



**Pacific Gas and  
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April 5, 2012

Ms. Michelle Cooke, Director  
Consumer Protection and Safety Division  
California Public Utilities Commission  
505 Van Ness Avenue, Room 2205  
San Francisco, CA 94102-3298

Re: Status Report on Laboratory Testing of Pipe Cut-Outs

Dear Ms. Cooke:

Following the discussion on March 23, 2012 with you, Julie Halligan and Jane Yura, PG&E is providing an updated status report on laboratory testing of pipe cut-outs from PG&E's natural gas pipeline system.

The Status Report on Laboratory Testing of Pipe Cut-Outs provides a list of each pipeline piece that has been removed either for 1) cause or 2) for hydrostatic testing and any completed laboratory tests. The laboratory testing of pipe cut-outs follows the process outlined in PG&E's July 27, 2011 letter from Bill Hayes to Julie Halligan. We will provide you with an update to this report on a regular basis.

If there are any questions regarding this report, please contact me, or Joe Medina, the Director of Transmission Process and MAOP Validation Project at (925) 324-6461.

Sincerely,

Bill Gibson

cc: Julie Halligan, CPUC  
Mike Roberston, CPUC

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Trina Horner, PG&E  
Joe Medina, PG&E  
Shilpa Ramaiya, PG&E  
Sumeet Singh, PG&E  
Frances Yee, PG&E  
Jane Yura, PG&E  
Roland Trevino, PG&E  
Ben Campbell, PG&E

Redacted

Attachments

## Cut Outs for Cause

Line Number	Approx. MP	Date Removed	Reason for Removal	Removal Comments	ATS or Other Test Report #	Report Results
L-100	139.030	4/29/2011	Perform mechanical testing on the SSAW seam weld	A mid-wall manufacturing anomaly was identified at this location during a validation dig following In-Line Inspection. A sample of pipe, including the mid-wall lamination, was cut-out to further analyze the seam weld.	Anamet # 2500501493	Pipe properties confirmed. Seam weld was determined by ATS to be SSAW.
L-100	149.020	8/20/2011	Remove weld anomalies in the long-seam and girth weld	This pipe was exposed as part of an In-Line Inspection dig to validate some minor external corrosion.	ATS Field Test. No # available at this time	ATS radiographed both the SSAW long-seam and the girth weld which both contained porosity. A cut-out was performed to remove the weld anomalies. Portions of Line 100, including this section, are scheduled for hydrotesting in 2012.
132	42.900	7/14/2011	Removed Per Pipeline Engineers Request	Removed sleeve used to repair a 2009 girth weld leak. Removal will allow destructive testing to determine the cause of the leak	413.61-12.34	Radiographic report of welds at this location. Numerous spots were discovered to contain lack of fusion, elongated indications, burn through and slag.
132	42.900	7/14/2011	Girth Weld Sample to be Tested for Fitness for Service Study	Girth weld originally chosen by Pipeline Engineering for testing & use in a Fitness for Service evaluation. The CPUC requested involvement in the weld leak testing (entry above) and therefore the girth weld was removed from the Fitness for Service Study due to timing issues.	413.61-11.179	Weld is safe and fit for service in its present condition.
132	43.180	7/25/2011	Girth Weld Sample to be Tested for Fitness for Service Study	Girth weld chosen by Pipeline Engineering for testing & use in a Fitness for Service evaluation.	413.61-11.179	Weld is safe and fit for service in its present condition.
132	43.180	7/25/2011	Longitudinal Weld Repair	Factory Repaired Longitudinal weld repair removed for testing at same location as above girth weld removal	413.61-11.179	Weld is safe and fit for service in its present condition.
132	41.610	7/21/2011	Girth Weld Sample to be Tested for Fitness for Service Study	Girth weld chosen by Pipeline Engineering for testing & use in a Fitness for Service evaluation.	413.61-11.179	Weld is safe and fit for service in its present condition.
132	42.410	7/21/2011	Girth Weld Sample to be Tested for Fitness for Service Study	Girth weld chosen by Pipeline Engineering for testing & use in a Fitness for Service evaluation.	413.61-11.179	Weld is safe and fit for service in its present condition.
132	42.410	7/23/2011	Girth Weld Sample to be Tested for Fitness for Service Study	Girth weld chosen by Pipeline Engineering for testing & use in a Fitness for Service evaluation.	413.61-11.179	Weld is safe and fit for service in its present condition.
132	39.368	7/29/2011	Offset removed @ request of Sunil Shori	Offset removed @ request of Sunil Shori	N/A	No testing performed and sample being stored in Milpitas.
132	39.311	8/5/2011	1956 pipe segment removed @ request of Sunil Shori	1956 pipe segment removed @ request of Sunil Shori	GE Inspection Services Report # LAPI0005	Sample being stored in Milpitas. MP corrected from 38.414 to 39.311. The inspections performed did not discover the presence of Stress Corrosion Cracking or any other external metal loss greater than 20% nominal wall thickness at the time of inspection. The inspection did find linear indications in the downstream long-seam.

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## Cut Outs for Cause

Line Number	Approx. MP	Date Removed	Reason for Removal	Removal Comments	ATS or Other Test Report #	Report Results
132	40.830	8/13/2011	Engineers Request - Long Seam Indication	Surface indication (dent) on the long-seam weld at L-132 MP 40.83. ATS was requested to also inspect the seam weld for weld quality purpose.	413.61-11.90	<ul style="list-style-type: none"> <li>Dent - No visible evidence of internal indications</li> <li>The weld quality of the respective long seam welds are acceptable to API Specification 5L.</li> </ul>
21E	64.170	5/12/2011	Perform Charpy V-Notch Testing on ERW long seam	Removed ERW seam samples for testing to support development of the updated Acceptance Criteria Position Paper.	Anament # 2500490196	Pipe properties confirmed
21E	55.560	6/5/2011	Evaluation of ERW Seam Leak in Line 21E.	The seam flaw had caused in a leak that was subsequently repaired in 1983 by installing a welded full encirclement steel sleeve. The objective of the analysis was to determine the cause of the leak and the characteristics of the pipe to support fatigue life evaluations for hypothetical seam flaws that might remain in the pipeline.	PP016880 DNV	An ERW seam leak in Line 21-E was the result of a short, very deep lack-of-fusion defect. The mechanical properties of the pipe material meet the requirements of the applicable API 5LX specification in effect at the time of manufacture. The toughness of the pipe material is sufficient to minimize the likelihood of long ruptures at the maximum allowable operating pressure (MAOP).
177A	153.370	7/13/2011	Stuck pig in an elbow	Removed an elbow during pigging because a piece of wood caused the pig to become lodged.	Anament # 2500518014	Pipe properties confirmed
177A	140.950	7/20/2011	Stuck pig in an elbow	Removed an elbow during pigging because a piece of steel debris caused the pig to become lodged.	Anament # 2500528620	Pipe properties confirmed
177A	98.380	8/3/2011	Buckled elbow discovered by a caliper pig	Removed an elbow during pigging because it was creating an ID restriction which wouldn't allow the Geometry and MFL tools to pass through without damage. The removed elbow turned out to be buckled which was causing the ID restriction.	Anament # 2500528620	Pipe properties confirmed. The buckled elbow was confirmed as well.
300A	130.360	6/25/2011	Linear indication in seam	Excavation was performed since the as-built records show 34" seamless pipe. As a result of the seam characterization process, a linear inclusion was identified in the pipeline and approximately 20' of pipe was replaced at this location and line returned to normal pressure operating conditions.	006.3.1-11.5	The NDE Services Group of PG&E's Applied Technology Services (ATS) Division was requested to characterize the long-seam weld at two different locations of Line 300A and evaluate all exposed long seam welds. The results indicated that at both locations the weld seam is a double-submerged arc weld (DSAW). Weld quality evaluation of 4 short sections indicated that 3 of 4 had acceptable weld quality. One was unacceptable.
153	12.990	6/24/2011	Longitudinal indication	Portion of pipe crossing canal (~80 ft) cut-out after x-ray revealed a longitudinal indication.	N/A	No test ordered.
153	15333 Redacted	6/26/2011	Corrosion	Visual inspection indicated corrosion on 4 inch tap valve.	N/A	No test ordered.

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## Cut Outs for Cause

Line Number	Approx. MP	Date Removed	Reason for Removal	Removal Comments	ATS or Other Test Report #	Report Results
153	14.839	7/12/2011	Similar in age and construction to L153 MP 12.990 listed above	Portion of pipe crossing canal (~80 ft) cut-out because it was similar in age and construction to T-45 above.	N/A	No test ordered.
132	42.190	6/2/2011	Feature	Possible internal wall loss @2:30 position.	413.61-11.179	An anomaly was confirmed to be an internal deposit. No pitting, corrosion or wall loss was detected.
132	43.540	6/7/2011	Non-standard construction	Tie-in sleeve exhibiting non-standard construction features.	413.61-11.179	The feature was confirmed as being a non-standard construction practice with the sleeve possessing two longitudinal weld seams.
132	43.590	6/3/2011	No apparent long-seam	Short pipe section, miter between Segment 189.3 and 189.6.	413.61-11.179	Although internal video inspection had originally indicated that this was a section of mitered pipe with no apparent long seam, visual examination after removal showed that it was a trimmed down fitting that was actual seamless.
132	42.340	5/29/2011	External Anomaly	Visual inspection by PLE and on-site USRB staff identified.	413.61-11.179	The axial component length of the C-shaped indicated was approximately 1.5" long. The indication was determined to be a lap or lamination in the surface of the pipe created during the original manufacturing process..
<b>New Additions since CPUC submittal in August 2011</b>						
132	39.368	9/16/2011	Deactivation of Glenview Dr, San Bruno Rupture Site	Cut-out of 4'-10.5" of 24" at 1210 Claremont Dr, San Bruno for deactivation/slurry fill of L132 at San Bruno Incident site	N/A	No Test Performed. Section stored in Gilroy
132	38.930	9/15/2011	Deactivation of Glenview Dr, San Bruno Rupture Site	Cut-out of 3'-.375" of 24" at 777 Glenview Dr, San Bruno for deactivation/slurry fill of L132 at San Bruno Incident site	N/A	No Test Performed. Section stored in Gilroy
132	39.311	9/13/2011	Deactivation of Glenview Dr, San Bruno Rupture Site	Cut-out of 25'-9.5" of 30" at 1701 Earl Ave, San Bruno for deactivation of L132 at San Bruno Incident site	N/A	No Test Performed. Section stored in Gilroy
132	39.311	9/13/2011	Deactivation of Glenview Dr, San Bruno Rupture Site	Cut-out of 21'-0" of 30" at 1701 Earl Ave, San Bruno for deactivation of L132 at San Bruno Incident site	N/A	No Test Performed. Section stored in Gilroy
132	22.050	11/18/2011	Hydrotest Failure	Cut-out approximately 58'-6" of 24" SMLS 0.3125"WT installed on GM 85737 in 1947.	Analysis to begin in April 2012 at Exponent	To be determined
132	35.450	10/7/2011	Linear indication on elbow	36" elbow removed from L-132 at MP 35.45 sent to San Ramon & Anamet for analysis currently underway	Analysis to begin in April 2012 at Exponent	To be determined

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### Cut Outs for Cause

Line Number	Approx. MP	Date Removed	Reason for Removal	Removal Comments	ATS or Other Test Report #	Report Results
132	41.830	11/1/2011	Seismic/Liquefaction Risk	Cut-out 85' of existing 30" DSAW pipeline installed in 1948 due to liquefaction risks near Colma Creek in South San Francisco	N/A	No Test Performed. Section stored in Gilroy
132	41.850	11/1/2011	Seismic/Liquefaction Risk	Cut-out 14'-7" of existing 30" DSAW pipeline (and miter joint) installed in 1948 to accommodate insertion of 30" pipeline with 24"/16" in South San Francisco	N/A	No Test Performed. Section stored in Gilroy
132	42.040	11/1/2011	Seismic/Liquefaction Risk	Cut-out 126' of existing 30" DSAW installed in 1948 due to unplanned miter obstruction and allow sufficient room for inserting.	N/A	No Test Performed. Section stored in Gilroy
132	42.076	11/1/2011	Seismic/Liquefaction Risk	189.2' removed from a dog-leg in the existing pipe due to conflict with the 290.5' installation of new direct buried 30" pipe	N/A	No Test Performed. Section stored in Gilroy
132	42.136	11/1/2011	Seismic/Liquefaction Risk	316.5' removed due to conflict with new 30" direct burial	N/A	No Test Performed. Section stored in Gilroy
132	42.171	11/1/2011	Seismic/Liquefaction Risk	186.5' removed at south end and 10.2' removed at north end of Antoinette Lane due to conflict with new 24" pipe direct burial	N/A	No Test Performed. Section stored in Gilroy
132	42.175	11/1/2011	Seismic/Liquefaction Risk	18.9' removed to receive insert and make tie-in to existing [Redacted]	N/A	No Test Performed. Section stored in Gilroy
132	42.183	11/1/2011	Seismic/Liquefaction Risk	45' removed to insert 16" pipe for Mission Insert #1	N/A	No Test Performed. Section stored in Gilroy
132	42.207	11/1/2011	Seismic/Liquefaction Risk	123.2' removed to cut out unplanned miter obstacles, build offset around sewer crossing, and for insertion work	N/A	No Test Performed. Section stored in Gilroy
132	42.225	11/1/2011	Seismic/Liquefaction Risk	98.1' removed for insertion work	N/A	No Test Performed. Section stored in Gilroy
132	42.250	11/1/2011	Seismic/Liquefaction Risk	134' removed to allow for insertion work and for strength testing and project tie-in	N/A	No Test Performed. Section stored in Gilroy
109	52.710	11/15/2011	Leak	Cut-out approximately 7'-9" of 24" DSAW .03125"WT installed on GM 1956721 in 1991. Sent to ATS in San Ramon for failure analysis, which is in progress.	ATS performing NDE to locate leak. (leak is under a reinforcing saddle)	To be Determined
57A	15.500	11/13/2011	Dent	Removed two dents, one 10% deep and one 12% deep, that were identified by a geometry pig.	N/A	No test ordered.
131	42.380	12/17/2011	Dent	Removed a piece of pipe from a casing which contained a dent with metal loss.	N/A	No test ordered.
300B	284.000	10/24/2011	Seam Hydro Rupture	Bakersfield Hydrotest rupture (34" dia). Failure investigation concluded that Hydro rupture was due to pre-existing weld metal cracking and the presence of weld lack of penetration - both of which were manufacturing anomalies created during the pipe fabrication.	Kiefner Report# 12-020 Exponent Report #1108060.000 AOTO 0312 RE13	Pre-existing seam weld defects.
301A	3.000	3/10/2012	Seam Leak	Hollister SSAW Seam Leak for Failure investigation. Failure Investigation not yet started.	NDE Being Performed prior to Root Cause	To be determined

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## Cut Outs for Cause

Line Number	Approx. MP	Date Removed	Reason for Removal	Removal Comments	ATS or Other Test Report #	Report Results
151	8.400	4/7/2011	Seam Leak	Failure investigation to begin April 2012.	Anamet Lab Work In Progress	To be determined
0210-01	0.200	Approx 10/31/2011	Linear indications in pipe body.	Found during T-122C bell hole inspection. Failure investigation to begin March 2012.	Anamet Lab Work In Progress	To be determined
124A	21.320	11/30/2011	Long Seam Indication	Rejectable radiographic indications in the SSAW Seam weld. Failure investigation not started yet.	Analysis to begin in April 2012 at Exponent	To be determined
L-153	25.827	10/1/2010	Pinhole Seam Leak	Pinhole Leak in SSAW seam weld. Failure investigation completed. Cause was weld metal solidification anomaly during pipe fabrication. No evidence of service related progression (fatigue, corrosion, SCC, etc) found.	N/A	Xray confirmed pin hole leak. Submitted to Anamet for testing. No test number yet.
300A	256.210	9/1/2011	Welding Flaws in Long Seam	Review long seam weld quality for possible defects.	006.3.1-11.20	A section of L-300A at PLS4 had some visible porosity in the long seam. We engaged ATS to perform NDT and the findings were that there are some manufacturing flaws that are not acceptable by PG&E. The test were done while the line was in-service(NDT). Based on the information it was decided to cut out the section.
118	62.285	12/16/2011	Construction Defect	MAOP validation team identified PCF's listed as ANSI 150. Based on operating pressure ANSI 300 or greater is required.	N/A	Upon inspection, it was determined that 2 fittings were not manufactured fittings and therefore were replaced. No testing was necessary.
220	24.160	11/8/2010	External Corrosion	Examined Pipe and field site. Cross sectioned to examine leak. Confirmed to be external corrosion of a repair that also appeared to have been ext corr.	No failure report.MEARS did CIS Report #9101117301	Contracted MEARS to perform an on/off survey. Looking for additional corroded pipe.
124B	7.830	10/28/2010	External Corrosion	Examined Pipe and Leak site in field - Confirmed to be corrosion.	No failure report.MEARS did CIS Report# 9101117301	Contracted MEARS to perform an on/off survey. Looking for additional corroded pipe.
50A	15.150	9/30/2010	Construction Defect	100% Complete. Pipe visually examined and cross-sectioned in ATS Lab. Construction defect/porosity in the weld. No signs of corrosion.	No report generated.	Construction defects - porosity & slag in saddle (fillet) weld.
300B	76.300	12/15/2011	Weld Failure	Fizzer in weld toe at elbow weld. Ground out approx 1/8 inch and weld repaired. Cut out Repaired Weld.	In progress at Anamet Lab	Lab work is under way to determine root cause.
153	25.830	10/21/2010	Construction Defect	Cause is known to be Construction Defect (porosity/voids) in Long seam weld metal. Review of final Anamet Report 5004.5239 complete, but final wording will not effect cause or source of leak.	Anamet Lab 5004.5239	Construction defect - small pinhole leak in SSAW long seam weld metal.
114	12.580	9/10/2011	Linear indication in seam of fitting	Removed mitered angle piece with defects in seam weld.	N/A	No testing performed.
114	10.510	12/14/2011	Crack on Elbow	Removed elbow with defect and adjacent pipe with corrosion.	N/A	No testing performed.

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### Cut Outs for Cause

Line Number	Approx. MP	Date Removed	Reason for Removal	Removal Comments	ATS or Other Test Report #	Report Results
1502-11	6.350	10/12/2010	Leak at girth weld	Found due to ALS performed in last qtr 2010 (LK# 10-81004-1). On 10/12/10 installed (2) 4" PCF s with a temp by-pass and installed 1ft of 4" pre-tested pipe to remove leaking girth weld. Pipe installed was pre-tested on A-0620-01 STPR. PSRS ID: 22801 PM#: 30816669	N/A	No further testing. Location of pipe unknown and most likely scrapped.
0632-01	1.940	10/27/2010	Leak at girth weld	Grade 1 leak found on the Gas Transmission Leak Survey (LK#10-81009-1). Leak pinpointed to be on the girth weld of the 3" 0632-01 DFM that supplies Williams. PSRS ID: 22746 PM#: 30811954	TBD	Cross section of 3" weld indicates lack of fusion at the root (Analysis by Dave Aguiar)
DREG5479 (R0045)	0.01 to 0.02	10/20/2011	Insufficient pipe specs to establish Mop of 600 psig	3 sections removed for testing to validate pipe specs as part of Class Location OII. Note that the pipe in question was deactivated and replaced with new pipe on PSRS24878 PM30863585	Anamet Report #5004.7131	Confirmed as commensurate
L-50A	18.130	9/29/2011	Leak developed around cap fabricated to cover an old service tee	LK 1310810011 PSRS ID: 22837 PM#: 30817842 Section of pipe provided to [Redacted] and [Redacted]	ATS no # available	Lack of fusion between pipe and fabricated cap
153-6	0.010	Week of 4/2/12	Dent	Dent was found during camera work Hydro T-047C. It was only six feet from the tie in hole.	N/A	No testing needed because this section of pipe was replaced.
191A	2.960	7/13/2011	Dent	Dent was found on Gas Transmission Leak Survey because this section of main was exposed by a run off system.	Anamet Report #5004.6329	Testing to determine pipe specifications, including long-seam type and yield strength.
L-195	4.24	04/23/12	Verification of pipe properties for assessment of commensurate status	Removed a piece of pipe to perform destructive testing and determine yield strength. ATS did a Destructive Test (API 5L Standard).	ATS#R0080 Anament # 5004.7131	Testing confirmed pipe diameter, wall thickness and seam. Yield strength verified through destructive testing. Segment confirmed to be commensurate.
DREG5479	0.00	10/20/11	Verification of pipe properties for assessment of commensurate status	Removed a piece of pipe to perform destructive testing and determine yield strength. ATS did a Destructive Test (API 5L Standard).	ATS # R0045 Anament #5004.7131	Testing confirmed pipe diameter, wall thickness and seam. Yield strength verified through destructive testing. Segment confirmed to be commensurate.
SP3	169.39	09/25/11	Verification of pipe properties for assessment of commensurate status	Removed a piece of pipe to perform destructive testing and determine yield strength. ATS did a Destructive Test (API 5L Standard).	ATS # 413.61-11.133	Yield strength verified through destructive testing. Segment confirmed to be commensurate.

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## Cut Outs Hydro Tests

Test #	Line Number	MP1	MP2	Cut Out Date	Hydrotest Date	Test Performed by	Date Test Completed	Report #	Report Results
T-02	L-101	0.62	3.08	06/01/11	06/04/11	ATS	03/27/12	413.62-21.34	ATS examination to confirm mechanical value for data collection and analysis. Pipe coupons were x-rayed and weld zone was found to be defect free. Pipe sections met API 5L requirements.
T-03	L-101	3.08	4.66	06/01/11	06/07/11	ATS	03/27/12	413.62-12-34	ATS examination to confirm mechanical value for data collection and analysis. Pipe coupons were x-rayed and weld zone was found to be defect free. Pipe sections met API 5L requirements.
T-07	L-105A	38.00	41.00		09/29/11	ATS	03/21/12	413.62-12.13 413.62-12.14	ATS examination to confirm mechanical value for data collection and analysis. Pipe coupons were x-rayed and weld zone was found to be defect free. Pipe sections met API 5L requirements.
T-09	L-105A-1	0.00	0.00		NA			Pending with ATS	
T-10	L-105C	0.00	1.77	08/19/11	08/25/11			Pending with ATS	
T-109E	L-148	14.60	16.12	10/22/11	10/24/11			Pending with ATS	
T-109W	L-148	16.12	17.63	10/22/11	10/31/11			Pending with ATS	
T-11	L-105N	11.07	11.86	05/31/11	06/05/11	ATS	12/06/11	413.62-11.26	ATS examination to confirm mechanical value for data collection and analysis. Pipe sections met API 5L requirements.
T-112	L-191	9.47	10.58		11/13/11			Pending with ATS	
T-115	L-300A	288.96	291.44	10/01/11	10/05/11			Pending with ATS	
T-116A	L-300A	267.94	268.65	11/10/11	11/12/11			Pending with ATS	
T-116B	L-300A	269.51	269.83	11/10/11	11/13/11			Pending with ATS	
T-117	L-300B	283.85	284.62	10/21/11	10/27/11			Pending with ATS	
T-118A	L-300A	239.57	241.60	11/10/11	11/13/11			Pending with ATS	
T-118B	L-300A	241.60	243.74	11/10/11	11/15/11			Pending with ATS	

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## Cut Outs Hydro Tests

Test #	Line Number	MP1	MP2	Cut Out Date	Hydrotest Date	Test Performed by	Date Test Completed	Report #	Report Results
T-120	L-300A	384.65	385.55		11/17/11			Pending with ATS	
T-12017	L-132	40.04	40.08		11/21/11			Pending with ATS	
T-121	L-303	26.56	27.67		11/16/11			Pending with ATS	
T-122	L-0211-01	0.00	0.74		10/28/11			Pending with ATS	
T-15	L-105N	27.94	28.13	09/04/11	09/11/11			Pending with ATS	
T-16	L-105N	28.13	28.64		09/23/11			Pending with ATS	
T-17	L-105N	28.64	30.63		10/17/11			Pending with ATS	
T-19	L-114	16.52	16.59	09/10/11	09/16/11			Pending with ATS	
T-20	L-131	42.34	42.42	07/23/11	07/26/11			Pending with ATS	
T-22N	L-131	50.71	51.43	10/04/11	10/12/11			Pending with ATS	
T-22S	L-131	51.43	55.50	10/04/11	10/13/11			Pending with ATS	
T-24	L-132	0.95	1.88	10/19/11	10/23/11			Pending with ATS	
T-25A	L-132	3.05	4.00	06/14/11	06/19/11			Pending with ATS	
T-26	L-132	4.92	7.10	10/06/11	10/15/11			Pending with ATS	
T-27	L-132	7.10	8.54	08/26/11	09/05/11			Pending with ATS	
T-28	L-132	8.54	10.32	08/10/11	08/14/11			Pending with ATS	
T-29	L-132	10.32	13.95	08/26/11	09/09/11			Pending with ATS	
T-30	L-132	13.95	18.46	10/18/11	11/10/11			Pending with ATS	
T-31	L-132	18.46	23.16	11/10/11	11/12/11			Pending with ATS	
T-32	L-132	23.16	25.60	10/02/11	11/04/11			Pending with ATS	
T-33	L-132	29.06	31.95	09/24/11	10/13/11			Pending with ATS	
T-34	L-132	31.95	34.68	09/24/11	10/20/11			Pending with ATS	
T-35	L-132	34.68	38.39	09/21/11	10/30/11			Pending with ATS	
T-40	L-132A	0.01	1.45	05/03/11	05/09/11			Pending with ATS	

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## Cut Outs Hydro Tests

Test #	Line Number	MP1	MP2	Cut Out Date	Hydrotest Date	Test Performed by	Date Test Completed	Report #	Report Results
T-41	L-132A	1.46	1.47	05/03/11	05/09/11			Pending with ATS	
T-42	L-147	0.02	0.85		10/14/11			Pending with ATS	
T-43A	L-147	0.85	1.50		10/17/11			Pending with ATS	
T-43B	L-147	1.50	3.40		10/22/11			Pending with ATS	
T-44	L-153	0.00	3.45	07/18/11	07/29/11			Pending with ATS	
T-45	L-153	9.20	13.61		06/29/11			Pending with ATS	
T-46	L-153	13.62	17.62		07/09/11	ATS	03/21/12	413.62-12.16	ATS examination to confirm mechanical value for data collection and analysis. Pipe coupons were x-rayed and weld zone was found to be defect free. Pipe sections met API 5L requirements.
T-47B	L-153	18.03	20.06		11/15/11			Pending with ATS	
T-49E	L-191	6.48	7.72	11/11/11	10/31/11			Pending with ATS	
T-49W	L-191	7.72	9.44	11/11/11	11/11/11			Pending with ATS	
T-51	L-300A	121.87	122.68	06/03/11	06/08/11	ATS	03/21/12	413.62-12.17	ATS examination to confirm mechanical value for data collection and analysis. Pipe coupons were x-rayed and weld zone was found to be defect free. Pipe sections met API 5L requirements.
T-52	L-300A	127.03	127.93	06/03/11	06/06/11	ATS	03/27/12	413.62-12.18	ATS examination to confirm mechanical value for data collection and analysis. Pipe coupons were x-rayed and weld zone was found to be defect free. Pipe sections met API 5L requirements.
T-54B	L-300A	155.08	156.40	09/19/11	09/21/11			Pending with ATS	
T-55	L-300A	156.40	157.86		09/23/11			Pending with ATS	
T-56S	L-300A	157.86	159.33	09/18/11	09/27/11			Pending with ATS	
T-60	L-300A	256.22	257.08	08/05/11	08/09/11			Pending with ATS	

4/4/2012

## Cut Outs Hydro Tests

Test #	Line Number	MP1	MP2	Cut Out Date	Hydrotest Date	Test Performed by	Date Test Completed	Report #	Report Results
T-62	L-300A	345.02	345.26	06/21/11	06/26/11	ATS	02/27/12	413.62-12.01	ATS examination to confirm mechanical value for data collection and analysis. Pipe coupons were x-rayed and weld zone was found to be defect free. Pipe sections met API 5L requirements.
T-63	L-300A	353.56	353.85	06/21/11	06/24/11	ATS	03/27/12	413.62-12.19	ATS examination to confirm mechanical value for data collection and analysis. Pipe coupons were x-rayed and weld zone was found to be defect free. Pipe sections met API 5L requirements.
T-64	L-300A	414.79	416.98	12/02/11	12/05/11			Pending with ATS	
T-65A	L-300A	450.00	450.83	09/17/11	09/22/11			Pending with ATS	
T-65B	L-300A	445.59	446.48	09/17/11	09/23/11	ATS	02/27/12	413.62-12.02	ATS examination to confirm mechanical value for data collection and analysis. Pipe coupons were x-rayed and weld zone was found to be defect free. Pipe sections met API 5L requirements.
T-67A	L-300A	477.77	478.06		10/21/11			Pending with ATS	
T-67B	L-300A	475.26	475.77		10/22/11			Pending with ATS	
T-68	L-300A	480.74	483.76		11/03/11			Pending with ATS	
T-70	L-300A	490.48	490.63	07/21/11	07/25/11	ATS	02/27/12	413.62-12.03	ATS examination to confirm mechanical value for data collection and analysis. Pipe coupons were x-rayed and weld zone was found to be defect free. Pipe sections met API 5L requirements.
T-71	L-300A	490.66	493.59	07/21/11	07/29/11			Pending with ATS	
T-72	L-300A	493.59	496.05	07/28/11	08/01/11			Pending with ATS	
T-73	L-300A	496.36	499.77	07/26/11	08/02/11			Pending with ATS	
T-74	L-300A	499.77	502.23	07/26/11	08/04/11			Pending with ATS	
T-75	L-300A-1	156.40	157.86		09/25/11			Pending with ATS	

4/4/2012

## Cut Outs Hydro Tests

Test #	Line Number	MP1	MP2	Cut Out Date	Hydrotest Date	Test Performed by	Date Test Completed	Report #	Report Results
T-76	L-300B	0.15	0.46		08/28/11			Pending with ATS	
T-77	L-300B	126.88	127.50	06/14/11	06/16/11			Pending with ATS	
T-79A	L-300B	152.73	155.26	10/08/11	10/11/11			Pending with ATS	
T-79B	L-300B	160.71	160.88	10/08/11	10/17/11			Pending with ATS	
T-80	L-300B	237.45	240.56	08/13/11	08/26/11			Pending with ATS	
T-81	L-300B	256.66	257.51	08/19/11	08/22/11			Pending with ATS	
T-82	L-300B	263.46	264.46	08/19/11	08/23/11			Pending with ATS	
T-84A	L-300B	353.54	353.82	07/19/11	07/22/11			Pending with ATS	
T-84B	L-300B	354.02	354.31	07/19/11	07/22/11			Pending with ATS	
T-85	L-300B	384.06	384.90	06/22/11	06/28/11	ATS	02/27/12	413.62-12.04	ATS examination to confirm mechanical value for data collection and analysis. Pipe coupons were x-rayed and weld zone was found to be defect free. Pipe sections met API 5L requirements.
T-86	L-300B	414.79	418.03	12/09/11	12/12/11			Pending with ATS	
T-87A	L-300B	450.78	450.80	10/01/11	10/04/11	ATS	02/27/12	413.62-12.05 413.62-12.09	ATS examination to confirm mechanical value for data collection and analysis. Pipe coupons were x-rayed and weld zone was found to be defect free. Pipe sections met API 5L requirements.
T-87B	L-300B	450.05	450.78	10/01/11	10/08/11			Pending with ATS	
T-87C	L-300B	445.49	446.50	10/01/11	10/05/11			Pending with ATS	
T-89N	L-300B	489.33	490.92	08/13/11	08/20/11			Pending with ATS	
T-89S	L-300B	484.01	484.72	08/13/11	08/16/11	ATS	03/21/12	413.62-12.10	ATS examination to confirm mechanical value for data collection and analysis. Pipe coupons were x-rayed and weld zone was found to be defect free. Pipe sections met API 5L requirements.

4/4/2012

## Cut Outs Hydro Tests

Test #	Line Number	MP1	MP2	Cut Out Date	Hydrotest Date	Test Performed by	Date Test Completed	Report #	Report Results
T-90A	L-300B	490.94	493.90	08/25/11	08/28/11	ATS	03/27/12	413.62-12.11	ATS examination to confirm mechanical value for data collection and analysis. Pipe sections met API 5L requirements.
T-90B	L-300B	493.90	496.37	08/25/11	08/29/11	ATS	03/27/11	413.62-12.11	ATS examination to confirm mechanical value for data collection and analysis. Pipe sections met API 5L requirements.
T-90C	L-300B	496.37	499.33	08/25/11	08/30/11	ATS	03/27/11	413.62-12.11	ATS examination to confirm mechanical value for data collection and analysis. Pipe sections met API 5L requirements.
T-90D	L-300B	499.33	502.62	08/25/11	08/31/11	ATS	03/27/11	413.62-12.11	ATS examination to confirm mechanical value for data collection and analysis. Pipe sections met API 5L requirements.
T-93A	L-400-3	293.41	297.87		11/14/11			Pending with ATS	
T-93B	L-400	293.40	297.86		11/02/11			Pending with ATS	
T-96A (E)	SP5	2.40	3.87	05/10/11	05/16/11	ATS	03/27/12	413.62-12.33	ATS examination to confirm mechanical value for data collection and analysis. Pipe coupons were x-rayed and weld zone was found to be defect free. Pipe sections met API 5L requirements.
T-96B (W)	SP5	0.00	2.40	05/10/11	05/19/11	ATS	03/27/12	413.62-12.33	ATS examination to confirm mechanical value for data collection and analysis. Pipe coupons were x-rayed and weld zone was found to be defect free. Pipe sections met API 5L requirements.
TV-23	L-131	57.46	57.47		NA			Pending with ATS	
TV-36A	L-132	40.08	42.34		06/09/11			Pending with ATS	
TV-36B	L-132	43.34	43.61		06/13/11			Pending with ATS	
TV-47A	L-153	17.65	18.01	08/02/11	07/28/11			Pending with ATS	

4/4/2012



Applied Technology Services  
 3400 Crow Canyon Road  
 San Ramon, CA 94583

ATS Report# 413.62-11.26



**Subject: Gas Transmission Hydrostatic Pressure Tested Pipe  
 Mechanical Properties Test Results Test# T-11.**

**Introduction:**

Per request from PG&E Gas Department, a section of pipe that underwent '2011 Hydrotesting' was made available to ATS for examination. The purpose being to obtain actual mechanical values for data collection and analysis following the pipe hydro pressurization. Pipe sections were radiographed for soundness and extracted for testing per the Existing Natural Gas Transmission Pipe test plan as set forth by ATS and approved by the CPUC.

**Summary:**

A Segment of pipe identified as T-11 marked Redacted from Line 105 with a diameter 24" and wall thickness of 0.25" was tested and found to be **conforming** to API 5L-44<sup>th</sup> PSL1 pipe grades: X52,X46,X42 and B .

Actual chemical composition and transverse tensile properties from said pipe section is listed below followed by API 5L requirements

**Table 1: T11 testing results**

Element	C	Cr	Cu	Mn	Ni	P	S	V	C.E.*
Wt%	0.139	0.01	0.04	1.19	0.02	0.015	0.014	0.03	0.35

\*Carbon Equivalent (C.E.) per API 5L, Section 9.2.5

	Weld	Base metal 180° from weld
Tensile Strength (ksi)	76.2	70.5
Yield Strength (0.5% E.U.L ksi)	61.8	55.5
Elongation% (2" gage)	25	30

Date: December 6, 2011

Submitted by:

Redacted

Redacted, Materials Eng  
Redacted

Approved by:

Redacted, Supervisor -ATS Chemistry and Materials

cc: ATS Records

**Table 2: Minimum Pipe Material Strength Requirements\***

	Yield 0.5% elongation, ksi	Tensile Strength, ksi	Elongation%,	Comments
X52	52.2	66.7	~25%	%E varies slightly with size, see API 5L for details
X46	46.4	63.1		
X42	42.1	60.2		
Grade B	35.5	60.2		
PG&E**	-	-	-	Where available.

\*Per API 5L, 44<sup>th</sup> edition, Oct 01 2008

\*\*If original specification values are available, for reference.

**Table 3: Pipe Material Impact Testing**

	Average of 3 impact samples, +32F (foot-lbs)	Average of 3 impact samples, +50F (foot-lbs)	Average of 3 impact samples +32F, mils lateral expansion	Comments
Weld	19.1	22	41	20ftlbs is required for PSL 2 pipe
Base metal	15	15	39	

**Table 4: Actual Pipe vs. 5L Grade Pipe Chemistry Comparison**

	T11-Actual	B	X42	X46	X52	Comments
Carbon	0.139	0.26	0.26	0.26	0.26	
Manganese	1.19	1.20	1.30	1.40	1.40	
Phosphor	0.015	0.03	0.03	0.03	0.03	
Sulfur	0.014	0.03	0.03	0.03	0.03	
V + Nb + Ti	0.03	0.15	0.15	0.15	0.15	

Note: All 5L chemistry limits are Maximums.

**Table 5: Average Pipe Hardness Testing results**

Location	Weld Metal	Base Metal-1	Base Metal-2	HAZ-1	HAZ-2
Vickers <sub>10</sub>	166	159	161	154	162

**Test Method Notes:**

Testing was performed to ASTM current edition as documented in Anamet, Inc. test report 5004.6369.



Applied Technology Services  
 3400 Crow Canyon Road  
 San Ramon, CA 94583

ATS Report# 413.62-12.01



**Subject: Gas Transmission Pipe Mechanical Properties Test Results  
L300A T62A.**

**Introduction:**

Per request from PG&E Gas Department, a section of pipe was made available to ATS for examination for the purpose being to obtain actual mechanical values for data collection and analysis. The pipe was identified as **Line 300A: 34" T-62A, Location A.** and were radiographed for weld soundness and extracted for testing per the Existing Natural Gas Transmission Pipe test plan as set forth by ATS and approved by the CPUC.

**Summary:**

The segment of pipe location identified as **T-62A,** [Redacted] and marked from **Line 300A** with a diameter **34"** and wall thickness of **0.316,** was submitted for testing. Pipe coupons were x-rayed and the weld zone was found to be defect free. The pipe was found to be **conforming** to API 5L-44<sup>th</sup> PSL1 pipe grades: **Grade B; X42; X46; X52; X56; X60; X65.**

Actual chemical composition and transverse tensile properties from said pipe sections is listed below followed by API 5L requirements.

**Table 1: L300A 'T62A' testing results**

Element	C	Cr	Cb	Cu	Mn	Mo	Ni
Wt%	0.24	0.02	<0.005	0.06	0.92	<0.005	0.07
Element	P	Si	S	Ti	V	C.E.	
Wt%	0.018	0.02	0.032	<0.005	<0.005	0.41	

\*Carbon Equivalent (C.E. IIW) per API 5L § 9.2.5

	Weld	P.M. @ 180°
<b>Tensile Strength (ksi)</b>	83.4	78.8
<b>Yield Strength (0.5% E.U.L ksi)</b>	66.7	66.6
<b>Elongation% (2" gage)</b>	21	33

Date: February 27, 2012

Submitted by: [Redacted]

[Redacted], Materials Eng.

[Redacted]

Approved by: [Redacted], Supervisor - ~~ATS~~ Chemistry and Materials

cc: ATS Records



**Table 2: Minimum Pipe Material Strength Requirements\***

	Yield 0.5% elongation, ksi	Tensile Strength, ksi	Elongation %	Comments
X65	65.3	77.6	21	%E varies slightly with grade, see API 5L for details
X60	60.2	75.4	22	
X56	56.6	71.1	23	
X52	52.2	66.7	25	
X46	46.4	63.1	26	
X42	42.1	60.2	27	
Grade B	35.5	60.2	27	
PG&E**	-	-		Where available.

\*Per API 5L, 44<sup>th</sup> edition, Oct 01 2008

\*\*If original specification values are available, for reference.

**Table 3: Pipe Material Impact Testing**

	Average of impact samples@ +32F (foot-lbs)	Average of 3 impact samples, +50F (foot-lbs)	Average of 3 impact samples +32F (mils) lateral expansion	Comments
T62A	14	20	24	20ftlbs is required for PSL 2 pipe

**Table 4: Actual Pipe vs. 5L Grade Pipe Chemistry Comparison**

	Actual	GradeB	X42	X46 to X60	X65	Comments
Carbon	0.24	0.26				S > limit
Manganese	0.92	1.20	1.30	1.40	1.45	
Phosphorus	0.018	0.03				
Sulfur	0.032	0.03				
V + Nb + Ti	<0.005	0.15				
CE <sub>ITW</sub>	0.41	0.43				CE only for PSL2

Note: All 5L grade chemistry limits are Maximums.

**Table 5: Range of Pipe Hardness Testing values (Vickers<sub>10</sub> HV10)**

Location*	Face	Center	Root
Actual	186-198	175-188	177-183

\* Hardness taken across base metal to HAZ to weld to HAZ to base metal

**Test Method Notes:**

Testing was performed to ASTM current methods as documented in Anamet, Inc. test report 5004.6659B



Applied Technology Services  
 3400 Crow Canyon Road  
 San Ramon, CA 94583

ATS Report# 413.62-12.10



**Subject: Gas Transmission Pipe Mechanical Properties Test Results  
T89D, Line300B**

**Introduction:**

Per request from PG&E Gas Department, a section of pipe was made available to ATS for examination. The purpose being to obtain actual mechanical values for data collection and analysis. The pipe was identified as Line 300B: 34" T-89D, (Redacted) MP# 484.72. It was radiographed for weld soundness and extracted for testing per the Existing Natural Gas Transmission Pipe test plan as set forth by ATS and approved by the CPUC.

**Summary:**

The segment of pipe locations identified as T89D and marked from Line 300B with a diameter 34" and wall thickness of 0.345, was submitted for testing. Pipe coupons were x-rayed and the weld zone was found to be defect free. The pipe was found to be conforming to API 5L-44<sup>th</sup> PSL1 pipe grades: GrB; x42; x46; x52; x56, x60

Actual chemical composition and transverse tensile properties from said pipe sections is listed below followed by API 5L requirements.

**Table 1: L300B 'T89D', testing results**

Element	C	Cr	Cb	Cu	Mn	Mo	Ni
Wt%	0.27	0.02	<0.005	0.04	1.01	<0.005	0.06
Element	P	Si	S	Ti	V	C.E.	
Wt%	0.018	0.02	0.024	<0.005	<0.005	0.45	

\*Carbon Equivalent (C.E. IIW) per API 5L § 9.2.5

	<i>Weld</i>	<i>P.M. @ 180°</i>
<b>Tensile Strength (ksi)</b>	85.5	83.1
<b>Yield Strength (0.5% E.U.L ksi)</b>	60.1	60.2
<b>Elongation% (2" gage)</b>	23.5	28

Date: March 21, 2012

Redacted

Submitted by:

Redacted  
 Materials Eng.

Approved by:

Redacted  
 Supervisor -ATS Chemistry and Materials

cc: ATS Records

**Table 2: Minimum Pipe Material Strength Requirements\***

	Yield 0.5% elongation, ksi	Tensile Strength, ksi	Elongation %	Comments
<i>X65</i>	65.3	77.6	22	%E varies slightly with grade, see API 5L for details
<i>X60</i>	60.2	75.4	22	
<i>X56</i>	56.6	71.1	24	
<i>X52</i>	52.2	66.7	25	
<i>X46</i>	46.4	63.1	26	
<i>X42</i>	42.1	60.2	27	
<i>Grade B</i>	35.5	60.2	27	
<i>PG&amp;E**</i>	-	-		Where available.

\*Per API 5L, 44<sup>th</sup> edition, Oct 01 2008

\*\*If original specification values are available, for reference.

**Table 3: Pipe Material Impact Testing**

	Average of impact samples@ +32F (foot-lbs)	Average of 3 impact samples, +50F (foot-lbs)	Average of 3 impact samples +32F (mils) lateral expansion	Comments
<i>T89D</i>	10.5	15.2	18.6	20ftlbs is required for PSL 2 pipe

**Table 4: Actual Pipe vs. 5L Grade Pipe Chemistry Comparison**

	Actual	GradeB	X42	X46 to X60	X65	Comments
<b>Carbon</b>	0.27	0.26				Carbon slightly Exceeds limit.
<b>Manganese</b>	1.01	1.20	1.30	1.40	1.45	
<b>Phosphorus</b>	0.018	0.03				
<b>Sulfur</b>	0.024	0.03				
<b>V + Nb + Ti</b>	<0.005	0.15				
<i>CE<sub>IIW</sub></i>	.045	0.43				CE only for PSL2

Note: All 5L grade chemistry limits are Maximums.

**Table 5: Range of Pipe Hardness Testing values (Vickers<sub>10</sub> HV10)**

Location*	Face	Center	Root
<i>Actual</i>	176-193	165-185	170-198

\* Hardness taken across base metal to HAZ to weld to HAZ to base metal

**Test Method Notes:**

Testing was performed to ASTM current methods as documented in Anamet, Inc. test report 5004.6659B



Applied Technology Services  
 3400 Crow Canyon Road  
 San Ramon, CA 94583

ATS Report# 413.62-12.11



**Subject: Gas Transmission Pipe Mechanical Properties Test Results  
 T90, Line 300B.**

**Introduction:**

Per request from PG&E Gas Department, a section of pipe was made available to ATS for examination for the purpose being to obtain actual mechanical values for data collection and analysis. The pipe was identified as Line 300B: 34" T-90, Location D [Redacted] [Redacted] and were radiographed for weld soundness and extracted for testing per the Existing Natural Gas Transmission Pipe test plan as set forth by ATS and approved by the CPUC.

**Summary:**

The segment of pipe locations identified as T90 and marked from Line 300B with a diameter 34" and wall thickness of 0.453, was submitted for testing. The pipe was found to be **conforming** to API 5L-44<sup>th</sup> PSL1 pipe grades: GrB, x42,x46,x52,x56,x60.

Actual chemical composition and transverse tensile properties from said pipe sections is listed below followed by API 5L requirements.

**Table 1: L300B 'T90' Location D, testing results**

Element	C	Cr	Cb	Cu	Mn	Mo	Ni
Wt%	0.25	0.03	<0.005	0.08	0.98	<0.005	0.07
Element	P	Si	S	Ti	V	C.E.	
Wt%	0.013	0.05	0.026	<0.005	<0.005	0.43	

\*Carbon Equivalent (C.E. IIW) per API 5L § 9.2.5

	Weld	P.M. @ 180°
<b>Tensile Strength (ksi)</b>	87.0	79.6
<b>Yield Strength (0.5% E.U.L ksi)</b>	64.6	62.6
<b>Elongation% (2" gage)</b>	25.0	32.5

Date: March 27, 2012

[Redacted]

Submitted by:

[Redacted]

Materials Eng.

Approved by:

[Redacted]

Supervisor -ATS Chemistry and Materials

cc: ATS Records

**Table 2: Minimum Pipe Material Strength Requirements\***

	Yield 0.5% elongation, ksi	Tensile Strength, ksi	Elongation %	Comments
X65	65.3	77.6	23	%E varies slightly with grade, see API 5L for details
X60	60.2	75.4	23	
X56	56.6	71.1	25	
X52	52.2	66.7	26	
X46	46.4	63.1	28	
X42	42.1	60.2	29	
Grade B	35.5	60.2	29	
PG&E**	-	-	-	Where available.

\*Per API 5L, 44<sup>th</sup> edition, Oct 01 2008

\*\*If original specification values are available, for reference.

**Table 3: Pipe Material Impact Testing**

	Average of impact samples @ +32F (foot-lbs)	Average of 3 impact samples, +50F (foot-lbs)	Average of 3 impact samples +32F (mils) lateral expansion	Comments
T90	11.3	13.1	13	20ftlbs is required for PSL 2 pipe

**Table 4: Actual Pipe vs. 5L Grade Pipe Chemistry Comparison**

	Actual	GradeB	X42	X46 to X60	X65	Comments
Carbon	0.25		0.26			
Manganese	0.98	1.20	1.30	1.40	1.45	
Phosphorus	0.013		0.03			
Sulfur	0.026		0.03			
V + Nb + Ti	<0.005		0.15			
CE <sub>ITW</sub>	0.43		0.43			
						CE only for PSL2

Note: All 5L grade chemistry limits are Maximums.

**Table 5: Range of Pipe Hardness Testing values (Vickers<sub>10</sub> HV10)**

Location*	Face	Center	Root
Actual	186-203	179-196	183-220

\* Hardness taken across base metal to HAZ to weld to HAZ to base metal

**Test Method Notes:**

Testing was performed to ASTM current methods as documented in Anamet, Inc. test report 5004.6659B



Applied Technology Services  
 3400 Crow Canyon Road  
 San Ramon, CA 94583

ATS Report# 413.62-12.13



**Subject: Gas Transmission Pipe Mechanical Properties Test Results T-7, Line 105A, 20"O.D.**

**Introduction:**

Per request from PG&E Gas Department, a section of pipe was made available to ATS for examination for the purpose being to obtain actual mechanical values for data collection and analysis. The pipe was identified as **Line 105A: 20" T-7, Location C** [Redacted] [Redacted] and were radiographed for weld soundness and extracted for testing per the Existing Natural Gas Transmission Pipe test plan as set forth by ATS and approved by the CPUC.

**Summary:**

The segment of pipe location identified as **T-7, Loc. C**, and marked from **Line 105A** with a diameter **20" O.D** and wall thickness of **0.316"** was submitted for testing. Pipe coupons were x-rayed and the weld zone was found to be defect free. The pipe was found to be **conforming** to API 5L-44<sup>th</sup> PSL1 pipe grades: GrbB;x42;x46;x52;x56.

Actual chemical composition and transverse tensile properties from said pipe sections is listed below followed by API 5L requirements.

**Table 1: Line 105A 'T-7' testing results**

Element	C	Cr	Cb	Cu	Mn	Mo	Ni
Wt%	0.27	0.02	<0.005	0.12	1.06	<0.005	0.03
Element	P	Si	S	Ti	V	C.E.	
Wt%	0.010	0.02	0.025	<0.005	<0.005	0.46	

\*Carbon Equivalent (C.E. IIW) per API 5L § 9.2.5

	Weld	P.M. @ 180°
<b>Tensile Strength (ksi)</b>	87.3	78.2
<b>Yield Strength (0.5% E.U.L ksi)</b>	66.2	59.5
<b>Elongation% (2" gage)</b>	22	31

Date: March 21, 2012

Submitted by: [Redacted] Materials Eng.

Approved by: [Redacted] Supervisor -ATS/Chemistry and Materials

cc: ATS Records

**Table 2: Minimum Pipe Material Strength Requirements\***

	Yield 0.5% elongation, ksi	Tensile Strength, ksi	Elongation %	Comments
X65	65.3	77.6	21	%E varies slightly with grade, see API 5L for details
X60	60.2	75.4	22	
X56	56.6	71.1	23	
X52	52.2	66.7	24	
X46	46.4	63.1	26	
X42	42.1	60.2	27	
Grade B	35.5	60.2	27	
PG&E**	-	-	-	Where available.

\*Per API 5L, 44<sup>th</sup> edition, Oct 01 2008

\*\*If original specification values are available, for reference.

**Table 3: Pipe Material Impact Testing**

	Average of impact samples@ +32F (foot-lbs)	Average of 3 impact samples, +50F (foot-lbs)	Average of 3 impact samples +32F (mils) lateral expansion	Comments
T-7	8.0	13.0	15.66	20ftlbs is required for PSL 2 pipe

**Table 4: Actual Pipe vs. 5L Grade Pipe Chemistry Comparison**

	Actual	GradeB	X42	X46 to X60	X65	Comments
Carbon	0.27			0.26		Carbon > limit
Manganese	1.06	1.20	1.30	1.40	1.45	
Phosphorus	0.010			0.03		
Sulfur	0.025			0.03		
V + Nb + Ti	0.00			0.15		
CE <sub>ITW</sub>	0.46			0.43		CE only for PSL2

Note: All 5L grade chemistry limits are Maximums.

**Table 5: Range of Pipe Hardness Testing values (Vickers<sub>10</sub> HV10)**

Location*	Face	Center	Root
Actual	176-201	166-203	172-188

\* Hardness taken across base metal to HAZ to weld to HAZ to base metal

**Test Method Notes:**

Testing was performed to ASTM current methods as documented in Anamet, Inc. test report 5004.6659, Rev.2.



Applied Technology Services  
 3400 Crow Canyon Road  
 San Ramon, CA 94583

ATS Report# 413.62-12.14



**Subject: Gas Transmission Pipe Mechanical Properties Test Results  
Line 105A, T-7", 30" O.D., Location C.**

**Introduction:**

Per request from PG&E Gas Department, a section of pipe was made available to ATS for examination for the purpose being to obtain actual mechanical values for data collection and analysis. The pipe was identified as **Line 105A: 30" T-7, Location C** (Redacted) and were radiographed for weld soundness and extracted for testing per the Existing Natural Gas Transmission Pipe test plan as set forth by ATS and approved by the CPUC.

**Summary:**

The segment of pipe location identified as **T-7, Location C**, and marked from **Line 105A** with a diameter **30"** and wall thickness of **0.320"** was submitted for testing. Pipe coupons were x-rayed and the weld zone was found to be defect free. The pipe was found to be **conforming** to API 5L-44<sup>th</sup> PSL1 pipe grades: GrB,x42,x46,x52.

Actual chemical composition and transverse tensile properties from said pipe sections is listed below followed by API 5L requirements.

**Table 1: Line105A 'T-7', 30" testing results**

<b>Element</b>	<b>C</b>	<b>Cr</b>	<b>Cb</b>	<b>Cu</b>	<b>Mn</b>	<b>Mo</b>	<b>Ni</b>
Wt%	0.21	0.03	<0.005	0.07	0.94	<0.005	0.07
<b>Element</b>	<b>P</b>	<b>Si</b>	<b>S</b>	<b>Ti</b>	<b>V</b>	<b>C.E.</b>	
Wt%	0.010	0.04	0.021	<0.005	<0.005	0.38	

\*Carbon Equivalent (C.E. IIW) per API 5L § 9.2.5

	<b>Weld</b>	<b>P.M. @ 180°</b>
<b>Tensile Strength (ksi)</b>	87.1	77.4
<b>Yield Strength (0.5% E.U.L ksi)</b>	66.1	56.3
<b>Elongation% (2" gage)</b>	20.5	30.5

Date: March 21, 2012

Submitted by: (Redacted)  
 (Redacted) Materials Eng.

(Redacted)

Approved by (Redacted) Supervisor -AVS Chemistry and Materials

cc: ATS Records



**Table 2: Minimum Pipe Material Strength Requirements\***

	Yield 0.5% elongation, ksi	Tensile Strength, ksi	Elongation %	Comments
X65	65.3	77.6	21	%E varies slightly with grade, see API 5L for details
X60	60.2	75.4	22	
X56	56.6	71.1	23	
X52	52.2	66.7	24	
X46	46.4	63.1	26	
X42	42.1	60.2	27	
Grade B	35.5	60.2	27	
PG&E**	-	-	-	Where available.

\*Per API 5L, 44<sup>th</sup> edition, Oct 01 2008

\*\*If original specification values are available, for reference.

**Table 3: Pipe Material Impact Testing**

	Average of impact samples@ +32F (foot-lbs)	Average of 3 impact samples, +50F (foot-lbs)	Average of 3 impact samples +32F (mils) lateral expansion	Comments
T-7, 30"	9.5	13	20.66	20ftlbs is required for PSL 2 pipe

**Table 4: Actual Pipe vs. 5L Grade Pipe Chemistry Comparison**

	Actual	GradeB	X42	X46 to X60	X65	Comments
Carbon	0.21	0.26				
Manganese	0.94	1.20	1.30	1.40	1.45	
Phosphorus	0.010	0.03				
Sulfur	0.021	0.03				
V + Nb + Ti	<0.005	0.15				
CE <sub>ITW</sub>	0.38	0.43				
						CE only for PSL2

Note: All 5L grade chemistry limits are Maximums.

**Table 5: Range of Pipe Hardness Testing values (Vickers<sub>10</sub> HV10)**

Location*	Face	Center	Root
Actual	175-203	162-201	177-192

\* Hardness taken across base metal to HAZ to weld to HAZ to base metal

**Test Method Notes:**

Testing was performed to ASTM current methods as documented in Anamet, Inc. test report 5004.6659, Rev.2.



Applied Technology Services  
 3400 Crow Canyon Road  
 San Ramon, CA 94583

ATS Report# 413.62-12.16



**Subject: Gas Transmission Pipe Mechanical Properties Test Results  
T-46, Line 153, 34"**

**Introduction:**

Per request from PG&E Gas Department, a section of pipe was made available to ATS for examination for the purpose being to obtain actual mechanical values for data collection and analysis. The pipe was identified as **T-46, Line 153, 34"**, MP 14.839, and were radiographed for weld soundness and extracted for testing per the Existing Natural Gas Transmission Pipe test plan as set forth by ATS and approved by the CPUC.

**Summary:**

The segment of pipe location identified as **T-46**, and marked from **Line 153** with a diameter **34"** and wall thickness of **0.314**, was submitted for testing. Pipe coupons were x-rayed and the weld zone was found to be defect free. The pipe was found to be **conforming** to API 5L-44<sup>th</sup> PSL1 pipe grades: GrB;x42;x46;x52;x56;x60;x65.

Actual chemical composition and transverse tensile properties from said pipe sections is listed below followed by API 5L requirements.

*Table 1: Line 153 'T-46' testing results*

Element	C	Cr	Cb	Cu	Mn	Mo	Ni
Wt%	0.29	0.03	<0.005	0.09	0.93	<0.005	0.07
Element	P	Si	S	Ti	V	C.E.	
Wt%	0.023	<0.01	0.033	<0.005	<0.005	0.46	

\*Carbon Equivalent (C.E. IIW) per API 5L § 9.2.5

	Weld	P.M. @ 180°
<b>Tensile Strength (ksi)</b>	83.6	82.3
<b>Yield Strength (0.5% E.U.L ksi)</b>	67.1	66.9
<b>Elongation% (2" gage)</b>	23	30

Date: March 21, 2012

Submitted by: Redacted

Redacted Materials Eng.

Approved by: Redacted

Redacted Supervisor -ATS/Chemistry and Materials

cc: ATS Records

**Table 2: Minimum Pipe Material Strength Requirements\***

	Yield 0.5% elongation, ksi	Tensile Strength, ksi	Elongation %	Comments
X65	65.3	77.6	22	%E varies slightly with grade, see API 5L for details.
X60	60.2	75.4	23	
X56	56.6	71.1	24	
X52	52.2	66.7	25	
X46	46.4	63.1	27	
X42	42.1	60.2	28	
Grade B	35.5	60.2	28	
PG&E**	-	-	-	Where available.

\*Per API 5L, 44<sup>th</sup> edition, Oct 01 2008

\*\*If original specification values are available, for reference.

**Table 3: Pipe Material Impact Testing**

	Average of impact samples@ +32F (foot-lbs)	Average of 3 impact samples, +50F (foot-lbs)	Average of 3 impact samples +32F (mils) lateral expansion	Comments
T-46	10.3	13.2	14.3	20ftlbs is required for PSL 2 pipe

**Table 4: Actual Pipe vs. 5L Grade Pipe Chemistry Comparison**

	Actual	GradeB	X42	X46 to X60	X65	Comments
Carbon	0.29	0.26				Carbon and S > limit
Manganese	0.93	1.20	1.30	1.40	1.45	
Phosphorus	0.023	0.03				
Sulfur	0.033	0.03				
V + Nb + Ti	0.015	0.15				
CE <sub>HW</sub>	0.46	0.43				CE only for PSL2

Note: All 5L grade chemistry limits are Maximums.

**Table 5: Range of Pipe Hardness Testing values (Vickers<sub>10</sub> HV10)**

Location*	Face	Center	Root
Actual	186-191	166-177	166-181

\* Hardness taken across base metal to HAZ to weld to HAZ to base metal

**Test Method Notes:**

Testing was performed to ASTM current methods as documented in Anamet, Inc. test report 5004.6593 Rev.2



Applied Technology Services  
 3400 Crow Canyon Road  
 San Ramon, CA 94583

ATS Report# 413.62-12.17



**Subject: Gas Transmission Pipe Mechanical Properties Test Results  
Line 300A, T-51A.**

**Introduction:**

Per request from PG&E Gas Department, a section of pipe was made available to ATS for examination for the purpose being to obtain actual mechanical values for data collection and analysis. The pipe was identified as **Line 300A: 34" T-51A**, and were radiographed for weld soundness and extracted for testing per the Existing Natural Gas Transmission Pipe test plan as set forth by ATS and approved by the CPUC.

**Summary:**

The segment of pipe location identified as **T-51A**, (Redacted), and marked from Line **Line 300A** with a diameter **34"** and wall thickness of **0.314**, was submitted for testing. Pipe coupons were x-rayed and the weld zone was found to be defect free. The pipe was found to be **conforming** to API 5L-44<sup>th</sup> PSL1 pipe grades: GrB;x42;x46;x52;x56;x60.

Actual chemical composition and transverse tensile properties from said pipe sections is listed below followed by API 5L requirements.

**Table 1: Line 300A 'T-51A' testing results**

Element	C	Cr	Cb	Cu	Mn	Mo	Ni
Wt%	0.27	0.03	0.00	0.05	0.97	<0.005	0.07
Element	P	Si	S	Ti	V	C.E.	
Wt%	0.029	0.06	0.033	<0.005	<0.005	0.45	

\*Carbon Equivalent (C.E. IIW) per API 5L § 9.2.5

	<i>Weld</i>	<i>P.M. @ 180°</i>
<b>Tensile Strength (ksi)</b>	89.7	82.9
<b>Yield Strength (0.5% E.U.L ksi)</b>	76.9	62.6
<b>Elongation% (2" gage)</b>	22.5	31.5

Date: March 21, 2012

Submitted by: [Redacted]  
 [Redacted] Materials Eng.

[Redacted]  
 Approved by: [Redacted] Supervisor -ATS/Chemistry and Materials

cc: ATS Records

**Table 2: Minimum Pipe Material Strength Requirements\***

	Yield 0.5% elongation, ksi	Tensile Strength, ksi	Elongation %	Comments
X65	65.3	77.6	21	%E varies slightly with grade, see API 5L for details
X60	60.2	75.4	22	
X56	56.6	71.1	23	
X52	52.2	66.7	24	
X46	46.4	63.1	26	
X42	42.1	60.2	27	
Grade B	35.5	60.2	27	
PG&E**	-	-	-	Where available.

\*Per API 5L, 44<sup>th</sup> edition, Oct 01 2008

\*\*If original specification values are available, for reference.

**Table 3: Pipe Material Impact Testing**

	Average of impact samples@ +32F (foot-lbs)	Average of 3 impact samples, +50F (foot-lbs)	Average of 3 impact samples +32F (mils) lateral expansion	Comments
T-51A	10.8	12.5	20.0	20ftlbs is required for PSL 2 pipe

**Table 4: Actual Pipe vs. 5L Grade Pipe Chemistry Comparison**

	Actual	GradeB	X42	X46 to X60	X65	Comments
Carbon	0.27		0.26			C.S > limit
Manganese	0.97	1.20	1.30	1.40	1.45	
Phosphorus	0.029		0.03			
Sulfur	0.033		0.03			
V + Nb + Ti	<0.005		0.15			
CE <sub>tot</sub>	0.45		0.43			CE only for PSL2

Note: All 5L grade chemistry limits are Maximums.

**Table 5: Range of Pipe Hardness Testing values (Vickers<sub>10</sub> HV10)**

Location*	Face	Center	Root
Actual	196-198	182-198	186-196

\* Hardness taken across base metal to HAZ to weld to HAZ to base metal

**Test Method Notes:**

Testing was performed to ASTM current methods as documented in Anamet, Inc. test report 5004.6593, Rev.2



Applied Technology Services  
 3400 Crow Canyon Road  
 San Ramon, CA 94583

ATS Report# 413.62-12.18



**Subject: Gas Transmission Pipe Mechanical Properties Test Results  
Line300A, T-52A.**

**Introduction:**

Per request from PG&E Gas Department, a section of pipe was made available to ATS for examination for the purpose being to obtain actual mechanical values for data collection and analysis. The pipe was identified as **Line 300A: 34" T-52A, Location** and were radiographed for weld soundness and extracted for testing per the Existing Natural Gas Transmission Pipe test plan as set forth by ATS and approved by the CPUC.

**Summary:**

The segment of pipe location identified as **T-52A, [Redacted]**, and marked from **Line 300A** with a diameter **34"** and wall thickness of **0.314**, was submitted for testing. Pipe coupons were x-rayed and the weld zone was found to be defect free. The pipe was found to be **conforming** to API 5L-44<sup>th</sup> PSL1 pipe grades: Gr B;x42;x46;x52;x56;x60.

Actual chemical composition and transverse tensile properties from said pipe sections is listed below followed by API 5L requirements.

**Table 1: Line 300A 'T-52A' testing results**

Element	C	Cr	Cb	Cu	Mn	Mo	Ni
Wt%	0.29	0.02	<0.005	0.05	1.00	<0.005	0.07
Element	P	Si	S	Ti	V	C.E.	
Wt%	0.031	0.04	0.028	<0.005	<0.005	0.47	

\*Carbon Equivalent (C.E. IIW) per API 5L § 9.2.5

	Weld	P.M. @ 180°
<b>Tensile Strength (ksi)</b>	91.4	86.6
<b>Yield Strength (0.5% E.U.L ksi)</b>	76.7	62.9
<b>Elongation% (2" gage)</b>	18.5	30.0

Date: March 27, 2012

[Redacted]

Submitted by:

[Redacted]

Materials Eng.

Approved by:

[Redacted]

Supervisor -ATS Chemistry and Materials

cc: ATS Records

**Table 2: Minimum Pipe Material Strength Requirements\***

	Yield 0.5% elongation, ksi	Tensile Strength, ksi	Elongation %	Comments
X65	65.3	77.6	21	%E varies slightly with grade, see API 5L for details
X60	60.2	75.4	22	
X56	56.6	71.1	23	
X52	52.2	66.7	24	
X46	46.4	63.1	26	
X42	42.1	60.2	27	
Grade B	35.5	60.2	27	
PG&E**	-	-	-	Where available.

\*Per API 5L, 44<sup>th</sup> edition, Oct 01 2008

\*\*If original specification values are available, for reference.

**Table 3: Pipe Material Impact Testing**

	Average of impact samples@ +32F (foot-lbs)	Average of 3 impact samples, +50F (foot-lbs)	Average of 3 impact samples +32F (mils) lateral expansion	Comments
T-52A	9.3	12.0	20.7	20ftlbs is required for PSL 2 pipe

**Table 4: Actual Pipe vs. 5L Grade Pipe Chemistry Comparison**

	Actual	GradeB	X42	X46 to X60	X65	Comments
Carbon	0.29	0.26				C,P> limit
Manganese	1.00	1.20	1.30	1.40	1.45	
Phosphorus	0.031	0.03				
Sulfur	0.028	0.03				
V + Nb + Ti	<0.005	0.15				
CE <sub>ITW</sub>	0.47	0.43				CE only for PSL2

Note: All 5L grade chemistry limits are Maximums.

**Table 5: Range of Pipe Hardness Testing values (Vickers<sub>10</sub> HV10)**

Location*	Face	Center	Root
Actual	194-201	180-201	179-203

\* Hardness taken across base metal to HAZ to weld to HAZ to base metal

**Test Method Notes:**

Testing was performed to ASTM current methods as documented in Anamet, Inc. test report 5004.6593, Rev.2



Applied Technology Services  
 3400 Crow Canyon Road  
 San Ramon, CA 94583

ATS Report# 413.62-12.19



**Subject: Gas Transmission Pipe Mechanical Properties Test Results  
Line 300A, T-63A.**

**Introduction:**

Per request from PG&E Gas Department, a section of pipe was made available to ATS for examination for the purpose being to obtain actual mechanical values for data collection and analysis. The pipe was identified as Line 300A: 34", T-63A, and were radiographed for weld soundness and extracted for testing per the Existing Natural Gas Transmission Pipe test plan as set forth by ATS and approved by the CPUC.

**Summary:**

The segment of pipe location identified as T-63A [Redacted] and marked from Line 300A with a diameter 34" and wall thickness of 0.513, was submitted for testing. Pipe coupons were x-rayed and the weld zone was found to be defect free. The pipe was found to be conforming to API 5L-44<sup>th</sup> PSL1 pipe grades: Gr B,x42,x46,x52,x56,x60.

Actual chemical composition and transverse tensile properties from said pipe sections is listed below followed by API 5L requirements.

**Table 1: L300A 'T-63A' testing results**

Element	C	Cr	Cb	Cu	Mn	Mo	Ni
Wt%	0.27	0.02	<0.005	0.13	0.97	<0.005	0.08
Element	P	Si	S	Ti	V	C.E.	
Wt%	0.028	0.04	0.028	<0.005	<0.005	0.45	

\*Carbon Equivalent (C.E. IIW) per API 5L § 9.2.5

	<i>Weld</i>	<i>P.M. @ 180°</i>
<b>Tensile Strength (ksi)</b>	89.6	84.0
<b>Yield Strength (0.5% E.U.L ksi)</b>	70.3	61.6
<b>Elongation% (2" gage)</b>	23.5	33.5

Date: March 27, 2012

Submitted by: [Redacted]  
 [Redacted] Materials Eng.

[Redacted]  
 Approved by: [Redacted], Supervisor - ~~ATS~~ Chemistry and Materials

cc: ATS Records



**Table 2: Minimum Pipe Material Strength Requirements\***

	Yield 0.5% elongation, ksi	Tensile Strength, ksi	Elongation %	Comments
X65	65.3	77.6	23	%E varies slightly with grade, see API 5L for details
X60	60.2	75.4	24	
X56	56.6	71.1	25	
X52	52.2	66.7	27	
X46	46.4	63.1	28	
X42	42.1	60.2	29	
Grade B	35.5	60.2	29	
PG&E**	-	-	-	Where available.

\*Per API 5L, 44<sup>th</sup> edition, Oct 01 2008

\*\*If original specification values are available, for reference.

**Table 3: Pipe Material Impact Testing**

	Average of impact samples@ +32F (foot-lbs)	Average of 3 impact samples, +50F (foot-lbs)	Average of 3 impact samples +32F (mils) lateral expansion	Comments
T-63A	10.8	17.0	16.0	20ftlbs is required for PSL 2 pipe

**Table 4: Actual Pipe vs. 5L Grade Pipe Chemistry Comparison**

	Actual	GradeB	X42	X46 to X60	X65	Comments
Carbon	0.27		0.26			C > limit
Manganese	0.97	1.20	1.30	1.40	1.45	
Phosphorus	0.028		0.03			
Sulfur	0.028		0.03			
V + Nb + Ti	<0.005		0.15			
CE <sub>max</sub>	0.45		0.43			CE only for PSL2

Note: All 5L grade chemistry limits are Maximums.

**Table 5: Range of Pipe Hardness Testing values (Vickers<sub>10</sub> HV10)**

Location*	Face	Center	Root
Actual	188-209	172-192	206-209

\* Hardness taken across base metal to HAZ to weld to HAZ to base metal

**Test Method Notes:**

Testing was performed to ASTM current methods as documented in Anamet, Inc. test report 5004.6593, Rev.2



Applied Technology Services  
 3400 Crow Canyon Road  
 San Ramon, CA 94583

ATS Report# 413.62-12.02



**Subject: Gas Transmission Pipe Mechanical Properties Test Results  
L300A T65B.**

**Introduction:**

Per request from PG&E Gas Department, a section of pipe was made available to ATS for examination for the purpose being to obtain actual mechanical values for data collection and analysis. The pipe was identified as **Line 300A: 34" T-65B, Location A** (Redacted) and were radiographed for weld soundness and extracted for testing per the Existing Natural Gas Transmission Pipe test plan as set forth by ATS and approved by the CPUC.

**Summary:**

The segment of pipe locations identified as **T65B** and marked from **Line 300A** with a diameter **34"** and wall thickness of **0.345**, was submitted for testing. Pipe coupons were x-rayed and the weld zone was found to be defect free. The pipe was found to be **conforming** to the strength requirements of API 5L-44<sup>th</sup> PSL1 pipe grades: **GrB; x42;x46;x52;x56;x60;x65**

Actual chemical composition and transverse tensile properties from said pipe sections is listed below followed by API 5L requirements.

**Table 1: L300A 'T65B' Location A, testing results**

Element	C	Cr	Cb	Cu	Mn	Mo	Ni
Wt%	0.27	0.02	<0.005	0.06	0.99	<0.005	0.07
Element	P	Si	S	Ti	V	C.E.	
Wt%	0.016	0.02	0.050	<0.005	<0.005	0.45	

\*Carbon Equivalent (C.E. IIW) per API 5L § 9.2.5

	Weld	P.M. @ 180°
<b>Tensile Strength (ksi)</b>	88.0	82.8
<b>Yield Strength (0.5% E.U.L ksi)</b>	72.0	66.6
<b>Elongation% (2" gage)</b>	22	30.5

Date: February 27, 2012

Submitted by: (Redacted)  
 (Redacted), Materials Eng.

Approved by: (Redacted)  
 (Redacted), Supervisor -ATS Chemistry and Materials

cc: ATS Records

**Table 2: Minimum Pipe Material Strength Requirements\***

	Yield 0.5% elongation, ksi	Tensile Strength, ksi	Elongation %	Comments
<i>X65</i>	65.3	77.6	22	%E varies slightly with grade, see API 5L for details
<i>X60</i>	60.2	75.4	22	
<i>X56</i>	56.6	71.1	23	
<i>X52</i>	52.2	66.7	25	
<i>X46</i>	46.4	63.1	26	
<i>X42</i>	42.1	60.2	27	
<i>Grade B</i>	35.5	60.2	27	
<i>PG&amp;E**</i>	-	-		Where available.

\*Per API 5L, 44<sup>th</sup> edition, Oct 01 2008

\*\*If original specification values are available, for reference.

**Table 3: Pipe Material Impact Testing**

	Average of impact samples@ +32F (foot-lbs)	Average of 3 impact samples, +50F (foot-lbs)	Average of 3 impact samples +32F (mils) lateral expansion	Comments
<i>T65B</i>	13.5	16	22	20ftlbs is required for PSL 2 pipe

**Table 4: Actual Pipe vs. 5L Grade Pipe Chemistry Comparison**

	Actual	GradeB	X42	X46 to X60	X65	Comments
<b>Carbon</b>	.27	0.26				Carbon, Sulfur, CE Exceed current API 5L standards
<b>Manganese</b>	0.99	1.20	1.30	1.40	1.45	
<b>Phosphorus</b>	0.016	0.03				
<b>Sulfur</b>	0.050	0.03				
<b>V + Nb + Ti</b>	<0.005	0.15				
<i>CE<sub>IIW</sub></i>	.045	0.43				CE only for PSL2

Note: All 5L grade chemistry limits are Maximums.

**Table 5: Range of Pipe Hardness Testing values (Vickers<sub>10</sub> HV10)**

Location*	Face	Center	Root
<i>Actual</i>	188-201	182-205	181-194

\* Hardness taken across base metal to HAZ to weld to HAZ to base metal

**Test Method Notes:**

Testing was performed to ASTM current methods as documented in Anamet, Inc. test report 5004.6659B



Applied Technology Services  
 3400 Crow Canyon Road  
 San Ramon, CA 94583

ATS Report# 413.62-12.03



**Subject: Gas Transmission Pipe Mechanical Properties Test Results  
Line 300A T-70.**

**Introduction:**

Per request from PG&E Gas Department, a section of pipe was made available to ATS for examination for the purpose being to obtain actual mechanical values for data collection and analysis. The pipe was identified as **Line 300A: 34" T-70, site A** (Redacted) (Redacted) and were radiographed for weld soundness and extracted for testing per the Existing Natural Gas Transmission Pipe test plan as set forth by ATS and approved by the CPUC.

**Summary:**

The segment of pipe locations identified as **T-70** and marked from **Line 300A** with a diameter **34"** and wall thickness of **0.515**, was submitted for testing. Pipe coupons were x-rayed and the weld zone was found to be defect free. The pipe was found to be **conforming** to API 5L-44<sup>th</sup> PSL1 pipe grades: **B, x42, x46, x52, x56, x60, x65**.

Actual chemical composition and transverse tensile properties from said pipe sections is listed below followed by API 5L requirements.

**Table 1: L300A 'T70' site A, testing results**

<b>Element</b>	<b>C</b>	<b>Cr</b>	<b>Cb</b>	<b>Cu</b>	<b>Mn</b>	<b>Mo</b>	<b>Ni</b>
Wt%	0.082	0.07	0.04	0.22	1.21	0.03	0.09
<b>Element</b>	<b>P</b>	<b>Si</b>	<b>S</b>	<b>Ti</b>	<b>V</b>	<b>C.E.</b>	
Wt%	0.008	0.34	<0.005	0.02	0.03	0.33	

\*Carbon Equivalent (C.E. IIW) per API 5L § 9.2.5

	<b>Weld</b>	<b>P.M. @ 180°</b>
<b>Tensile Strength (ksi)</b>	87.8	83.4
<b>Yield Strength (0.5% E.U.L ksi)</b>	68.8	67.7
<b>Elongation% (2" gage)</b>	30	38.5

Date: February 27, 2012

Submitted by: (Redacted)  
 (Redacted), Materials Eng.

(Redacted)  
 Approved by (Redacted), Supervisor -ATS Chemistry and Materials

cc: ATS Records

**Table 2: Minimum Pipe Material Strength Requirements\***

	Yield 0.5% elongation, ksi	Tensile Strength, ksi	Elongation %	Comments
<i>X65</i>	65.3	77.6	23	%E varies slightly with grade, see API 5L for details
<i>X60</i>	60.2	75.4	24	
<i>X56</i>	56.6	71.1	25	
<i>X52</i>	52.2	66.7	27	
<i>X46</i>	46.4	63.1	28	
<i>X42</i>	42.1	60.2	29	
<i>Grade B</i>	35.5	60.2	29	
<i>PG&amp;E**</i>	-	-		Where available.

\*Per API 5L, 44<sup>th</sup> edition, Oct 01 2008

\*\*If original specification values are available, for reference.

**Table 3: Pipe Material Impact Testing**

	Average of impact samples@ +32F (foot-lbs)	Average of 3 impact samples, +50F (foot-lbs)	Average of 3 impact samples +32F (mils) lateral expansion	Comments
<i>T70</i>	136	133	81	20ftlbs is required for PSL 2 pipe

**Table 4: Actual Pipe vs. 5L Grade Pipe Chemistry Comparison**

	<i>Actual</i>	<i>GradeB</i>	<i>X42</i>	<i>X46 to X60</i>	<i>X65</i>	Comments
<b>Carbon</b>	0.082	0.26				Mn o.k. per API 5L 44 <sup>th</sup> edition footnote.
<b>Manganese</b>	1.21	1.20	1.30	1.40	1.45	
<b>Phosphorus</b>	0.008	0.03				
<b>Sulfur</b>	<0.005	0.03				
<b>V + Nb + Ti</b>	0.09	0.15				
<b>CE<sub>IIW</sub></b>	0.33	0.43				
						CE only for PSL2

Note: All 5L grade chemistry limits are Maximums.

**Table 5: Range of Pipe Hardness Testing values (Vickers<sub>10</sub> HV10)**

Location*	Face	Center	Root
<i>Actual</i>	197-213	182-212	202-215

\* Hardness taken across base metal to HAZ to weld to HAZ to base metal

**Test Method Notes:**

Testing was performed to ASTM current methods as documented in Anamet, Inc. test report 5004.6659B



Applied Technology Services  
 3400 Crow Canyon Road  
 San Ramon, CA 94583

ATS Report# 413.62-12.33



**Subject: Gas Transmission Pipe Mechanical Properties Test Results  
Line SP5, T-96.**

**Introduction:**

Per request from PG&E Gas Department, a section of pipe was made available to ATS for examination for the purpose being to obtain actual mechanical values for data collection and analysis. The pipe was identified as **Line Sp5: 24" T-96**, and were radiographed for weld soundness and extracted for testing per the Existing Natural Gas Transmission Pipe test plan as set forth by ATS and approved by the CPUC.

**Summary:**

The segment of pipe location identified as **T-96**, [Redacted], and marked from **Line SP5** with a diameter **24"** and wall thickness of **0.314"**, was submitted for testing. The pipe was found to be **conforming** to API 5L-44<sup>th</sup> PSL1 pipe grades: GrB,x42,x46.

Actual chemical composition and transverse tensile properties from said pipe sections is listed below followed by API 5L requirements.

*Table 1: L-SP5 'T-96' testing results*

Element	C	Cr	Cb	Cu	Mn	Mo	Ni
Wt%	0.18	0.03	<0.005	0.04	0.47	<0.005	0.07
Element	P	Si	S	Ti	V	C.E.	
Wt%	0.018	0.11	0.036	<0.005	<0.005	0.27	

\*Carbon Equivalent (C.E. IIW) per API 5L § 9.2.5

	Weld	P.M. @ 180°
<b>Tensile Strength (ksi)</b>	76.1	67.9
<b>Yield Strength (0.5% E.U.L ksi)</b>	60.0	50.2
<b>Elongation% (2" gage)</b>	24.5	30.5

[Redacted]

Date: March 27, 2010

[Redacted]

Submitted by:

[Redacted] Materials Eng.

Approved by:

[Redacted] Supervisor -ATS Chemistry and Materials

cc: ATS Records

**Table 2: Minimum Pipe Material Strength Requirements\***

	Yield 0.5% elongation, ksi	Tensile Strength, ksi	Elongation %	Comments
X65	65.3	77.6	21	%E varies slightly with grade, see API 5L for details
X60	60.2	75.4	22	
X56	56.6	71.1	23	
X52	52.2	66.7	24	
X46	46.4	63.1	26	
X42	42.1	60.2	27	
Grade B	35.5	60.2	27	
PG&E**	-	-	-	Where available.

\*Per API 5L, 44<sup>th</sup> edition, Oct 01 2008

\*\*If original specification values are available, for reference.

**Table 3: Pipe Material Impact Testing**

	Average of impact samples@ +32F (foot-lbs)	Average of 3 impact samples, +50F (foot-lbs)	Average of 3 impact samples +32F (mils) lateral expansion	Comments
T96, LSP5	5.0	6.8	9.7	20ftlbs is required for PSL 2 pipe

**Table 4: Actual Pipe vs. 5L Grade Pipe Chemistry Comparison**

	Actual	GradeB	X42	X46 to X60	X65	Comments
Carbon	0.18	0.26				S > limit
Manganese	0.47	1.20	1.30	1.40	1.45	
Phosphorus	0.018	0.03				
Sulfur	0.036	0.03				
V + Nb + Ti	<0.005	0.15				
CE <sub>lim</sub>	0.27	0.43				CE only for PSL2

Note: All 5L grade chemistry limits are Maximums.

**Table 5: Range of Pipe Hardness Testing values (Vickers<sub>10</sub> HV10)**

Location*	Face	Center	Root
Actual	161-181	147-165	148-163

\* Hardness taken across base metal to HAZ to weld to HAZ to base metal

**Test Method Notes:**

Testing was performed to ASTM current methods as documented in Anamet, Inc. test report 5004.7023



Applied Technology Services  
 3400 Crow Canyon Road  
 San Ramon, CA 94583

ATS Report# 413.62-12.34



**Subject: Gas Transmission Pipe Mechanical Properties Test Results  
Line 101, T-2/3.**

**Introduction:**

Per request from PG&E Gas Department, a section of pipe was made available to ATS for examination for the purpose being to obtain actual mechanical values for data collection and analysis. The pipe was identified as **Line 101: 36" T-2/3**, and were radiographed for weld soundness and extracted for testing per the Existing Natural Gas Transmission Pipe test plan as set forth by ATS and approved by the CPUC.

**Summary:**

The segment of pipe location identified as **T-2/3**, [Redacted] and marked from **Line 101** with a diameter **36"** and wall thickness of **0.360**, was submitted for testing. Pipe coupons were x-rayed and the weld zone was found to be defect free. The pipe was found to be **conforming** to API 5L-44<sup>th</sup> PSL1 pipe grades: GrB,x42,x46,x52,x56,x60.

Actual chemical composition and transverse tensile properties from said pipe sections is listed below followed by API 5L requirements.

**Table 1: Line 101 'T2/3' testing results**

<b>Element</b>	<b>C</b>	<b>Cr</b>	<b>Cb</b>	<b>Cu</b>	<b>Mn</b>	<b>Mo</b>	<b>Ni</b>
Wt%	0.20	0.02	<0.005	0.08	1.19	<0.005	0.02
<b>Element</b>	<b>P</b>	<b>Si</b>	<b>S</b>	<b>Ti</b>	<b>V</b>	<b>C.E.</b>	
Wt%	0.021	0.07	0.031	<0.005	0.03	0.41	

\*Carbon Equivalent (C.E. IIW) per API 5L § 9.2.5

	<b>Weld</b>	<b>P.M. @ 180°</b>
<b>Tensile Strength (ksi)</b>	88.3	85.3
<b>Yield Strength (0.5% E.U.L ksi)</b>	69.6	64.0
<b>Elongation% (2" gage)</b>	26.0	30.5

Date: March 27, 2012

[Redacted]

Submitted by:

[Redacted], Materials Eng.

Approved by:

[Redacted], Supervisor -ATS/Chemistry and Materials

cc: ATS Records



**Table 2: Minimum Pipe Material Strength Requirements\***

	Yield 0.5% elongation, ksi	Tensile Strength, ksi	Elongation %	Comments
X65	65.3	77.6	22	%E varies slightly with grade, see API 5L for details
X60	60.2	75.4	22	
X56	56.6	71.1	24	
X52	52.2	66.7	25	
X46	46.4	63.1	26	
X42	42.1	60.2	27	
Grade B	35.5	60.2	27	
PG&E**	-	-	-	Where available.

\*Per API 5L, 44<sup>th</sup> edition, Oct 01 2008

\*\*If original specification values are available, for reference.

**Table 3: Pipe Material Impact Testing**

	Average of impact samples@ +32F (foot-lbs)	Average of 3 impact samples, +50F (foot-lbs)	Average of 3 impact samples +32F (mils) lateral expansion	Comments
T2/3	18.3	30.3	26.3	20filbs is required for PSL 2 pipe

**Table 4: Actual Pipe vs. 5L Grade Pipe Chemistry Comparison**

	Actual	GradeB	X42	X46 to X60	X65	Comments
Carbon	0.20	0.26				S > limit
Manganese	1.19	1.20	1.30	1.40	1.45	
Phosphorus	0.021	0.03				
Sulfur	0.031	0.03				
V + Nb + Ti	0.03	0.15				
CE <sub>ITW</sub>	0.41	0.43				CE only for PSL2

Note: All 5L grade chemistry limits are Maximums.

**Table 5: Range of Pipe Hardness Testing values (Vickers<sub>10</sub> HV10)**

Location*	Face	Center	Root
Actual	186-198	177-201	183-206

\* Hardness taken across base metal to HAZ to weld to HAZ to base metal

**Test Method Notes:**

Testing was performed to ASTM current methods as documented in Anamet, Inc. test report 5004.7023



Applied Technology Services  
 3400 Crow Canyon Road  
 San Ramon, CA 94583

ATS Report# 413.62-12.04



**Subject: Gas Transmission Pipe Mechanical Properties Test Results  
Line 300B, (34" O.D.)T-85B.**

**Introduction:**

Per request from PG&E Gas Department, a section of pipe was made available to ATS for examination for the purpose being to obtain actual mechanical values for data collection and analysis. The pipe was identified as Line 300B: 34" T-85B, Location A. and were radiographed for weld soundness and extracted for testing per the Existing Natural Gas Transmission Pipe test plan as set forth by ATS and approved by the CPUC.

**Summary:**

The segment of pipe locations identified as T85B (Redacted) and marked from Line 300B with a diameter 34" and wall thickness of 0.435, was submitted for testing. Pipe coupons were x-rayed and the weld zone was found to be defect free. The pipe was found to be conforming to API 5L-44<sup>th</sup> PSL1 pipe grades: x60, x56, x52, x46, x42, Grd B.

Actual chemical composition and transverse tensile properties from said pipe sections is listed below followed by API 5L requirements.

**Table 1: L300B 'T85B' Location A, testing results**

Element	C	Cr	Cb	Cu	Mn	Mo	Ni
Wt%	0.26	0.02	<0.005	0.08	0.90	<0.005	0.07
Element	P	Si	S	Ti	V	C.E.	
Wt%	0.023	0.01	0.034	<0.005	<0.005	0.42	

\*Carbon Equivalent (C.E. IIW) per API 5L § 9.2.5

	<i>Weld</i>	<i>P.M. @ 180°</i>
<b>Tensile Strength (ksi)</b>	85.9	82.3
<b>Yield Strength (0.5% E.U.L ksi)</b>	72.5	64.6
<b>Elongation% (2" gage)</b>	21.5	30.5

Date: February 27, 2012

Submitted by: Redacted

Redacted, Materials Eng.

Approved by

Redacted, Supervisor ~~ATS Chemistry and Materials~~

cc: ATS Records

**Table 2: Minimum Pipe Material Strength Requirements\***

	Yield 0.5% elongation, ksi	Tensile Strength, ksi	Elongation %	Comments
<i>X65</i>	65.3	77.6	23	%E varies slightly with grade, see API 5L for details
<i>X60</i>	60.2	75.4	23	
<i>X56</i>	56.6	71.1	25	
<i>X52</i>	52.2	66.7	26	
<i>X46</i>	46.4	63.1	28	
<i>X42</i>	42.1	60.2	29	
<i>Grade B</i>	35.5	60.2	29	
<i>PG&amp;E**</i>	-	-		Where available.

\*Per API 5L, 44<sup>th</sup> edition, Oct 01 2008

\*\*If original specification values are available, for reference.

**Table 3: Pipe Material Impact Testing**

	Average of impact samples@ +32F (foot-lbs)	Average of 3 impact samples, +50F (foot-lbs)	Average of 3 impact samples +32F (mils) lateral expansion	Comments
<i>T85B</i>	13.2	14.7	14	20ftlbs is required for PSL 2 pipe

**Table 4: Actual Pipe vs. 5L Grade Pipe Chemistry Comparison**

	Actual	GradeB	X42	X46 to X60	X65	Comments
<b>Carbon</b>	0.26	0.26				Sulfur acceptable per review.
<b>Manganese</b>	0.90	1.20	1.30	1.40	1.45	
<b>Phosphorus</b>	0.023	0.03				
<b>Sulfur</b>	0.034	0.03				
<b>V + Nb + Ti</b>	<0.005	0.15				
<i>CE<sub>ITW</sub></i>	0.42	0.43				CE only for PSL2

Note: All 5L grade chemistry limits are Maximums.

**Table 5: Range of Pipe Hardness Testing values (Vickers<sub>10</sub> HV10)**

Location*	Face	Center	Root
<i>Actual</i>	193-206	172-206	181-196

\* Hardness taken across base metal to HAZ to weld to HAZ to base metal

**Test Method Notes:**

Testing was performed to ASTM current methods as documented in Anamet, Inc. test report 5004.6659B



Applied Technology Services  
 3400 Crow Canyon Road  
 San Ramon, CA 94583

ATS Report# 413.62-12.05



**Subject: Gas Transmission Pipe Mechanical Properties Test Results  
T87A-20", Line 300B.**

**Introduction:**

Per request from PG&E Gas Department, a section of pipe was made available to ATS for examination for the purpose being to obtain actual mechanical values for data collection and analysis. The pipe was identified as **Line 300B: 20" T-87A, Location A.** (Redacted Redacted) and were radiographed for weld soundness and extracted for testing per the Existing Natural Gas Transmission Pipe test plan as set forth by ATS and approved by the CPUC.

**Summary:**

The segment of pipe locations identified as **T87A** and marked from **Line 300B** with a diameter **20"** and wall thickness of **0.500**, was submitted for testing. Pipe coupons were x-rayed and the weld zone was found to be defect free. The pipe was found to be **conforming** to API 5L-44<sup>th</sup> PSL1 pipe grades: **Grade B, x42**

Actual chemical composition and transverse tensile properties from said pipe sections is listed below followed by API 5L requirements.

**Table 1: L300B 'T87A' Location A, testing results**

<b>Element</b>	<b>C</b>	<b>Cr</b>	<b>Cb</b>	<b>Cu</b>	<b>Mn</b>	<b>Mo</b>	<b>Ni</b>
Wt%	0.25	0.03	<0.005	0.02	1.03	<0.005	0.02
<b>Element</b>	<b>P</b>	<b>Si</b>	<b>S</b>	<b>Ti</b>	<b>V</b>	<b>C.E.</b>	
Wt%	0.011	0.03	0.029	0.01	<0.005	0.43	

\*Carbon Equivalent (C.E. IIW) per API 5L § 9.2.5

	<b>Weld</b>	<b>P.M. @ 180°</b>
<b>Tensile Strength (ksi)</b>	n/a	76.1
<b>Yield Strength (0.5% E.U.L ksi)</b>	n/a	45.9
<b>Elongation% (2" gage)</b>	n/a	38.5

Date: February 27, 2012

Submitted by: (Redacted)  
 (Redacted) Materials Eng.

(Redacted)  
 Approved by: (Redacted), Supervisor -ATS Chemistry and Materials

cc: ATS Records

**Table 2: Minimum Pipe Material Strength Requirements**

	Yield 0.5% elongation, ksi	Tensile Strength, ksi	Elongation %	Comments
<i>X65</i>	65.3	77.6	23	%E varies slightly with grade, see API 5L for details
<i>X60</i>	60.2	75.4	24	
<i>X56</i>	56.6	71.1	25	
<i>X52</i>	52.2	66.7	27	
<i>X46</i>	46.4	63.1	28	
<i>X42</i>	42.1	60.2	29	
<i>Grade B</i>	35.5	60.2	29	
<i>PG&amp;E**</i>	-	-	-	Where available.

\*Per API 5L, 44<sup>th</sup> edition, Oct 01 2008

\*\*If original specification values are available, for reference.

**Table 3: Pipe Material Impact Testing**

	Average of impact samples@ +32F (foot-lbs)	Average of 3 impact samples, +50F (foot-lbs)	Average of 3 impact samples +32F (mils) lateral expansion	Comments
<i>T87A</i>	15.7	16.5	16	20ftlbs is required for PSL 2 pipe

**Table 4: Actual Pipe vs. 5L Grade Pipe Chemistry Comparison**

	Actual	GradeB	X42	X46 to X60	X65	Comments
<b>Carbon</b>	0.25	0.26				
<b>Manganese</b>	1.03	1.20	1.30	1.40	1.45	
<b>Phosphorus</b>	0.011	0.03				
<b>Sulfur</b>	0.029	0.03				
<b>V + Nb + Ti</b>	0.01	0.15				
<i>CE<sub>ITW</sub></i>	0.43	0.43				CE only for PSL2

Note: All 5L grade chemistry limits are Maximums.

**Table 5: Range of Pipe Hardness Testing values (Vickers<sub>10</sub> HV10)**

Location*	Face	Center	Root
<i>Actual</i>	N/A	N/A	N/A- Pipe not welded

\* Hardness taken across base metal to HAZ to weld to HAZ to base metal

**Test Method Notes:**

Testing was performed to ASTM current methods as documented in Anamet, Inc. test report 5004.6659B



Applied Technology Services  
 3400 Crow Canyon Road  
 San Ramon, CA 94583

ATS Report# 413.62-12.09



**Subject: Gas Transmission Pipe Mechanical Properties Test Results  
L300B T87A 34” diameter.**

**Introduction:**

Per request from PG&E Gas Department, a section of pipe was made available to ATS for examination for the purpose being to obtain actual mechanical values for data collection and analysis. The pipe was identified as **Line 300B: 34” T-87A, Location A** (Redacted) and were radiographed for weld soundness and extracted for testing per the Existing Natural Gas Transmission Pipe test plan as set forth by ATS and approved by the CPUC.

**Summary:**

The segment of pipe locations identified as **T87A** and marked from **Line 300B** with a diameter **34”** and wall thickness of **0.500**, was submitted for testing. Pipe coupons were x-rayed and the weld zone was found to be defect free. The pipe was found to be **conforming** to API 5L-44<sup>th</sup> PSL1 pipe grades: **GrB, x42, x46, x52, x56**.

Actual chemical composition and transverse tensile properties from said pipe sections is listed below followed by API 5L requirements.

**Table 1: L300B ‘T87A’ Location A, testing results**

<b>Element</b>	<b>C</b>	<b>Cr</b>	<b>Cb</b>	<b>Cu</b>	<b>Mn</b>	<b>Mo</b>	<b>Ni</b>
Wt%	0.28	0.02	<0.005	0.06	0.99	<0.005	0.07
<b>Element</b>	<b>P</b>	<b>Si</b>	<b>S</b>	<b>Ti</b>	<b>V</b>	<b>C.E.</b>	
Wt%	0.012	0.05	0.037	<0.005	<0.005	0.46	

\*Carbon Equivalent (C.E. IIW) per API 5L § 9.2.5

	<b>Weld</b>	<b>P.M. @ 180°</b>
<b>Tensile Strength (ksi)</b>	89.5	85.0
<b>Yield Strength (0.5% E.U.L ksi)</b>	68.7	59.5
<b>Elongation% (2” gage)</b>	24.5	32.5

Date: February 27, 2012

Submitted by: (Redacted)  
 (Redacted), Materials Eng.

Approved by: (Redacted)  
 (Redacted) Supervisor -ATS Chemistry and Materials

cc: ATS Records

**Table 2: Minimum Pipe Material Strength Requirements\***

	Yield 0.5% elongation, ksi	Tensile Strength, ksi	Elongation %	Comments
<i>X65</i>	65.3	77.6	23	%E varies slightly with grade, see API 5L for details
<i>X60</i>	60.2	75.4	24	
<i>X56</i>	56.6	71.1	25	
<i>X52</i>	52.2	66.7	27	
<i>X46</i>	46.4	63.1	28	
<i>X42</i>	42.1	60.2	29	
<i>Grade B</i>	35.5	60.2	29	
<i>PG&amp;E**</i>	-	-		Where available.

\*Per API 5L, 44<sup>th</sup> edition, Oct 01 2008

\*\*If original specification values are available, for reference.

**Table 3: Pipe Material Impact Testing**

	Average of impact samples@ +32F (foot-lbs)	Average of 3 impact samples, +50F (foot-lbs)	Average of 3 impact samples +32F (mils) lateral expansion	Comments
<i>T87A</i>	19.7	26.8	27.3	20ftlbs is required for PSL 2 pipe

**Table 4: Actual Pipe vs. 5L Grade Pipe Chemistry Comparison**

	Actual	GradeB	X42	X46 to X60	X65	Comments
<b>Carbon</b>	0.28	0.26				Carbon and Sulfur > then current 5L Limits.
<b>Manganese</b>	0.99	1.20	1.30	1.40	1.45	
<b>Phosphorus</b>	0.012	0.03				
<b>Sulfur</b>	0.037	0.03				
<b>V + Nb + Ti</b>	<0.005	0.15				
<b>CE<sub>IIW</sub></b>	0.46	0.43				CE only for PSL2

Note: All 5L grade chemistry limits are Maximums.

**Table 5: Range of Pipe Hardness Testing values (Vickers<sub>10</sub> HV10)**

Location*	Face	Center	Root
<i>Actual</i>	186-206	185-206	206-218

\* Hardness taken across base metal to HAZ to weld to HAZ to base metal

**Test Method Notes:**

Testing was performed to ASTM current methods as documented in Anamet, Inc. test report 5004.6659B