



---

# CPUC Meeting Materials

Weekly Non-Destructive Examination Program Updates

March 14, 2014

DRAFT For Discussion Purposes Only

1



- PG&E/SE Alignment
  - L-114
  - Extent of Conditions for TCI Inspections
  - NDE Program Enhancements
  - NDE Program Validation Protocols/Extent of Conditions (LLNL)
- Completed Activities To Date
- Next Steps
  - Schedule
  - Immediate Needs



- See presentation dated 3/7/2014 for past items
- Completed all 43 committed digs/re-inspections (Appendix I)
- Leak Survey details
  - Leak Survey began on 600 miles of identified Gas Transmission pipeline (12/2/2013)
  - February Leak Survey Finalized :
  - Zero leaks found on weld (Girth or Long Seam)
  - PG&E requesting authorization to suspend “monthly” leak surveys (Appendix II)
- LLNL finalized “Review of PG&E Proposed Dig Plan” (Appendix III)
  - Established 3 alternatives
    - Re-inspection/Digs with 5% error
    - Re-Inspection/Digs with 2% error
    - Comprehensive analysis of weld inspections through existing film
      - PG&E working to secure LLNL’s services for Comprehensive analysis
        - Contract routing for signature

<sup>1</sup>Activity progress/completion is discussed in the Completed Activities To Date section

<sup>2</sup>Dates are contingent on weather, permit, and/or construction schedules



## LLNL Recommended Alternative

---

- Comprehensive Analysis Alternative
  - Analyze all film for 488 non-compliant welds
  - Establish conditional probability of weld flaws being present by utilizing rejection information from construction
  - Utilize probability of weld flaws within population of 488
  - Utilize non-compliant weld film and establish total % of area that can detect
  - Determine population of welds requiring re-inspection
  - Dig/Re-inspect welds requiring it
    - Speculation that many of the required digs be of the 43 PG&E has already re-inspected
    - Will need to confirm once analysis is complete
  - LLNL issued summary report on 3/13/2014 (Appendix III)

<sup>1</sup>Activity progress/completion is discussed in the Completed Activities To Date section

<sup>2</sup>Dates are contingent on weather, permit, and/or construction schedules



## Completed Activities to Date

---

- See 2/7/14 presentation for items prior to 2/1/14
- Excavated/Tested/Passed 43 welds as of 3/11/14:
  - 5 welds on L-132
  - 12 welds at Vernalis Station
  - 2 welds at Redacted Pressure Limiting Station (PLS)
  - 4 welds on L-108 (MLV38.1)
  - 4 welds at Gateway Generating Station
  - 8 welds at L-108 (MLV38.17)
  - 3 welds on DFM-1616
  - 3 welds on L-331A (WV-7)
  - 2 welds on L-302W(Appendix I)
- Completed L-114 Final Report
- Created Map of pipeline segments to be Leak Surveyed as a result of L-114 Findings
- Completed 3 monthly Leak Surveys of 600 miles of pipeline
  - Zero leaks on welds have been found



- High Level activities within the next 6 Weeks
- See 2/7/14 presentation for prior items:
  - Finalize Comprehensive Analysis of TCI Data Set
    - Establish required digs (3 months)
    - Finalize digs/re-inspections (TBD)
  - Establish LLNL contract update for analysis associated with recommended alternative for TCI Validation
    - LLNL to perform analysis of all film ~~and~~ recommendations for re-inspection
    - PG&E has contract in progress currently
- Issue revised standards/Testing/Training for NDE Program (4/15/2014)



---

# Appendix I

Summary of WV-8A Re-Inspections

DRAFT For Discussion Purposes Only

12



**Technical Services, Inc.**  
 P. O. Box 721139, Houston, Texas 77272-1139

Redacted  
 Email:   
[www.ndttechnicalservices.com](http://www.ndttechnicalservices.com)

**SUMMARY AND ASSESSMENT OF EOC – RE-INSPECTION PERFORMED ON GIRTH WELDS**

In accordance with the approved PG&E Inspection Test Plan (ITP), on March 11, 2014 a re-inspection utilizing radiographic examination with AGFA D5 film was performed on two (2) girth welds at verification dig site WV-8A  in Dunnigan, CA. Once each of the welds were radiographed they were “fingerprinted” (weld features compared against original images) to verify that the original radiographic film images of the weld matched the images of the re-inspected girth weld.

The following weld numbers were re-inspected:

<u>Original Weld Id Number</u>	<u>Re-inspection Weld Id Number</u>
Location: 8A      W-127	W-127-RI
Location: 8A      W-128	W-128-RI

The following were the results of these-inspections:

Weld Number: W-127-RI      Comments: Weld matched fingerprint and weld was determined to be acceptable to API 1104, 20th edition.

Weld Number: W-128-RI      Comments: Weld matched fingerprint and weld was determined to be acceptable to API 1104, 20th edition.

Location 8A contained two (2) 20 in. OD girth weld identified as Weld #127 & 128. A copy of WIX’s Radiographic Testing Inspection report indicating the results of their evaluation of welds examined are attached.

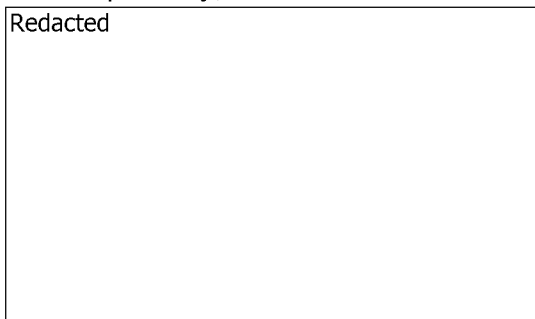


This summary completes the evaluation and documentation of the re-inspections performed on the two (2) identified girth welds on the WV-8A project in Dunnigan, CA.

Let me know should you require any additional information concerning these reviews and approvals.

Respectfully,

Redacted





Western Industrial X-Ray, Inc.  
 P.O. Box 238 Fairfield, CA  
 (707) 425-4673  
 (888) For X-Ray  
 info@wixinc.net  
 www.wixinc.net

Date 3/11/2014 Page 1 Of 1  
 Radiographic Report or Control # Rig G - 01  
 Customer PG&E  
 Address \_\_\_\_\_  
 Customer's P.O. Number \_\_\_\_\_  
 Job Location Redacted Dunnigan L302W  
 Job Number 42070345 WV-08A  
 Item Description 20" Girth Welds  
 100% Insp.  Spot Insp. \_\_\_\_\_ Percent \_\_\_\_\_

Nondestructive Inspection Report

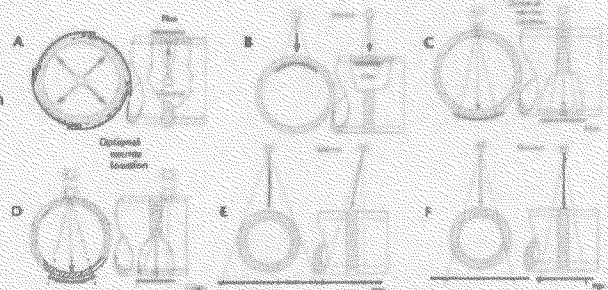
Piece or Joint #s	Weld Number	Film No.	A c c	R e j	Defect Code	Comments	Work Summary	
							Amount	Description
20" x .500" w	127 RI	3	✓				<u>2</u> Travel Hours	_____ # Persons
20" x .500" w	128 RI	3	✓				<u>0930</u> In Time	<u>1300</u> Out Time
							<u>3.5</u> Work Hours	
							_____ Standby Hours	
							<u>5.5</u> Total Hours	
							_____ Per Diem	_____ # Persons
							_____ Mileage One Way _____ Round Trip _____	
							<u>2</u> Weld <u>20</u> in. dia. _____ Weld _____ in. dia.	
							_____ Weld _____ in. dia. _____ Weld _____ in. dia.	
							_____ Weld _____ in. dia. _____ Weld _____ in. dia.	
							<u>6</u> Film <u>26" x 90</u> Type <u>D5</u>	
							_____ Film _____ x _____ Type _____	
Technique Date/Procedure Qualification								
							Inspection Specification _____	<u>API 1104</u>
							Acceptance Standard _____	<u>20th</u>
							RT Procedure No. <u>RT7</u> Shooting Sketch (RSSS) _____	<u>D</u>
							View: <u>DWE</u> <u>SWV</u> Source <u>Jr192</u> Curies _____	<u>95</u>
							Physical Source Size: <u>106x09</u> Effective Focal Spot: _____	<u>139</u>
							Pb Screens: Front <u>005</u> Center <u>NA</u> Back <u>01</u>	
							Dia. <u>20</u> Material Type: <u>X52</u> Thickness: <u>5</u> Reinf: <u>125</u>	
							SFD: <u>20</u> Source To Obj: <u>19.5</u> IQI Essential Wire: <u>1B-8 / 016</u>	
							Exp. Time: <u>2</u> min. <u>30</u> sec. Dev. Time: <u>5m</u> @ <u>68</u> deg.	
							Film Manufacturer: <u>Agfa</u> Speed: <u>D5</u> No. of Exp. <u>3</u> Film <u>3</u>	
							Geometric Unsharpness (Ug): <u>004</u> Avg. Density: <u>2.6</u>	
							Dia. _____ Material Type: _____ Thickness: _____ Reinf: _____	
							SFD: _____ Source To Obj: _____ IQI Essential Wire: _____	
							Exp. Time: _____ min. _____ sec. Dev. Time: _____ @ _____ deg.	
							Film Manufacturer: _____ Speed: _____ No. of Exp. _____ Film _____	
							Geometric Unsharpness (Ug): _____ Avg. Density: _____	
							Dia. _____ Material Type: _____ Thickness: _____ Reinf: _____	
							SFD: _____ Source To Obj: _____ IQI Essential Wire: _____	
							Exp. Time: _____ min. _____ sec. Dev. Time: _____ @ _____ deg.	
							Film Manufacturer: _____ Speed: _____ No. of Exp. _____ Film _____	
							Geometric Unsharpness (Ug): _____ Avg. Density: _____	

Defect Code

- BT - Burn Through
- C - Crack
- CV - Root Concavity
- CX - Root Convexity
- ICP - Inadequate Cross Penetration
- IF - Incomplete Fusion
- IP - Incomplete Penetration
- PD - Inadequate Penetration Due to High-Low
- P - Porosity
- SL - Slag Lines
- SI - Slag Inclusions
- UC - Undercut
- TI - Tungsten Inclusion

Level II  
 Level I

Redacted



The person signing this document represents that they have the authority to sign on the behalf of the customer. This report does not guaranty or warranty the condition of the materials tested. Western Industrial X-Ray, Inc. is not liable for any interpretation of results or losses attributable to any testing performed. There is no warranty for these services. Any liability is limited to the amount paid for the services in question. Final film interpretation is the responsibility of the customer.

Redacted

Customer's Signature

Date 3-11-2014



---

# Appendix II

PG&E Weld Quality Leak Survey Recommendation

DRAFT For Discussion Purposes Only

13

RC&E Weld Quality Control  
Leak Survey Recommendation

Background

In 2012, RC&E began reviewing its Non Destructive Examination (NDE) Program against best industry practices. As part of the RC&E Gas Operations NDE Process Improvement Initiative, the Gas Quality and Improvement (G&I) Group requested the NDE Services Group of RC&E's Applied Technology Services (ATS) to perform job observations of NDE vendors. During the performance of one of these unannounced job observations at a project site on L-114 in Brentwood, CA, the RC&E ATS NDE inspector observed TC Inspection (TCI) performing Radiographic Testing (RT) in a noncompliant manner to both the referenced code (American Petroleum Institute) API edition and their own method procedure.

Actions Taken

RC&E took immediate action, which included ceasing all work with TCI and conducting an in-depth examination of all weld inspections completed by TCI from 2012-2013. RC&E is currently working with Kieffer and Associates, as well as Lawrence Livermore National Labs (LLNL), to do a thorough review of records and to determine the best approach to verify quality. This effort will give RC&E actionable data to identify potential weld inspection gaps and develop a plan to resolve them.

In addition to the statistical work on inspection quality assessments being undertaken by LLNL, RC&E has also evaluated the quality of inspection records for 3,755 welds inspected by this vendor dating back to year 2010. RC&E has also evaluated the radiographic film quality and inspection coverage, finding potential inspection quality issues with 488 of those, as outlined below.

- 1) 137 welds - Inspections performed with the 2 exposures instead of 3
- 2) 127 welds - Inspections performed where the exposure angle is in excess of 120 degrees
- 3) 224 welds - Inspections performed with missing weld coverage

The CPUC found RC&E to be in violation of 49CFR192.243 and API 1104 for the 224 welds and RC&E was fined \$8.1 million as a result of the violation. RC&E has since excavated and evaluated the safety and the quality of inspection for 43 welds, beginning with the worst quality radiographs. These welds met criteria for API 1104 and revealed that the lower quality of radiographs has not missed any defects that would be of a size that would cause an increased pipeline safety risk or be out of compliance with API 1104.

RC&E has also initiated a monthly leak survey of pipe potentially impacted by a lack of adequate documentation or quality control practices for weld inspections. RC&E determined the scope of the leak survey by considering the following factors:

- Pipe Installation Year : Code requirements for radiography of welds were not implemented until July 1962. As a result, pipe installed prior to 1962 is not subject to the radiography quality control issues being addressed by this work. Therefore, only post-1962 pipe was considered for inclusion in the leak survey.

3/13/2014

- **Land Movement:** In discussing construction-related threats to pipeline integrity, ASME B31.8S-2004, the consensus industry standard for managing system integrity of gas pipelines and incorporated by reference into 49 CFR 192, states that “the existence of these construction related threats alone does not pose an integrity issue. The presence of these threats in conjunction with the potential for outside forces significantly increases the likelihood of an event.” The primary threat for outside forces associated with girth welds is interaction with areas of potential land movement. Therefore, only pipe with a vulnerability to land movement was included in the scope of the survey.
- **Class Location :** All Class 3 and 4 pipe meeting the prior criteria are included in the scope of the survey due to population density near the pipeline.
- **High Consequence Areas (HCAs) :** HCAs in Class 1 and 2 locations are also included in the scope of the survey due to population near the pipeline.

As a result of these criteria, approximately 600 miles of pipe were included in the scope of the survey. PG&E has conducted a leak survey of these pipelines for 3 months, and has not found any leaks during these surveys.

#### Recommendation

The supplemental leak survey was initiated to ensure the safety of the public near PG&E's pipelines. While PG&E felt a leak survey was appropriate to ensure the safety of the public in the short term, leak survey is not the most effective method to understand the overall risk associated with PG&E's welding quality control process for the following reasons:

- A leak survey only detects an issue with a weld after it has already failed, which does not educate the scope of the potential issue as effectively as a random sample of welds would.
- Since the leak rate on welds is very low (less than 1% of overall leaks), it is unlikely that the leak survey will produce significant results on the state of the welds associated with this pipe.
- Since the issue being addressed is a quality control and an inspection issue and not a construction issue, conducting a leak survey does not address how well the quality control on the weld was conducted or documented, even if it identifies an issue with the weld itself.

Based on the results of the leak survey conducted so far, the ongoing efforts with Kiefner and LLNL, and the findings so far from the in-field evaluations, PG&E believes it is appropriate to suspend these future “monthly” leak surveys pending results of the additional studies underway. If any welds excavated through the study indicate an immediate safety issue, PG&E will re-initiate the leak survey process.

3/13/2014



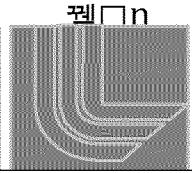
---

# Appendix III

Review of PG&E Proposed Dig Plan

DRAFT- For Discussion Purposes Only

14



Redacted

Official Use Only

LLNL-TR-649349

Official Use Only

# Review of PG&E Proposed

K. Lee, G. G. B. and L. Glascoe

February 2014

Official Use Only

## OFFICIAL USE ONLY

- : May be exempt from public release under exemption and category:
- : Exemption Department of Energy review required before public
- : Date: June 6, 2014
- : Name/org: Lee, G. Glascoe Engineering
- : Guidance: EIR-2 (August 1999)

Technical Report submitted Pacific Gas and Electric Company

Official Use Only

Official Use Only

Official Use Only





# Review of PG&E Proposed

Kristin P. Lennox, Alan Lamont, Graeme Boquet and Lee

## Executive Summary

A variety of methods were used to assess and bound risk welds that were subjected to incomplete inspections at in assessed. A comprehensive analytical approach that identified and mitigate risk more effectively based solely on the original risk based method underlying how to set estimates. A contractor inspected in a number of the welds inspections were covered. G&E proposed statistical sampling based digital remediation strategy, and requested that the plan and present possible alternatives.

From a purely technical standpoint, due to size considerations, and there are limits on that can be made due to the lack of random addressed by changing the sample size calculation and fixing the statistics may be less critical than two more. First, the confidence bound G&E proposed (95% confidence that there are 0% defects in the population) is weak, particularly for welds with 5% industry standard considered unusually high. The proposed analysis largely is not the most informative about the set of the form of nonparaphy. This is not necessarily a pessimistic view of the risk situation.

This document contains three proposed alternatives. The first alternative does not provide a comprehensive assessment of weld defect probability for suggested. This is using graphic information as well as about replacement rates for defective welds. This method can be carried out in parallel with rapidly provide an improved assessment of the state assessment is complete, the decision can be made as weld inspection is necessary. The proposed method is purely statistical in nature and designed to address problems regarding the original sampling based sample sizes. The consistent with the original sampling strategy, they would not leverage any information and the default sample sizes would provide flaw rates with the set.





Official Use Only

inspections and a lower bound on risk. The latter assumptions of the 5% bound on and are purely statistical in nature. That is, they are quality based on incomplete radiographic information.

3 Alternative Comprehensive Risk Based Method

There are difficulties in using statistical methods to address this situation:

- 1) They may not provide a low enough bound on the set of 488. In particular, the current standard flaw rate (5%) that is based on human replacement rate of welds at install time. Since we believe that improper welding was linked to imp. is to believe that the flaw rate is prior to any inspection being a lower bound could require a substantially higher sample size than that
- 2) Statistical bounds rely on key assumptions about R out. Specifically, any member of a population should have equal probability of being selected, or that all items have equal probability of exhibiting a flaw. Since welds dig plan according to standards, the of these assumptions are more likely in welds where the original radiography was poor with flaws that were not repaired are those due to poor radiography. Therefore, sampling based flawed radiography is likely to provide biased results will probably not be satisfied with the 5% bounding criteria and the assumptions, then the sample for the risk based procedure.

If, however, PG&E or their regulators desire a lower there are alternative methods to a purely statistical approach, as noted previously do not account for the partial information about weld: inspection data. Not inspections do not necessarily have probability of finding flaws; they have a reduced (or positive) finding flaws for some portion of the circumference of determined that a particular inspection had a very high change significant weld defects, they are more likely to be present. In case, only welds where the inspection is likely to be present, should be inspected for

Official Use Only



Official Use Only

expected flaw higher than PG&E and their regulators with, then the welds with the highest conditional probability for failure to the welds selected for re-inspection were chosen based on the poor quality of work it is expected that the agency has been conducting also

4 Alternative Statistical Methods

While a purely statistical approach is used of all available welds, it may be preferable to other methods. Two purely sampling based approaches providing confidence with the original analysis are the methods in terms of sampling assumptions are also

4.1 Finite Sample Analysis

The total population size is 488 welds. It is than 5% welds) is acceptable, than this can be determined how many welds must be checked. The first probability of no observed failures given a sample of population where the maximum acceptable number of (x=25) is assumed to exist. This probability can be

Pr(no observed failures | x failures total) = (C(N-x, n) / C(N, n)) \* (p^n) \* (1-p)^(N-x-n)

where N is the population size and n is the sample size. The population size is 488 welds. The sample size is 43 welds. The level of confidence is 95%. One identifies the calculated probability of observing no failures. The minimum sample size is 43 welds. The level of confidence is 90%. That the level of confidence is 95% that the flaw is 6.5%.

This method is a more rigorous method than the original PG&E sample calculation. Disadvantages of this method need for completely sampling for all welds in order for the method to be applicable. The method is a more rigorous method than the original PG&E sample calculation. Disadvantages of this method need for completely sampling for all welds in order for the method to be applicable. The method is a more rigorous method than the original PG&E sample calculation. Disadvantages of this method need for completely sampling for all welds in order for the method to be applicable.

3 John W. Sargent, Sampling Techniques, John Wiley and Sons, (1977) p. 5

Official Use Only



Official Use Only

sampling plan and comprehensive application potential advantages and disadvantages of the present

The statistical approach of the assumptions of the sample size calculation, but data prior to the anticipated low rate of weld defects. A sample size of the the give a 95% confidence 5% defect rate with 54 samples observed in a welded assumption is key for this analysis, and does not plan. An alternative that assumes a 10% defect rate is a flaw for any section of 48 welds. 5 samples observed flawed welds to conclude with 95% confidence rate for improperly inspected welds is no greater than

In the context of the the approach, is strictly rigorous; random sampling is not being carried out advisable in this case. Although the strategy of inspecting radiographic records violates the assumptions of both approaches, the results are likely to be conservative

Of potentially greater concern is the 5% upper bound records provided in the installation and discussions with subject matter experts, one would not expect to see that had never been inspected. The bound may therefore However, purely statistical approaches would require exhaustive substantially lower bounds. This is due to the fact approaches do not take into account partial information form of complete inspection data. Given that even an carries some information about weld quality, there is a rate could be more effectively by carefully analyzing the inspection data along with weld quality information from This is a problem that the authors consider most suitable problem. The strategy outlined in parallel with the existing welds, and the likely benefits assessed based on quickly. The analysis is complete, the potential need for additional