations	Yes  X Good - Ad  Poor - Coo oating removed a was in good	24469.5 ohr NA  X No  Whered to Pipe ating Significantly & tie in weld areas	Pappears to be  n/cm  Sample(  Disbonded or Mi	very low, may be to the state of the state o	Soil Box Soil Box Soil Box Ves Sting Partially Dist. Stest pipes instal d transportation.	of inspection.  NA SRM-100 00 position under p  X No conded or Degrade	US: N/A ipe.  Sample pH:  d	N/		
1.6 1.7 1.8	Soil Resistivity in D Method: Comments: Soil Sample Locatic Ground Water Presi Comments: Coating Condition:  Comments:  Map of Coating Deg *Note any calcareous Holidays	A-Pin on ent?:  [ Contradation*: s deposit locations	Yes  X Good - Ad  Poor - Coo oating removed a was in good	24469.5 ohr NA  X No  Whered to Pipe ating Significantly & tie in weld areas	Pappears to be  n/cm  Sample(  Disbonded or Mi	very low, may be to the state of the state o	Soil Box Soil Box Soil Box Ves Sting Partially Dist. Stest pipes instal d transportation.	of inspection.  NA SRM-100 00 position under p  X No conded or Degrade	US: N/A ipe.  Sample pH:  d	N/		
1.6 1.7 1.8	Soil Resistivity in D Method: Comments: Soil Sample Locatic Ground Water Presi Comments: Coating Condition:  Comments:  Map of Coating Deg *Note any calcareous Holidays	A-Pin on ent?:  [ Contradation*: s deposit locations	Yes  X Good - Ad  Poor - Coo oating removed a was in good	24469.5 ohr NA  X No  Whered to Pipe ating Significantly & tie in weld areas	Pappears to be  n/cm  Sample(  Disbonded or Mi	very low, may be to the state of the state o	Soil Box Soil Box Soil Box Ves Sting Partially Dist. Stest pipes instal d transportation.	of inspection.  NA SRM-100 00 position under p  X No conded or Degrade	US: N/A ipe.  Sample pH:  d	N/		
1.6 1.7 1.8	Soil Resistivity in D Method: Comments: Soil Sample Locatic Ground Water Presi Comments: Coating Condition:  Comments:  Map of Coating Deg *Note any calcareous Holidays	A-Pin on ent?:  [ Contradation*: s deposit locations	Yes  X Good - Ad  Poor - Coo oating removed a was in good	24469.5 ohr NA  X No  Whered to Pipe ating Significantly & tie in weld areas	Pappears to be  n/cm  Sample(  Disbonded or Mi	very low, may be to the state of the state o	Soil Box Soil Box Soil Box Ves Sting Partially Dist. Stest pipes instal d transportation.	of inspection.  NA SRM-100 00 position under p  X No conded or Degrade	US: N/A ipe.  Sample pH:  d	N/		
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1.6 1.7 1.8 1.9	Soil Resistivity in D Method: Comments: Soil Sample Locatic Ground Water Presi Comments: Coating Condition:  Comments:  Map of Coating Deg *Note any calcareous Holidays clock	A-Pin on ent?:  [ Contradation*: s deposit locations	Yes  X Good - Ad  Poor - Coo oating removed a was in good	24469.5 ohr NA  X No  Whered to Pipe ating Significantly & tie in weld areas	Pappears to be  n/cm  Sample(  Disbonded or Mi	very low, may be to the state of the state o	Soil Box Soil Box Soil Box Ves Sting Partially Dist. Stest pipes instal d transportation.	of inspection.  NA SRM-100 00 position under p  X No conded or Degrade	US: N/A ipe.  Sample pH:  d	N/		
1.6 1.7 1.8 1.9	Soil Resistivity in D Method: Comments: Soil Sample Locatic Ground Water Presi Comments: Coating Condition:  Comments:  Map of Coating Deg *Note any calcareous Holidays clock	A-Pin on ent?:  [ Contradation*: s deposit locations	Yes  X Good - Ad  Poor - Coo oating removed a was in good	24469.5 ohr NA  X No  Whered to Pipe ating Significantly & tie in weld areas	Pappears to be  n/cm  Sample(  Disbonded or Mi	very low, may be to the state of the state o	Soil Box Soil Box Soil Box Ves Sting Partially Dist. Stest pipes instal d transportation.	of inspection.  NA SRM-100 00 position under p  X No conded or Degrade	US: N/A ipe.  Sample pH:  d	N/		
1.6 1.7 1.8 1.9	Soil Resistivity in D Method: Comments: Soil Sample Locatic Ground Water Presi Comments: Coating Condition:  Comments:  Map of Coating Deg *Note any calcareous Holidays clock	A-Pin on ent?:  [ Contradation*: s deposit locations	Yes  X Good - Ad  Poor - Coo oating removed a was in good	24469.5 ohr NA  X No  Whered to Pipe ating Significantly & tie in weld areas	Pappears to be  n/cm  Sample(  Disbonded or Mi	very low, may be to the state of the state o	Soil Box Soil Box Soil Box Ves Sting Partially Dist. Stest pipes instal d transportation.	of inspection.  NA SRM-100 00 position under p  X No conded or Degrade	US: N/A ipe.  Sample pH:  d	N/		
1.6 1.7 1.8 1.9	Soil Resistivity in D Method: Comments: Soil Sample Locatic Ground Water Presi Comments: Coating Condition:  Comments:  Map of Coating Deg *Note any calcareous Holidays  clock  clock	A-Pin on ent?:  [ Contradation*: s deposit locations	Yes  X Good - Ad  Poor - Coo oating removed a was in good	24469.5 ohr NA  X No  Whered to Pipe ating Significantly & tie in weld areas	Pappears to be  n/cm  Sample(  Disbonded or Mi	very low, may be to the state of the state o	Soil Box Soil Box Soil Box Ves Sting Partially Dist. Stest pipes instal d transportation.	of inspection.  NA SRM-100 00 position under p  X No conded or Degrade	US: N/A ipe.  Sample pH:  d	N/		
1.6 1.7 1.8 1.9	Soil Resistivity in D Method: Comments: Soil Sample Locatio Ground Water Presi Comments: Coating Condition:  Map of Coating Deg *Note any calcareous Holidays clock  clock	A-Pin on ent?:  [ Contradation*: s deposit locations	Yes  X Good - Ad  Poor - Coo oating removed a was in good	24469.5 ohr NA  X No  Whered to Pipe ating Significantly & tie in weld areas	Pappears to be  n/cm  Sample(  Disbonded or Mi	very low, may be to the state of the state o	Soil Box Soil Box Soil Box Ves Sting Partially Dist. Stest pipes instal d transportation.	of inspection.  NA SRM-100 00 position under p  X No conded or Degrade	US: N/A ipe.  Sample pH:  d	N/		
1.6 1.7 1.8 1.9	Soil Resistivity in D Method: Comments: Soil Sample Locatio Ground Water Presi Comments: Coating Condition:  Map of Coating Deg *Note any calcareous Holidays clock  clock	A-Pin on ent?:  [ C: radation*: deposit locations Disbond	Yes  X Good - Ad  Poor - Coo oating removed a was in good	24469.5 ohr NA  X No  Whered to Pipe ating Significantly & tie in weld areas	Pappears to be  n/cm  Sample(  Disbonded or Mi	very low, may be to the state of the state o	soil Box Soil Box Soil Box Ves Ting Partially Dist. Stest pipes instal did transportation.	of inspection.  NA SRM-100 00 position under p  X No conded or Degrade	US: N/A ipe.  Sample pH:  d	N/		
1.6 1.7 1.8 1.9	Soil Resistivity in D Method: Comments: Soil Sample Locatic Ground Water Presi Comments: Coating Condition:  Map of Coating Deg *Note any calcareous Holidays clock clock clock	A-Pin on ent?:  [ C: radation*: deposit locations Disbond	X Good - Ad Poor - Cor outing removed a was in good	24469.5 ohi NA  X No  Whered to Pipe ating Significantly & tie in weld areas d conition except f	P appears to be n/cm  Sample(  Disbonded or Mi blasted. Pipe se or coating damag	very low, may be 1  S) Collected?:  NA  Fair - Coa ssing  ction removed and te from removal ar  Zero Reference f	urned off at time Soil Box Soil Box Pes Soil Gox Yes Sting Partially Disk Itest pipes instal Id transportation. Flow	of inspection.  NA  SRM-100  10 position under p  X  No  Nonded or Degrade  led. Removed pipe  See comments pa	US: N/A ippe.  Sample pH.  d section was also ge 10.	assesed and	A	
1.6 1.7 1.8 1.9	Soil Resistivity in D Method: Comments: Soil Sample Locatic Ground Water Presi Comments: Coating Condition:  Map of Coating Deg *Note any calcareous Holidays clock clock clock	A-Pin on ent?:  [ Contradation*: s deposit locations ] ] ]	X Good - Ad Poor - Col coating removed a was in good	24469.5 ohi NA  X No  Whered to Pipe ating Significantly & tie in weld areas d conition except f	P appears to be n/cm  Sample(  Disbonded or Mi blasted. Pipe se or coating damag	very low, may be 1  S) Collected?:  NA  Fair - Coa ssing  ction removed and te from removal ar  Zero Reference f	urned off at time Soil Box Soil Box Pes Soil Gox Yes Sting Partially Disk Itest pipes instal Id transportation. Flow	of inspection.  NA  SRM-100  10 position under p  X  No  Nonded or Degrade  led. Removed pipe  See comments pa	US: N/A ippe.  Sample pH.  d section was also ge 10.	assesed and	A	
1.6 1.7 1.8 1.9	Soil Resistivity in D Method: Comments: Soil Sample Locatio Ground Water President of Control of Control Comments: Comments: Map of Coating Deg *Note any calcareous Holidays clock	A-Pin on ent?:  [ Contradation*: s deposit locations Disbono  1 - Calcareous	Yes  X Good - Ad Poor - Cor oating removed a was in good  dments	24469.5 ohi  NA  X No  Whered to Pipe ating Significantly & tie in weld areas of conition except f	P appears to be n/cm  Sample(  Disbonded or Mi blasted. Pipe se or coating damag	very low, may be 1  S) Collected?:  NA  Fair - Coa ssing  ction removed and te from removal ar  Zero Reference f	urned off at time Soil Box Soil Box Pes Soil Gox Yes Sting Partially Disk Itest pipes instal Id transportation. Flow	of inspection.  NA  SRM-100  10 position under p  X  No  Nonded or Degrade  led. Removed pipe  See comments pa	US: N/A ippe.  Sample pH.  d section was also ge 10.	assesed and	A	
1.6 1.7 1.8 1.9	Soil Resistivity in D Method: Comments: Soil Sample Locatic Ground Water Presi Comments: Coating Condition:  Comments:  Map of Coating Deg *Note any calcareous Holidays  clock  clock  clock  clock  clock Feet 0	A-Pin on ent?:  [ Contradation*: s deposit locations Disbono  1 - Calcareous	X Good - Ad Poor - Col coating removed a was in good	24469.5 ohi  NA  X No  Whered to Pipe ating Significantly & tie in weld areas of conition except f	P appears to be n/cm  Sample(  Disbonded or Mi blasted. Pipe se or coating damag	very low, may be 1  S) Collected?:  NA  Fair - Coa ssing  ction removed and te from removal ar  Zero Reference f	urned off at time Soil Box Soil Box Pes Soil Gox Yes Sting Partially Disk Itest pipes instal Id transportation. Flow	of inspection.  NA  SRM-100  10 position under p  X  No  Nonded or Degrade  led. Removed pipe  See comments pa	US: N/A ippe.  Sample pH.  d section was also ge 10.	assesed and	A	

Form H: Dire	ect Examination		t - Page 2 o	f 10							
	DA/IL Route Number:	<u>-!</u> L-14	17	Site De	<u>DA</u> esignation	T43A/B	R	8.11	<u>ILI</u> og Distance:	NA	
ı	Date of Excavation:	10/7/2			N-Segment:	NA	<u>,_b</u>		Ref. Section:	Table 5.	6.2
	Mile Point:	1.9			MA Number:	NA			Girth Weld:	NA	
Examina	tion Performed By:	H. Mayer/J	J. Hayes		_	NA		Distance Fro	m Girth Weld:	NA	
PG&	E Project Manager:	Donovar	n Fink	Reg	ion Number:	NA					
	Approved By:	Kenji G	ailey	Subre	gion # (ICDA):	NA					
	Order Number:	41497	360		Stationing:	NA					
	Photos Taken?*: *See Photo Log for a	X Yes additional info	No ormation.								
1.11	Coating Sample Ta	ken?:	Yes	X No	Loca	ation of Sample	e:		NA		
1.12	Liquid Underneath	Coating?:	Yes	X No	If Ye	s, pH of Liquid	l:		NA		
	Corrosion Product	Present?:	Yes	X No	If Ye	es, Was Sampl NA		Yes	X No		
1.14	Soil pH (Sb Electro	ode): L	Jpstream:	6.0	Dow	nstream:	7.5	Pip	e pH:	6.0	
			·		<del></del>			•			-
	er Coating Remo										
2.1 I	Pipe Temperature	(°F):	60.0° F	_	M	easured Pipe ——	Diameter (In.)		63" =	20.05"	
2.2	Weld Seam Type:	=	SAW	SSAW Lap	ERW Flash	☐ SM X AO	ILS Smith	IF CAN'T DETI	ERMINE, VISUA	LLY PERFORM	
2.3	Girth Weld Coordir  Northing:  Easting:  Elevation:	nates & Ident	tify Type (See NA NA NA	e Table 5.7.3)	PDOF		LS Weld	Clock Position		8:55	
2.4	Damage Found: Corrosion Dama Other Damage	<b>P</b>	Yes [	X No	n relevant too	Mechanical Dall Marks, no co	amage rrosion found gi	Yes reater than 20%	X No		
2.5	UT Wall Thickness	Measureme TD 4 O'cloo 8 O'cloo	C: 0.270"/ ck 0.268"/	0.275" 1 0 0.270" 5 0	O'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.	271" 272
	UT Wall Thickness	Grid @ 6:00	is required.	Be sure to at	tach grid to	H-Form electr	onically. See	page 6 of 10.			
2.6	Wet Fluorescent M	ag. Part. Is F	Required.	Comment	s:	2 linear indic	ations on the re	moved pipe se	ction. See MT	& Photo repo	rt.
\	Were there any linea	ar indications	? 🗓	Yes		•	DE report electr le black light an	, ,			
	Take Photos to Do *See Photo Log for a			her Anomali	es*						
	Overview Map of C *See Pit Depth Mea			l Information		Zero Referer	nce Point:	U	S Exposed Pipe	360 degrees	
*Note any r	calcareous deposits						Flow -			<b></b>	•
12 o'clo		Ī				T	T				Т
9 o'clo	ck										┪
6 o'clo	ock										1
3 o'clo	ock	+									1
12 o'clo	ck										
	eet 0 1		2	3	4	5	6	7	8	9	<b>-</b> 10

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

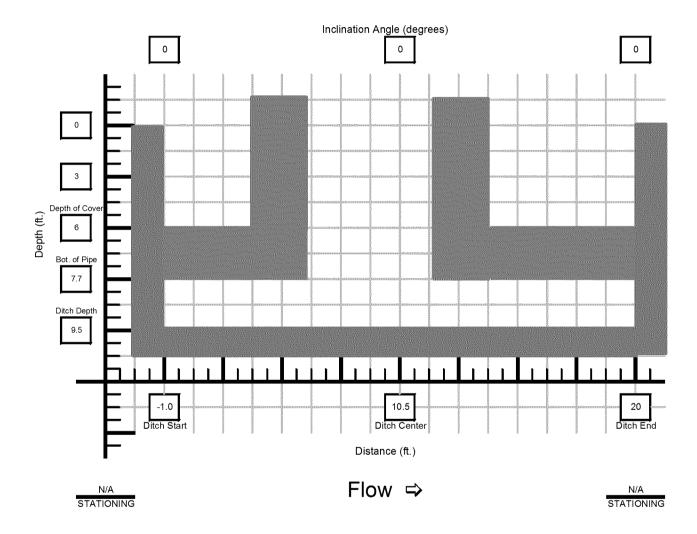
DA	<u>/ILI</u>
Route Number:	L-147
Date of Excavation:	10/7/2011
Mile Point:	1.95
Examination Performed By:	H. Mayer/J. Hayes
PG&E Project Manager:	Donovan Fink
Approved By:	Kenji Gailey
Order Number:	41497360

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

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

### **Excavation Drawing:**

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



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

**See attached Delorme screen shot on page 11.

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

	Rout	e Numl	DA/IL	<u>!</u>	L-147			<u>DA</u> Site Designation T43A/B_B ILI Log Distance:															
Da		xcavat		1	0/7/201		_	Site		ment:													
		Mile Po			1.95		_			ımber:			IA			RMP-11 Ref. Section: Reference Girth Weld:							
Examination				H. Ma	ayer/J.	Hayes	_						IA				om Girt			Ν			
PG&E I					novan l					ımber:		Ν	IA		•								
		proved			(enji Gail			Subreg					IA						-00.	100	9		
	Orde	r Numl	ber:		4149736	0			Stati	oning:		Ν	IA							009			
																			][.100	019	9		
Grid Size = Clock Position		Inch x ify belo		Inch (s	specify (	grid siz	e)												Hig	029 hest p	e it readi	ng	
	Anom	aly#	NA								•	Grid#	NA										
Λ.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
A																							
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PIT DEPTH GRID 1 OF 2

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

										,	SUKEI		J. 1.1.		. •							
	Pout	DA/ILI oute Number: L-147						<u>DA</u> Site Designation T43A/B_B						ILI Log Distance: NA								
Da		xcavation: 10/7/2011						N-Segment:				T43A/B_B NA		RMP-11 Ref. Section:				Table 5.6.2				
		/lile Po			1.95				IMA N				IA					Weld:		NA		
Examination PG&E I					ayer/J. novan I			Por	gion Nu	ımbarı			IA IA		Dist	ance Fr	om Girt	h Weld:	d: NA			
FGALI		roved			enji Gail		_	Subreg				N			•				00	.001009		
	Orde	r Numb	er:		4149736			-		oning:			IA		, ,				.010099			
0-14-01							,												] .10 .20	019! 029!	9 9	
Grid Size = Clock Position		Inch x ify belo		inch (s	specity (	grid siz	e)												Hig	hest p	it readi	ng
	Anoma	aly#	NA								-	Grid#	NA									
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PIT DEPTH GRID 2 OF 2

### INTERNAL CORROSION WALL LOSS GRID

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

<u>D</u> 4	<u>4</u>
Site Designation	T43A/B_B
N-Segment:	NA
IMA Number:	NA
-	NA
Region Number:	NA
Subregion # (ICDA):	NA
Stationing:	NA

<u>IL</u>	<u>.1</u>
ILI Log Distance:	NA
RMP-11 Ref. Section:	Table 5.6.2
Reference Girth Weld:	NA
Distance From Girth Weld:	NA

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

All measurements are in inches.

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

	e la contenta e e la contenta e e la contenta e e la contenta e e e e e e e e e e e e e e e e e e e											
	1	2	3	4	5	6 \	/ 7	8	9	10	11	12
Α	0.251"	0.251"	0.249"	0.249"	0.249"	0.249"	0.249"	0.248"	0.248"	0.248"	0.248"	0.248"
В	0.251"	0.254"	0.251"	0.251"	0.249"	0.249"	0.249"	0.249"	0.248"	0.248"	0.248"	0.249"
С	0.253"	0.251"	0.251"	0.251"	0.251"	0.251"	0.251"	0.249"	0.249"	0.248"	0.249"	0.249"
D	0.251"	0.251"	0.251"	0.251"	0.251"	0.249"	0.250"	0.249"	0.249"	0.248"	0.247"	0.249"
Ε	0.251"	0.251"	0.251"	0.251"	0.251"	0.251"	0.251"	0.251"	0.247"	0.248"	0.247"	0.248"
F	0.251"	0.251"	0.251"	0.251"	0.249"	0.249"	0.251"	0.249"	0.249"	0.247"	0.248"	0.249"
G	0.251"	0.251"	0.247"	0.246"	0.249"	0.248"	0.247"	0.247"	0.246"	0.247"	0.248"	0.247"
Н	0.248"	0.249"	0.249"	0.249"	0.248"	0.247"	0.247"	0.247"	0.246"	0.246"	0.246"	0.246"
I	0.249"	0.249"	0.249"	0.249"	0.247"	0.246"	0.244"	0.247"	0.244"	0.244"	0.247"	0.246"
J	0.247"	0.247"	0.247"	0.246"	0.246"	0.246"	0.242"	0.244"	0.244"	0.243"	0.244"	0.246"
K	0.247"	0.247"	0.247"	0.246"	0.246"	0.246"	0.244"	0.244"	0.244"	0.244"	0.244"	0.246"
L	0.249"	0.247"	0.247"	0.247"	0.248"	0.248"	0.248"	0.242"	0.244"	0.244"	0.246"	0.244"

INTERNAL CORROSION GRID

1 of 1

### **COATING DAMAGE**

DA/I	<u>LI</u>	DA		<u>ILI</u>	
Route Number:	L-147	Site Designation	T43A/B_B	ILI Log Distance:	NA
Date of Excavation:	10/7/2011	N-Segment:	NA	RMP-11 Ref. Section:	Table 5.6.2
Mile Point:	1.95	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
	1			
	<del>                                     </del>			
	+ +			
	<del>                                     </del>			
	<del>                                     </del>			
	+ +			
	+ +			
	<del>                                     </del>			
	1			
	<del>                                     </del>			
	+			
	+			
	<del>                                     </del>			
	<del>                                     </del>			
	† †			
	† †			
	+ +			
	+ +			
	<del>                                     </del>			

### **CORROSION LOG**

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

IC or EC	FEET FROM REFERENCE	o'clock	MAX PIT DEPTH (MILS)	MAX LENGTH (IN.)	MAX CIRC EXTENT (IN.)
NA					
NA	NA	NA	NA	NA	NA NA
$\vdash$					
$\vdash$				+	
		-			
				ļ	!

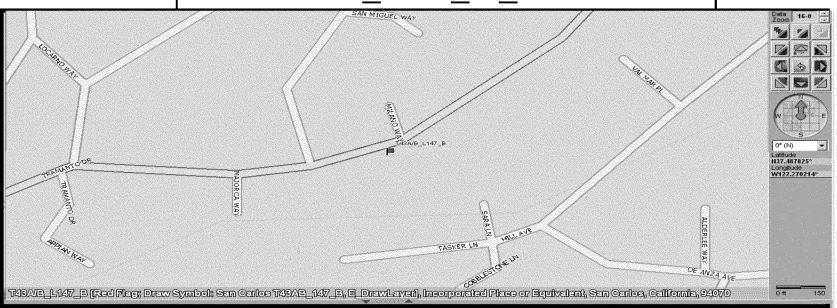
### **PHOTO LOG**

DA/II	<u>LI</u>	<u>DA</u>		<u>ILI</u>		
Route Number:	Route Number: L-147		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.									

Form H: D	irect Examination D	ata Sheet - Page 10				,
	<u>DA/ILI</u> Route Number:	L-147	<u>DA</u> Site Designation	<u>\</u> T43A/B_B	<u>ILI</u> ILI Log Distance:	NA NA
	Date of Excavation:	10/7/2011	N-Segment:	NA	RMP-11 Ref. Section:	Table 5.6.2
	Mile Point:	1.95	IMA Number:	NA NA	Reference Girth Weld:	NA
Exami	nation Performed By:	H. Mayer/J. Hayes	-	NA	Distance From Girth Weld:	NA
	6&E Project Manager:	Donovan Fink	Region Number:	NA		
	Approved By:	Kenji Gailey	Subregion # (ICDA):	NA		
	Order Number:	41497360	Stationing:	NA		
3.0 REC	OAT DATA					
3.1	Sandblast Media:	Sharp S	Shot 30/60	Anchor Profile Meas	surement: Average: 3.2 mils	
3.2	Pipe Recoated With:					
	Powercrete J	X Poly Tape	Bar-Rust 235	Dev Grip 238	Dev Tar 247 X Protal 7200	PE Tape
3.3	For Epoxy Coa	ating Systems. Record	Environmental Condition	on:	<del></del>	
	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	<del>-</del>	· <del></del>		
	_	·		00 000 70	0.00 70 40.00	70
3.4	Repair Coating Hardr	ness (If ARC Coating:)	US 3:00 DS 3:00 -	82 6:00 - 79 79 6:00 - 75		79 81
			DS 3:00 -	79 6:00 - 75	9:00 - 79 12:00 -	01
3.5	Measured Coating Th	ickness: US	33.7	6:00 - 38.7	9:00 - 57.5 12:00	- 27.4
		DS	37.3	6:00 - 28.6	9:00 - 39.0 12:00	- 29.3
	Holiday Tested?:	X Yes No				
	· · · · =	= =			D : ABILEL VE	
	Device Used:		Sponge Voltage	Used: UNK	Repair All Holidays. YE	.5
3.6	Coupon Test Stat	tion Installed?:	Yes X No E	ETS Installed?:	es X No	
	If Yes, Date Installed:	NA				
	Curfore Configurations	. 🗆 🗆	G-5 Box Carso	mita Cham	NA	
	Surface Configuration:	: Fink	G-5 Box Carso	nite Other:		
3.7	Backfill Material:	Native	Imported Sand	Other:	NA	
	Coating Protections?:	X Yes	No			
	-			Consulation Contract	STAC average /tages gitting	!
	If Yes, Check One:	Rockguard	Tuf-E-Nuf	Conwed Other:	STACguard (transition	is only)
3.8		over Bell Hole After E		NA		
	*If specified, a CIS sho	uld be done for approxin	nately 100' on either side	of the bell hole. Attach data	a.	
	Comments:			NA		
	A44h -:4l4-h -£					
3.9	Attach site sketch of	excavation site.				
4 0 REPA	IP DATA					
4.0 REPA 4.1	Repair Made:	Yes X No	4.2 Number	of Repair Made:	Replacement "In-Kind configurat	ion"
	•		_			
4.3	Repair Type	Metallic Sleeve	Non Metallic	Sleeve Replace	Can Filler Metal	Other
4.4	Damage Repaired:	Corre	osion I	Mechanical Other	r	
Miss Co	mments/Information:	T42A had apating	romoved area for increase	tion was blasted from socie	g up to test pipe tie in weld. About 1	ft of acating
					. About 1.5 ft of coating was inspecte	
	was inspected at the PG		in was blasted from coati	ig up to toot pipe tie iii weid:	Thouse 1.0 to 1 ocaling was mopoca	sa. Removed
pipo occion	wao mopostoa at the r	ac yara.				

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



Page 12 of 31

### INSPECTION & LIFE EXTENSION SERVICES

	MAGNETIC PARTICLE EXAMINATION REPORT									✓ Non-N	uclear
To:					F	rom:			Date:		
	Pacific Gas	& Electric Co	mpany			H.	Mayer/J. Ha	yes	10	/7/2011	
Project:			T43A/	/B_L147_B	_MP-	1.95					
Purchase Order No:				GEIS Jo	b No:						
	4149	7360					ı	_API00	15		
	Weld	Structural	Casting N	Machinery	Mach	n. Parts	Pipe	N/A	Other:		
Item	<b>7</b>						<b>4</b>			N/A	
116111	Non-Weld	Plate	Pipe	Bar	Ca	sting	Mach. Parts	N/A	Other:		
	7		<b>4</b>			]				N/A	
Material	Size	Material Thickr	1 ''	of Base Mate			Type of Filler Ma	terial	Weld	✓ N/A	
Matchai	20"	0.250"	Ca	arbon Stee	<u> </u>		C/S		☐ Smooth	As W	elded
Location		the intersectio Way in San Car			10	System		j	L-147		
Acceptance					F	Procedu	ure				
Standards		Customer Sp	ecifications				G	EIS QCF	P# 500 Rev 1	7	
Towns of Charles	Initial I	Plate Edge li	n Process Ba	ack Gouge	Roo	t Pass	Repair	12	Hour 24	Hour	Final
Type of Check	7										V
	Longitudinal	Coil		DC Pro	be		✓ Continuou	s	Other:		
	✓ Wet □ Dry □				Direct Contact						
Type of Inspection	Circular	ACI	Prod	✓ Yoke			Other				
	MT Yoke & Model - Serial No. / Blacklight Model - Serial No.					Surface Preparation Method					
	Parker DA-	400 - S# 18830 /	Spectroline BIP	- S# 159725 <sup>2</sup>	1				(Kleen Blast) - N		1
	l	nspection Mediur	n / Color / Batch	No.		$\top$			netization Method / Equipment		
	Magnag	lo 14A / Flour	escent Greer	n / <b>09M12</b> K	(				N/A		
Reference: Summar	ry			✓ See	Attach	nment			Results of Ir	acpostion	
The following are			ted:						Nesults of II	spection	
Bare pipe: -0.40' to Bare pipe: 17.4' to							<u> </u>		nt indications found ( nt indications found (		
Removed pipe secti		ore alterratart.					<u> </u>		ications were found.	g time of map.	
Summary: Lin-01: Axial Start=	4 601/Erom 11/6 on	d of mino\ Al md E	"00" CM 000"	CI IZ Pacitio	A.O	,					
Lin-01: Axial Start=											
These are on the re	emoved pipe sectio	n.									
Indications were on th	ne removed pipe secti	on. Please see atta	ched photo report	t for additional	inform	ation.	I				
Сору То:		<u> </u>		Reques	sted By	r:			Reported By (Te	chnician):	
Pacific Gas & Electri	c Company					David	d Aguiar		H. May	er/J. Hay	es
GE Inspection Service	ces (Los Angeles)			7 (	Custon	ner Spe	cifications		NDT supervisor:		
					Accept		Reject			J. Filiatra	
NOTICE: THIS EXAMII	NATION REPORT IS A	REPORT OF THE RE	ESULTS OF THE N	DT PROŒDUR	EACTU	JALLY PE	ERFORMED BY TH	IS COMPA			

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



### GE Energy

### Inspection & Life Extension Services

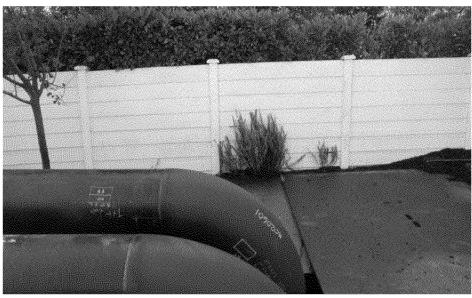
- 1									
		LTRA9	ONICEXAMI	NATION RE	PORT			☐ Nuclear	✓ Non-Nuclear
То:	Pacific G	as & Ele	ectric Compa	nv		From: <b>H. Maver</b>	& J. Hayes	Date: 10/7/2011	
Project:									
				T43A/B_L	.147_B_MP-	1.95			
Purchase Order I					GEIS Job No:				
		97360					LAPIO		
Item	Weld Str	uctural	Casting	Machinery	Mach.Parts	Pipe ✓	N/A	Other:	
	Non-Weld F	Plate	Pipe	Bar	Casting	Mach. Parts	N/A	Other	
Material	Size:		No. of Pieces	Type of B	ase Metal	Type of Fil	ler Material	Weld	✓N/A
	20"		1		n Steel	С	:/S	Smooth	As Welded
Location	70.6 Ft SW of t				nd Milano	System			
	V	Vay in S	San Carlos, C	A 94070				L-147	
Acceptance		04-		-4:		Procedure		000 004	
Standards	Soundness Thi	ckness	mer Specifica Bond	ations		Transducer		QCP-601	Transducer Serial No.:
				V	Single Crystal		Dual Crysta	ı	020HFC
		le-Beam	Other		uency	Size		igle	Couplant / Batch #
	[7]			5 N	/Hz	0.375"	(	)°	Sonatest Ultragel II
Type of	UT Equipment/Mode	<u> </u>			at	Concave	Convex		/ 25-901 07225 AF
Inspection	3	SN-60		[ <u>·</u>	7				
peetieii	Serial:	# 01NL	(N	Standard		Material	Notch	Depth	Serial No.:
	Calibra	ation Da	te:						
	10/	5/2011		Step Wedge	7	Material	Thickne	ss Range	Serial No.:
	Calibration	n Due: 1/5.	/2012	Tube Wedge		C/S	0.200"	- 0.500"	V34693
Reference: Sum	nmary				☑ See /	Attachment		Results of I	nenection:
The followin	g areas were red	questec	d to be inspe	cted:				Nesults of I	rispection.
12" x 12" (1"x	1" grid) at a rando	m 6:00	position on the	ne pipe.			- No relevant	indications @ t	ime of inspection.
12" laminatio	n scans at cut-line	e locatio	ons.				- No relevant	indications @ t	ime of inspection.
Thickness rea	idings US & DS ins	spection	areas at the	clock position	ons.		- No relevant	indications@t	ime of inspection.
	e attached repor	ts for a	dditional info	rmation.			<u> </u>	lo	· <del>·</del>
Copy To:					Requested By		_	Reported By	`
	ectric Company	,				David Aguia		1	1ayer/J. Hayes
GE Inspection S	ervices (Los Angeles	s)				r Specification	ns	NDT Supervis	or:
					✓ Accept	Reject		Andre	e J. Filiatrault

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



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Pacific Gas & Electric Company



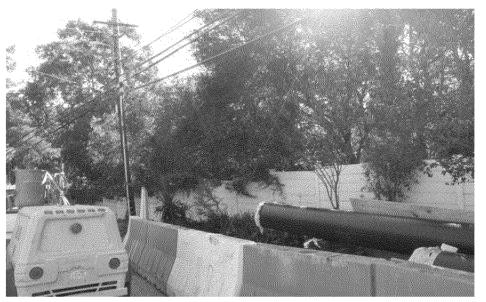
Topography looking upstream



Topography looking downstream



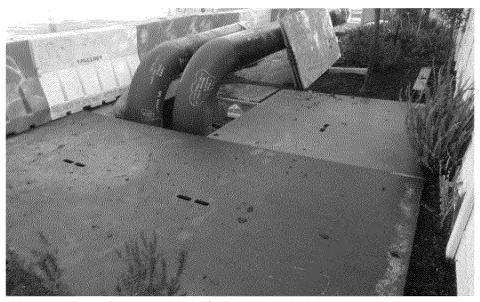
Typical surrounding topography



Typical surrounding topography

Page 15 of 31

GE Energy



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



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

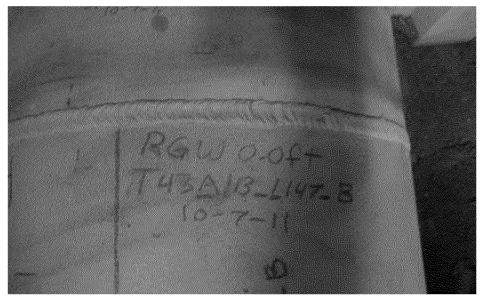


Overview of T43A(US) & T43B(DS) in same excavation.



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

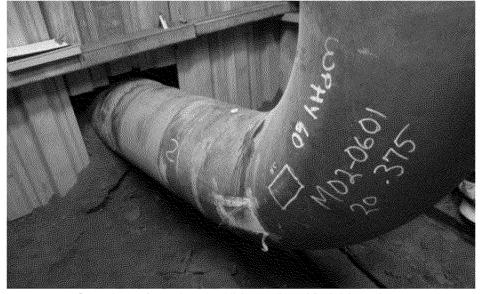
Page 16 of 31



Overview of Reference Girth Weld measurments were taken from.



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

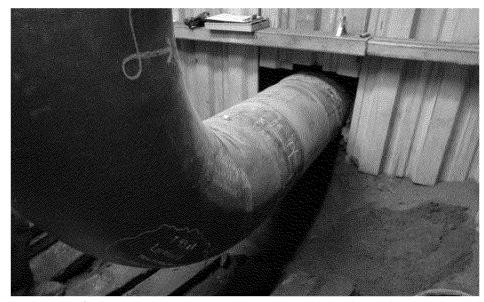


Overview of coating condition -1ft to 2ft, 3:00 position



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

Page 17 of 31



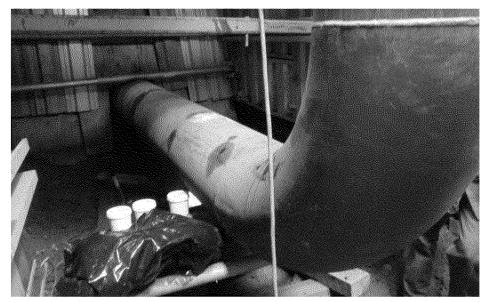
Overview of coating condition -1ft to 2ft, 9:00 position



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

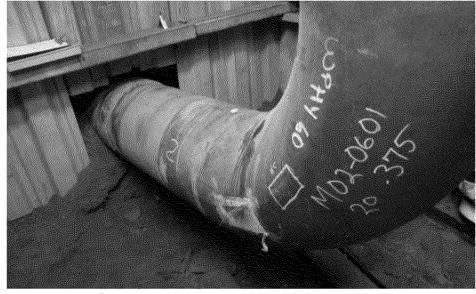
Page 18 of 31



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



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

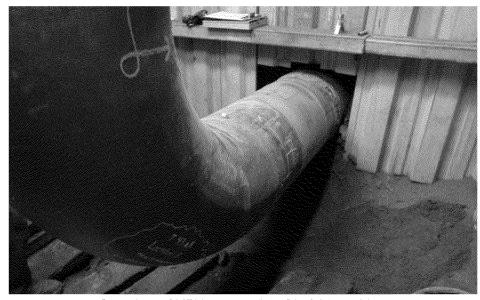


Overview of MPI layout -1ft to 2ft, 3:00 position



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

Page 19 of 31



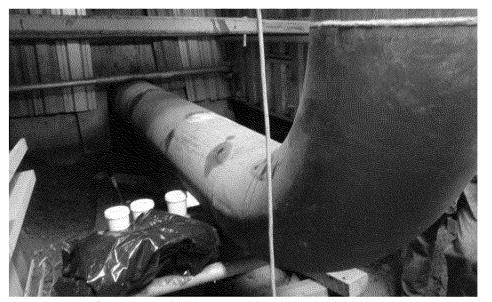
Overview of MPI layout -1ft to 2ft, 9:00 position



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



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

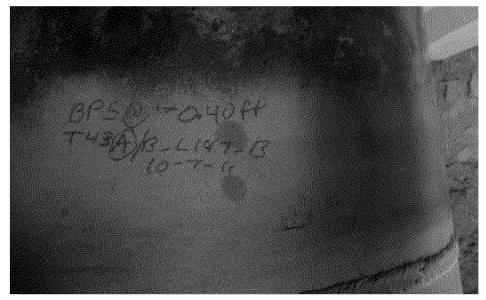


Overview of MPI layout 17ft to 20ft, 9:00 position

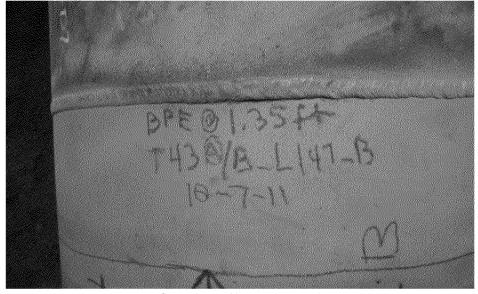
Page 20 of 31



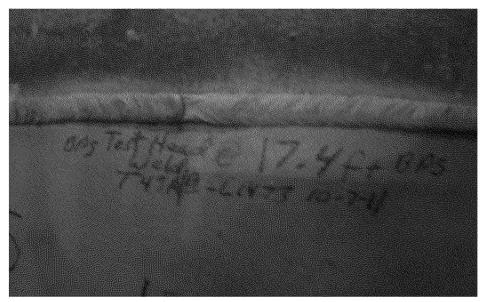
Overview of MPI layout 17ft to 20ft, 9:00 position



Overview of bare pipe start

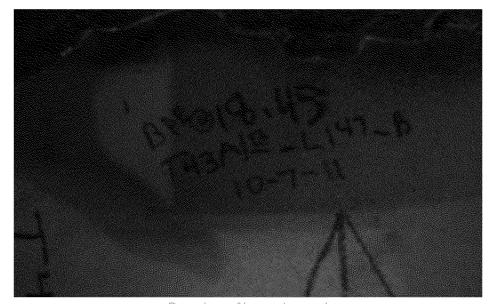


Overview of bare pipe end



Overview of bare pipe start

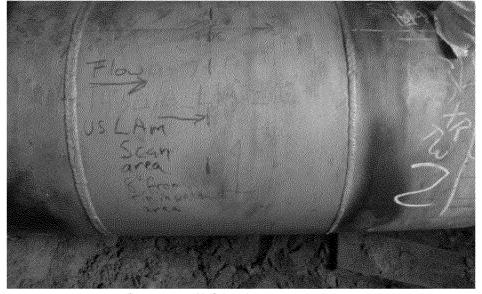
Page 21 of 31



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.

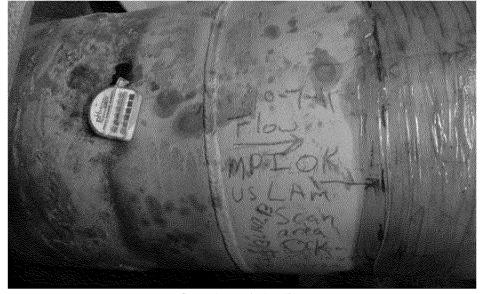
Page 22 of 31



Overview of US MPIOK and Lamination scan OK.



Overview DS of MPIOK and Lamination scan OK.



Overview of pipe Ph.



Closeup of pipe Ph.

Page 23 of 31



Removed pipe section coating assesment 3:00



Overview of coating condition 3:00 position



Overview of coating condition 3:00 position



Overview of coating condition 3:00 position

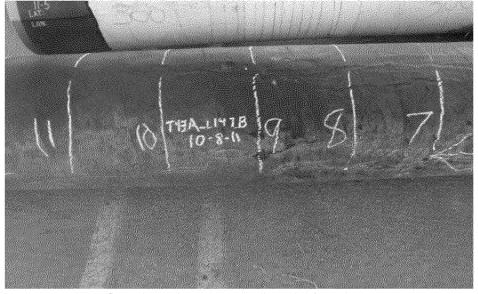
Page 24 of 31



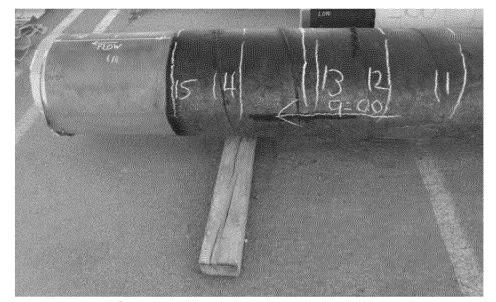
Removed pipe section coating assesment 9:00



Overview of coating condition 9:00 position

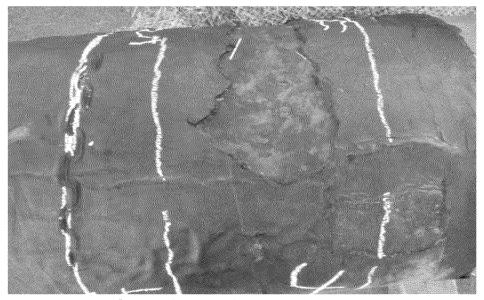


Overview of coating condition 9:00 position

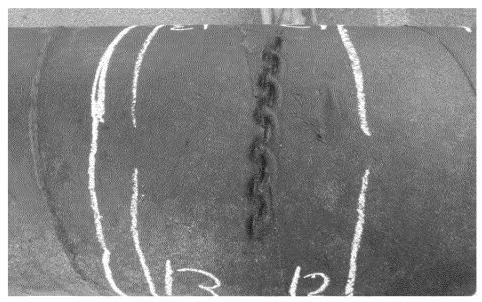


Overview of coating condition 9:00 position

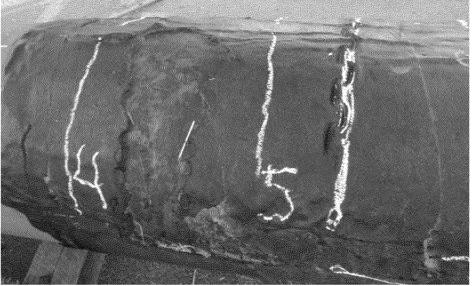
Page 25 of 31



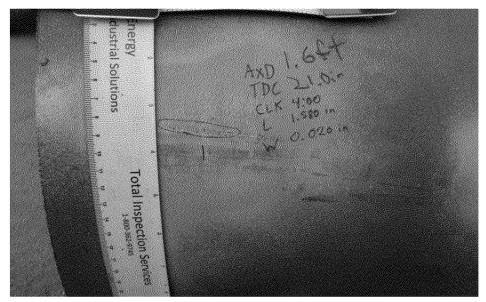
Coating damaged from removal process.



Coating damaged from removal process.

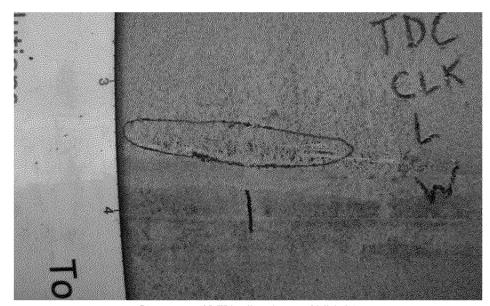


Coating damaged from removal process.

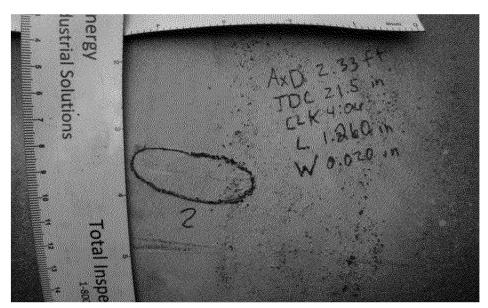


Removed pipe section linear indication-01

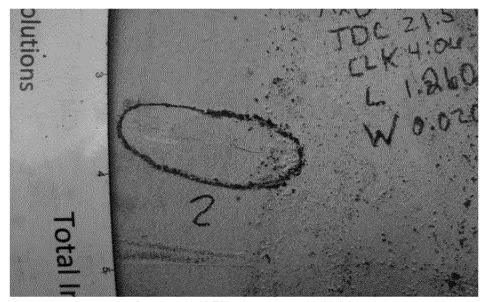
Page 26 of 31



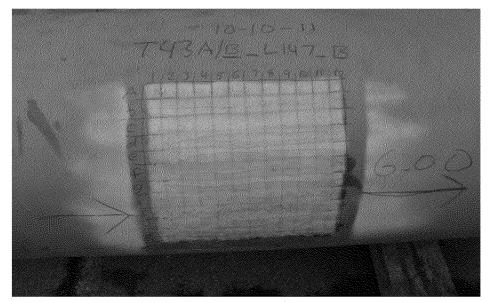
Close up of MT Indications of LIN-01



Removed pipe section linear indication-02

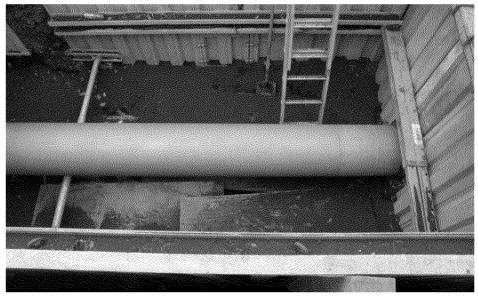


Close up of MT Indications of LIN-02



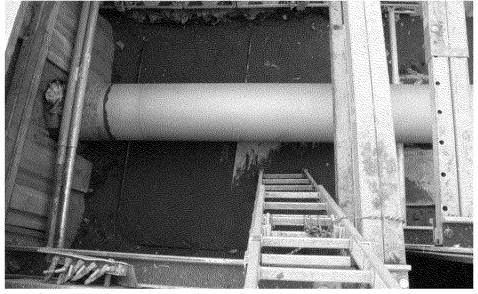
Overview of UT Grid.

Page 27 of 31



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

Page 28 of 31



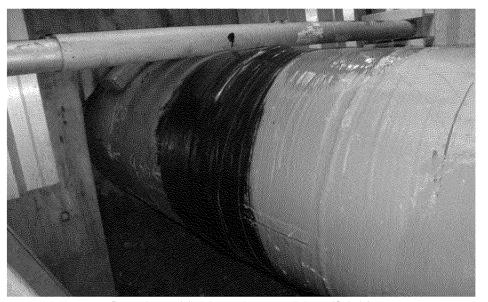
Overview of final coating condition 3:00



Overview of final coating condition 3:00



Overview of final coating condition 3:00



Overview of final coating condition US 3:00

Page 29 of 31



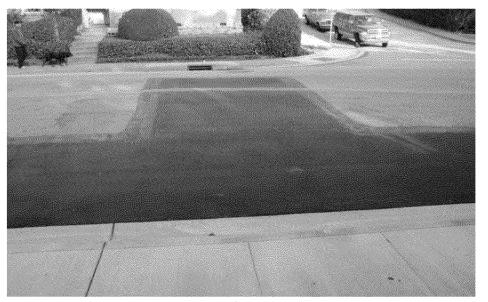
Overview of completed Slurry



Overview of completed Slurry



Overview of completed Cover looking upstream



Overview of completed Cover looking downstream

Page 30 of 31

GE Energy



Overview of completed Cover, 3:00 view



Overview of completed Cover, 9:00 view

Page 31 of 31

# **EXHIBIT E**

Exponent\*

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



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

Prepared by:

Brad James, Ph.D., P.E., FASM Exponent Failure Analysis Associates

149 Commonwealth Drive

Menlo Park, CA 94025

October 2013

· Exponent, Inc.

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## Contents

	Page
Executive Summary	1
Background	2
Non-Destructive Examination	3
Fractographic Examination	6
Optical Microscopy	6
Scanning Electron Microscopy	7
Metallographic Analysis	12
Chemical Analysis	19
Mechanical Testing	20
Discussion	21
Conclusions	22
Limitations	23

Appendix A Microhardness Testing

## **Executive Summary**

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

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

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

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

### **Background**

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

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

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

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

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

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

### **Non-Destructive Examination**

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

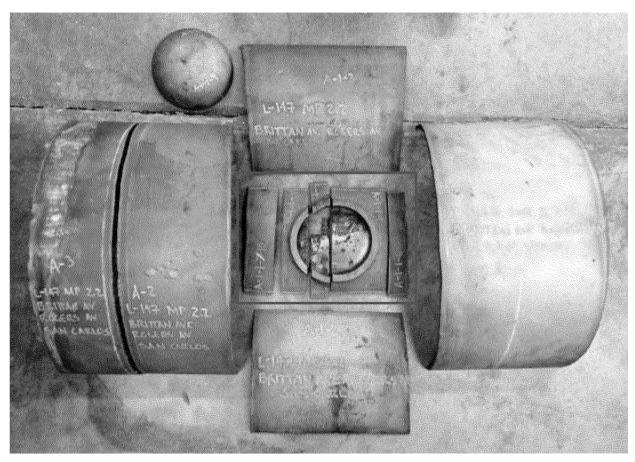


Figure 1. Photograph of the section of L-147 containing the crack and the PLIDCO cap welded over it to stop the gas leak. The red box shows the area magnified in Figure 3. Note the sectioning of the pipe and the yellow markings were made by Anamet.



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

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

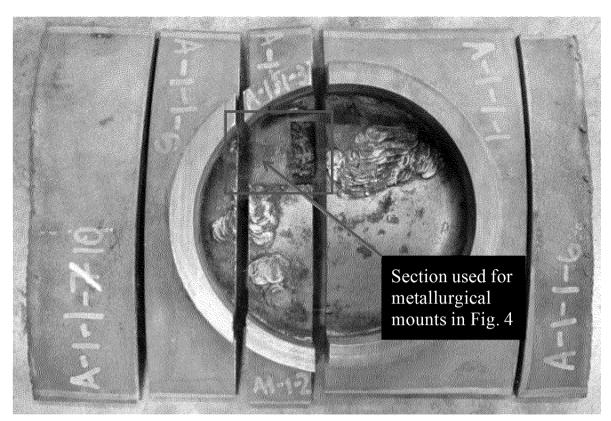


Figure 3. Photograph of the section of L-147 (boxed in red in Figure 1) containing the crack and the PLIDCO cap. Note the sectioning of the pipe and the yellow markings were made by Anamet.

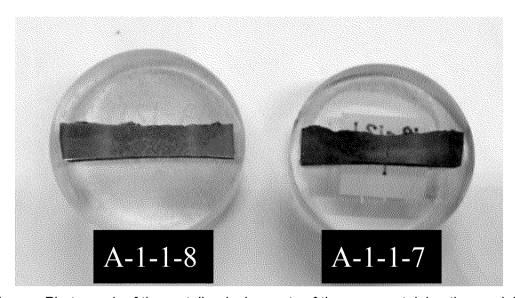


Figure 4. Photograph of the metallurgical mounts of the area containing the crack in L-147 under the PLIDCO cap. Note the metallurgical mounts were made by Anamet: Exponent retained Anamet's sample ID numbers A-1-1-8 (left); A-1-1-7 (right).

## **Fractographic Examination**

## **Optical Microscopy**

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

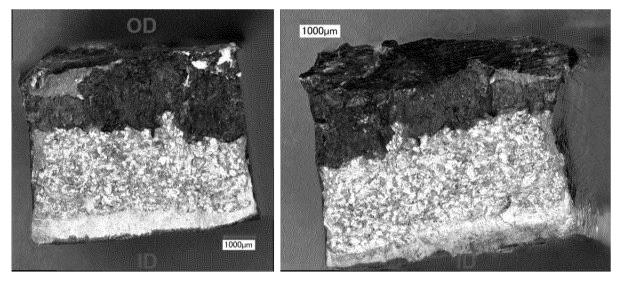


Figure 5. Optical micrographs of the leak surface after opening Anamet's A-1-1-8 metallurgical mount.

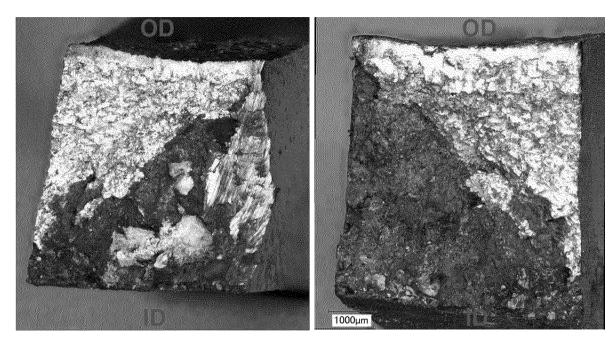


Figure 6. Optical micrographs of the leak surface after opening Anamet's A-1-1-7 metallurgical mount.

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

### **Scanning Electron Microscopy**

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

<sup>&</sup>lt;sup>3</sup> ASM Handbook, Volume 6: Welding, Brazing, and Soldering, ASM International, 2003, pp. 649-651.

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

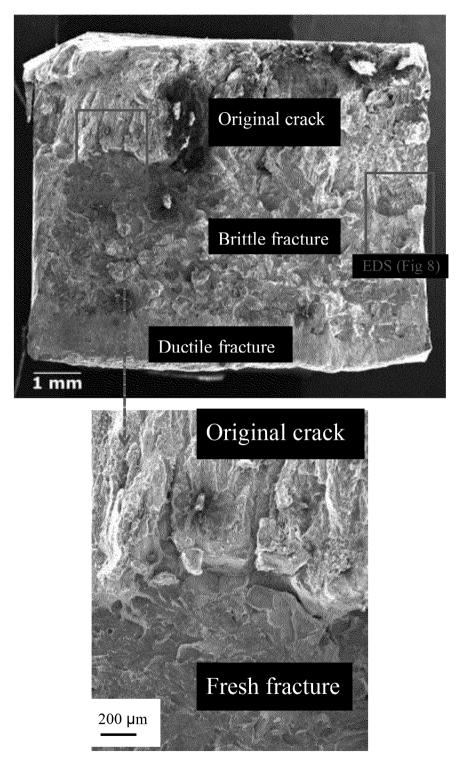


Figure 7. SEM images of Sample A-1-1-8 fracture surface (left side of Figure 5). Top image shows the entire surface with one red box magnified (bottom image) and another red box for the area analyzed with EDS in Figure 8.

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

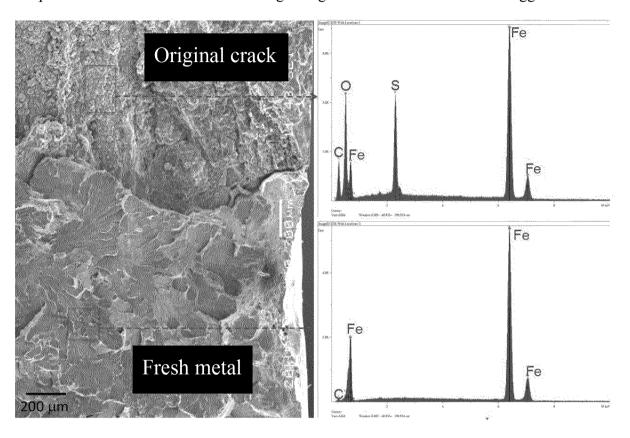
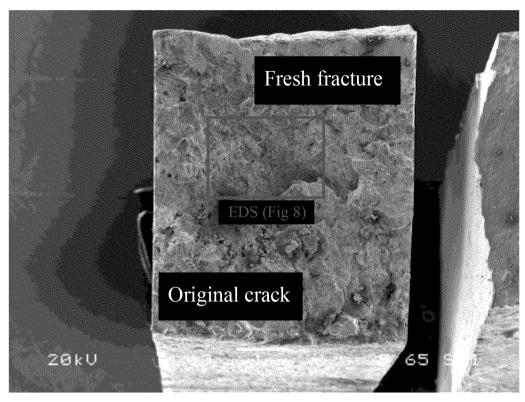


Figure 8. EDS analysis of the area in the red box in the right side of the top image in Figure 7. The lower portion is the freshly cracked surface; the top is the surface of the original crack composed of iron oxide with a large amount of sulfur, likely from the mercaptans added to give scent to the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

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

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



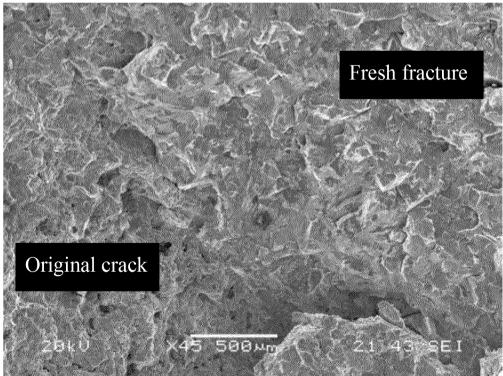


Figure 9. One side of the crack surface in Sample A-1-1-7 (right side of Figure 6). The red box shows the area analyzed with EDS in Figure 10.

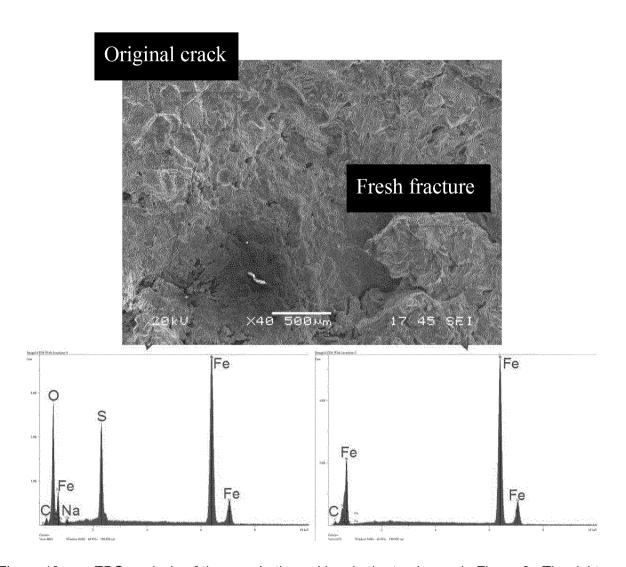


Figure 10. EDS analysis of the area in the red box in the top image in Figure 9. The right side is the freshly cracked surface; the left side is the surface of the original crack composed of iron oxide with significant sulfur.

## **Metallographic Analysis**

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

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

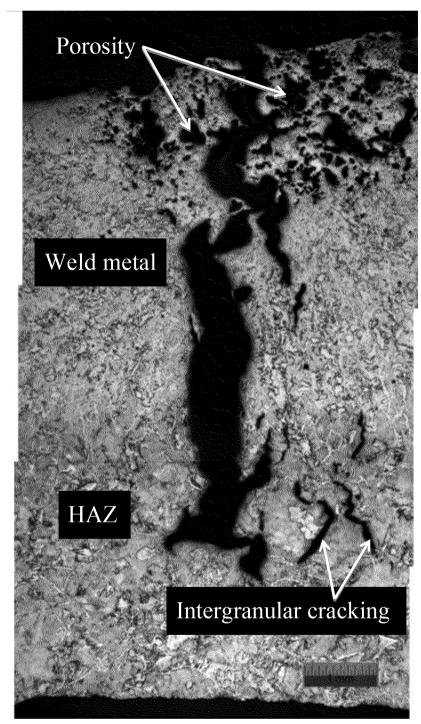
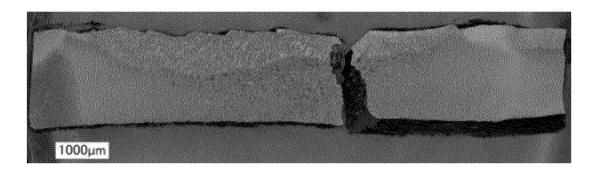


Figure 11. Composite optical micrograph of a metallurgical mount prepared by Anamet. Image reproduced from the September 6, 2013 Anamet report with permission from Anamet.



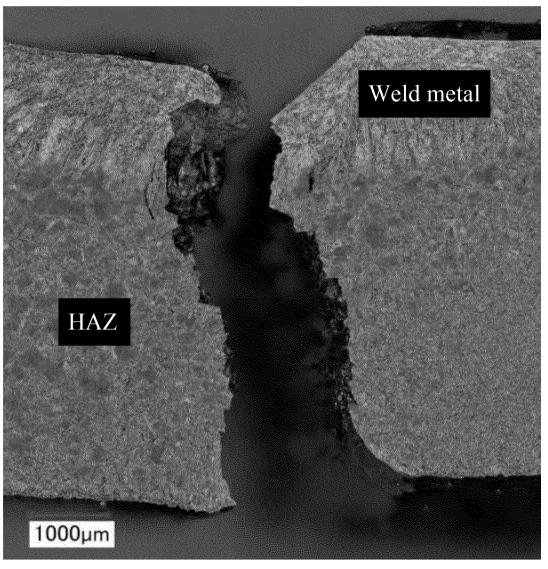
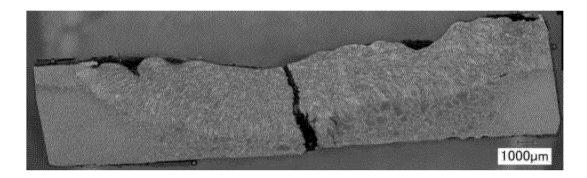


Figure 12. Images of Sample A-1-1-8, re-mounted following fractographic examination.



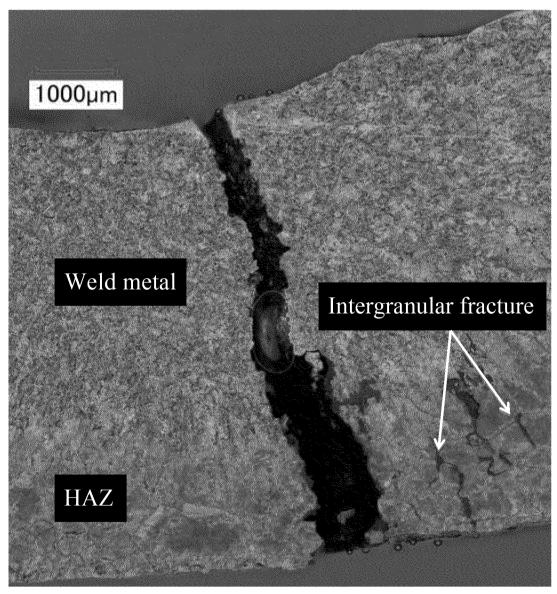


Figure 13. Images of Sample A-1-1-7, remounted following fractographic examination.

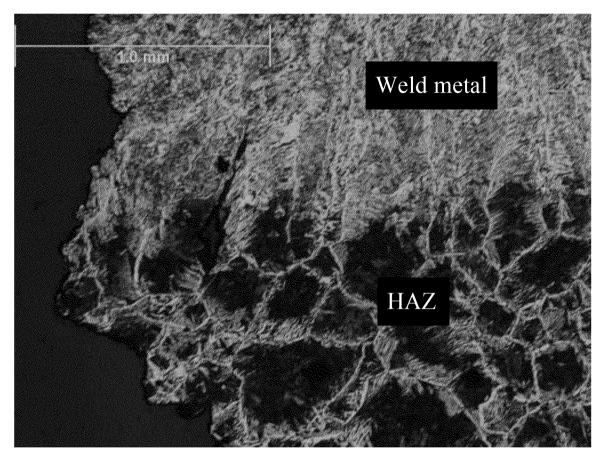


Figure 14. Metallographic image that shows significant grain coarsening beneath the weld in Sample A-1-1-8, with Widmanstatten ferrite at the prior-austenite grain boundaries in the heat-affected zone (HAZ).

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

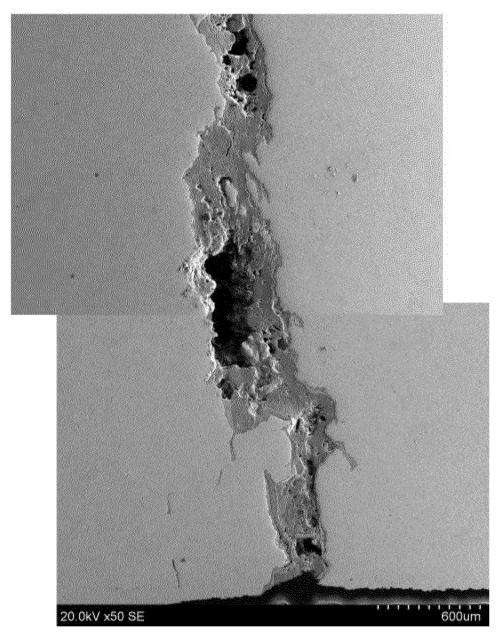


Figure 15. Composite SEM micrograph of the metallographic mount prepared by Anamet. Image reproduced from the September 6, 2013 Anamet report with permission from Anamet.

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

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

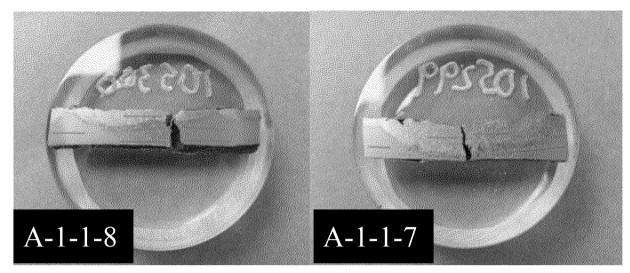


Figure 16. Metallurgical mounts of samples A-1-1-8 and A-1-1-7 made subsequent to opening the crack and examining it via optical microscopy and SEM/EDS. The red lines show where strings of microhardness testing points.

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

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

## **Chemical Analysis**

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

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

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

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

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

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

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

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

## **Mechanical Testing**

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

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

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

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

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

#### **Discussion**

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

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

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

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

#### **Conclusions**

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

#### Limitations

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

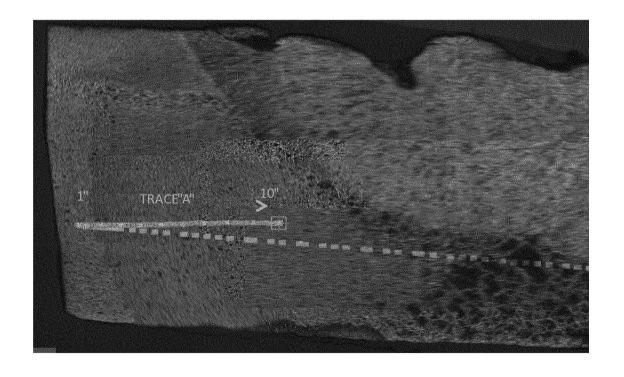
The findings presented herein are made to a reasonable degree of engineering certainty. We have made every effort to accurately and completely investigate all areas of concern identified during our investigation. If new data becomes available or there are perceived omissions or misstatements in this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

# Appendix A

**Microhardness Testing** 

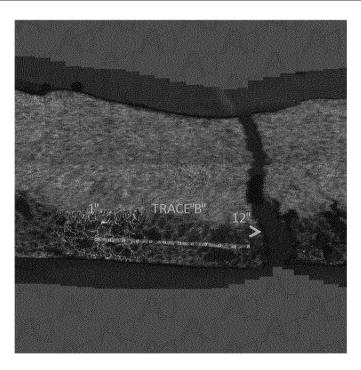
Job Number	Item Number	Comments	Operator
1306838	105299	Kevin Moore	C. Jewett

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



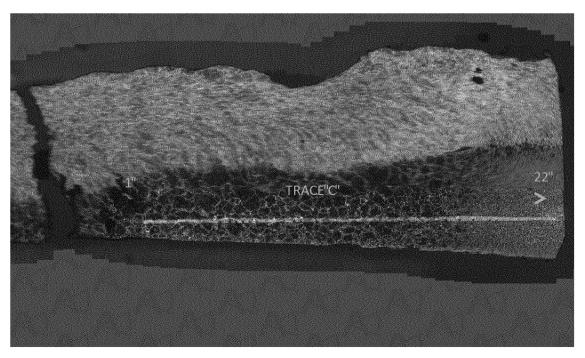
Job Number	Item Number	Comments	Operator
1306838	105299	Kevin Moore	C. Jewett

Trace B Loc	Mean Length	Hardness (HV)
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
	A	404
	Avg:	161
	Max:	187
	Min:	137



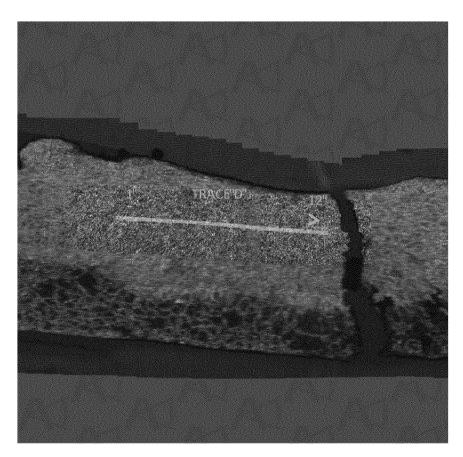
Job Number	Item Number	Comments	Operator
1306838	105299	Kevin Moore	C. Jewett

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



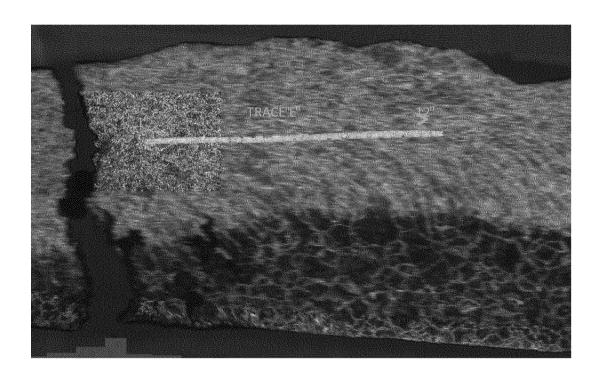
Job Number	Item Number	Comments	Operator
1306838	105299	Kevin Moore	C. Jewett

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



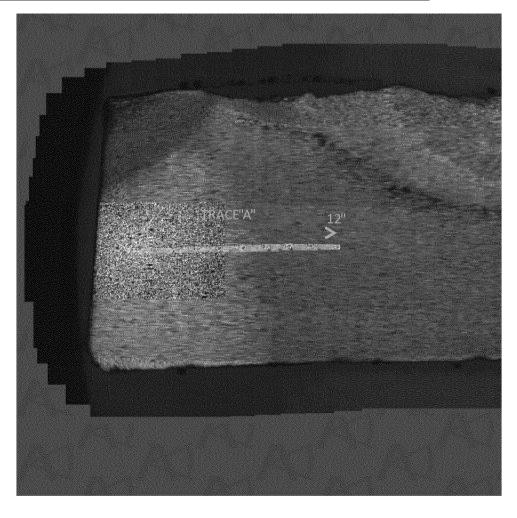
Job Number	Item Number	Comments	Operator
1306838	105299	Kevin Moore	C. Jewett

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



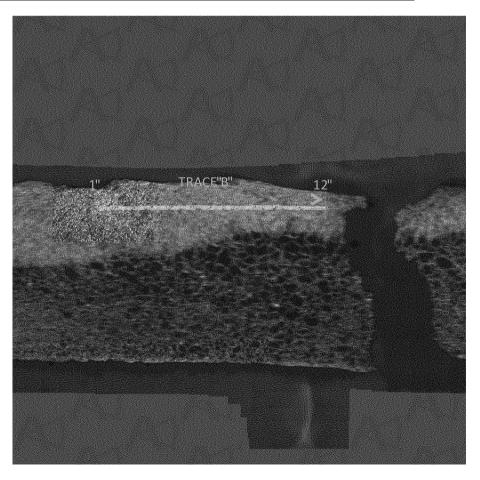
Job Number	Item Number	Comments	Operator
1306838	105300	Kevin Moore	C. Jewett

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



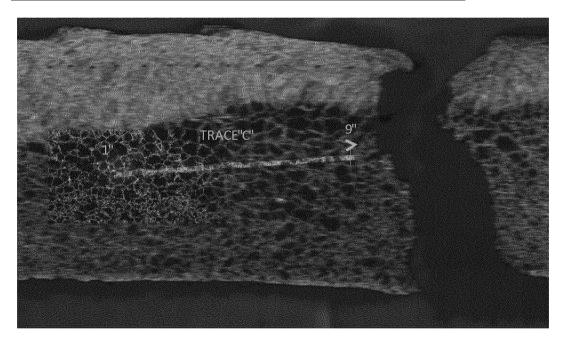
Job Number	Item Number	Comments	Operator
1306838	105300	Kevin Moore	C. Jewett

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



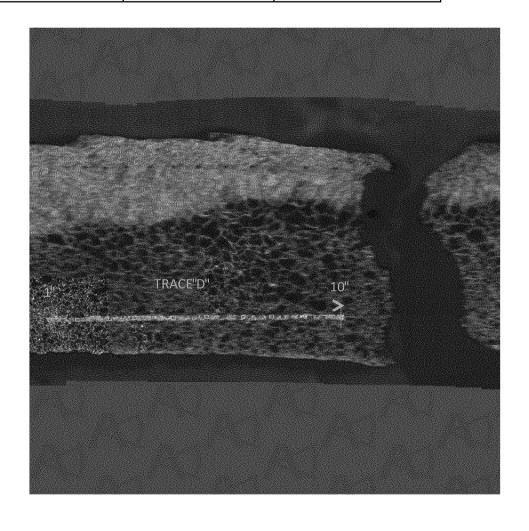
Job Number	Item Number	Comments	Operator
1306838	105300	Kevin Moore	C. Jewett

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



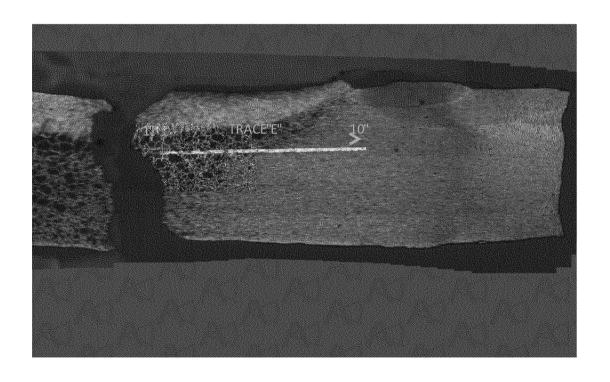
Job Number	Item Number	Comments	Operator
1306838	105300	Kevin Moore	C. Jewett

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



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

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



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

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

