

Analysis of unplanned over pressure events

1/31/11

Identification of unplanned pressure increase events

- 01/06 – 09/08: Conducted manual record review through coordination with engineering and operations organizations
- 09/08 – 09/10: Gas Events Reporting Tool, web-based relational database on the Company intranet to track gas events meeting the criteria outlined in PG&E's Work Procedure WP1465-02, implemented in September 2008

Number of Events

Year	2006	2007	2008	2009	2010	Total
Transmission ¹	0	0	3	2	1	6
Distribution (> 60 psig)	0	0	1	2	0	3
Distribution (≤ 60 psig)	1	4	2	4	2	13
Total	1	4	6	8	3	22

¹Based on transmission definition referenced in 49CFR 192.3

Pipeline Segment Identification

- GIS used to identify all impacted segments for the transmission and distribution (> 60 psig) systems associated with the respective incidents



Event Details

Transmission and Distribution > 60 psig

Event	Date	Location/Line	Pipeline Designation (DOT Definition)	Max P reached (psig)	MAOP (psig)	% SMYS at MAOP ¹	% SMYS at Max P ¹	Root Cause	Immediate Corrective Action
1	15-Dec-08	Area 5, Stockton Division, Line 148, Modesto (McMullin Ranch Station) <u>Note:</u> Only one 34' segment is >20% SMYS	Transmission	650	408	28.3%	46.6%	Operations - Liquids damaged station equipment	Restored station to normal pressure; leak surveyed L148 and all potentially effected piping and equipment. Modifications were made to station equipment to make it less susceptible to liquid contamination.
2	05-Sep-08	Area 4, Kern Division, Segs Primary Regulator Station, Line 300B, Dagget (MP 140.64B)	Transmission	399	300	12.4%	16.4%	Equipment failure - Regulator and monitor failed to lock up	Returned station to appropriate pressure; performed complete internal inspection of both the monitor and regulator and rebuilt both units.
3	15-Dec-08	Area 3, Milpitas (DFM-0805-01)	Transmission	275	200	23.8%	32.7%	Equipment- Filter	Normal pressures were restored and stabilized pressures by switching to the stand-by regulator/monitor run. The downstream system was leak surveyed.
4	12-Jun-09	Area 3, Central Coast Division, Watsonville, DFM1816-01 (Front St. Regulator Station)	Transmission	338	303	19.9%	30.3%	Operations -work procedure error	The valve was closed and pressures were restored immediately to acceptable levels. Line 1816-01 and attached systems were leak surveyed, completed on 6/13/09 with no leaks detected. T&R Crew tailboard was conducted on 6/15/09.
5	13-Nov-09	Area 3, San Jose Division, (DFM0805-01 & 0807-01, Milpitas)	Transmission	222	200	23.8%	26.4%	Operations - pipeline liquids	System pressure was brought under control and the regulator station internally inspected. All effected components were cleaned and returned to service. The downstream DFM system was leak surveyed; one leak on a threaded fitting was found and repaired.
6	22-Jun-10	Milpitas District, Milpitas (DFM-0805-01 & 0807-01, Valve 52) <u>Note:</u> 0807-01 is Distribution and Part of 0805-01 which is Transmission	Transmission	300	200	23.8%	35.7%	Operations - Work procedure error	Valve 52 was immediately closed upon discovery of the error and the line was returned to an acceptable pressure. The downstream distribution feeder system was leak surveyed on 6/23/10 and no leaks were found on this system
7	02-Dec-08	Area 7, North Coast Division, Sonoma (DFM 1305-01)	Distribution (> 60 psig)	200	150	6.3%	7.8%	Operator error - MAOP valve not completely closed during maintenance work.	During maintenance of valve, which includes its operation, the valve was not completely closed tight and the pressure increased above the MAOP.
8	10-Jun-09	Area 7, North Coast Division, Sonoma (DFM 1305-01 MLV 3.79)	Distribution (> 60 psig)	187	150	6.3%	7.8%	Equipment- Valve	The crew dispatched was unable to obtain a positive seal on the valve. Pressure in the adjacent system was lowered until the valve could be replaced to prevent over pressuring the lower rated system. A leak survey was performed on 6/10/09.
9	24-Aug-09	Area 6, Sierra Division, Roseville, DFM0618-05 (MLV 3.42 at Baseline Station)	Distribution (> 60 psig)	230	175	19.9%	25.4%	Operations - Work procedure error	The valve was immediately closed and pressures in the affected systems returned to acceptable pressure levels.

¹Maximum %SMYS of segment within the pipeline system

- GIS used to identify segments with potential manufacturing seam threat consisting of:
 - Pre-1970 ERW pipe
 - Pipe with Joint Efficiency < 1 (SSAW¹, AO Smith, Lap Weld and Pre-1970 Unknowns)

- Excluded segments where downstream SCADA data points exist for the identified pipeline and pressure readings were below the 5-year MOP high or system MOP

- Performed correlation of SCADA pressure readings where multiple data points exist for the identified pipeline
 - Identified and excluded segments where calculated pressure was below the 5-year MOP high or system MOP based on interpolating SCADA pressure readings and the distance between those readings
 - Further refined impacted segments by conducting hydraulic analysis based on pipeline conditions of pressure event date to identify segments where pressure was below the 5-year MOP high or system MOP

¹SSAW is identified by the code and ASME B31.8 to have a Joint Efficiency (JE) of 1 but is defined as PG&E to have a JE < 1



Results

HCA Segments

Event	Pipeline Number	Total Pipeline Miles (HCA + non-HCA)	Pipeline Designation	HCA Miles	HCA Miles (Impacted)
1	L148	27.9	Transmission	1.6	<0.1
2	L300B (MP 140.64B)	1.5	Transmission	0.0	0.0
3	0805-01* & 0807-01*	4.1	Transmission	1.9	0.0
4	1816-01	20.8	Transmission	4.0	0.4
5	0805-01* & 0807-01*	4.1	Transmission	1.9	0.0
6	0805-01* & 0807-01*	4.1	Transmission	1.9	0.0
Total		64.3		7.5	<0.5

*Pipelines with multiple pressure increase events



Results

Non-HCA Segments

Event	Pipeline Number	Total Pipeline Miles (HCA + non-HCA)	Pipeline Designation	Non-HCA Miles	Non-HCA Miles (Impacted)
1	L148	27.9	Transmission	22.0	1.8
2	L300B (MP 140.64B)	1.5	Transmission	1.5	<0.1
3	0805-01* & 0807-01*	3.6	Transmission	0.3	0
4	1816-01	20.8	Transmission	6.5	5.8
5	0805-01* & 0807-01*	4.1	Transmission	0.3	0
6	0805-01* & 0807-01*	0.5	Transmission	0.5	<0.1
7	1305-01*	3.8	Distribution (> 60 psig)	3.8	<0.1
8	1305-01*	3.8	Distribution (> 60 psig)	3.8	<0.1
9	0618-05	6.2	Distribution (> 60 psig)	6.2	1.3
Total		64.3		40.3	9.1

*Pipelines with multiple pressure increase events



Long Seam Threat Activation Determination HCA Segments

Event	Pipeline Number	Pipeline Designation	HCA Miles (Impacted)	5 YR MOP Exceeded? ¹	Long Seam Threat Activated?
1	L148	Transmission	<0.1	Y	Y
2	L300B (MP 140.64B)	Transmission	0.0	N	N
3	0805-01* & 0807-01*	Transmission	0.0	N	N
4	1816-01	Transmission	0.4	Y	Y
5	0805-01* & 0807-01*	Transmission	0.0	N	N
6	0805-01* & 0807-01*	Transmission	0.0	N	N

Red = Lines with activated long seam threat

¹ Per 49 CFR 192.917, an operator may consider manufacturing and construction defects stable if operating pressure on the covered segment has not increased over the maximum operating pressure experienced during the preceding 5 years.

*Pipelines with multiple pressure increase events



Long Seam Threat Activation Determination Non-HCA Segments

Event	Pipeline Number	Pipeline Designation	Non-HCA Miles (Impacted)	5 YR MOP Exceeded? ¹	Long Seam Threat Activated?
1	L148	Transmission	1.8	Y	Y
2	L300B (MP 140.65)	Transmission	<0.1	Unknown – no SCADA, pending confirmation from GSO/TSP	Unknown
3	0805-01* & 0807-01*	Transmission	0	N	N
4	1816-01	Transmission	5.8	Y	Y
5	0805-01* & 0807-01*	Transmission	0	N	N
6	0805-01* & 0807-01*	Transmission	0	N	N
7	1305-01*	Distribution (> 60 psig)	<0.1	Unknown – no SCADA, pending confirmation from GSO/TSP	N/A ²
8	1305-01*	Distribution (> 60 psig)	<0.1	Unknown – no SCADA, pending confirmation from GSO/TSP	N/A ²
9	0618-05	Distribution (> 60 psig)	1.3	Unknown – no SCADA, pending confirmation from GSO/TSP	N/A ²

Red = Lines with activated long seam threat

¹ Per 49 CFR 192.917, an operator may consider manufacturing and construction defects stable if operating pressure on the covered segment has not increased over the maximum operating pressure experienced during the preceding 5 years.

² Distribution pipelines are not subject to the Transmission Integrity Management regulations and, therefore, the long seam threat criteria of 192.917 do not apply.

*Pipelines with multiple pressure increase events



Recommended Actions HCA and Non-HCA Segments

Event(s)	Pipeline Number	HCA Miles (Impacted)	Non-HCA Miles	Max % 5 YR MOP Exceeded? ¹	Long Seam Threat Activated?	Recommended Actions ¹
1	L148	<0.1 (10' stub)	1.8	56.7%	Y	<ol style="list-style-type: none"> 1. Further records and engineering analysis to determine if segment actually experienced the pressure increase 2. Replace segment of pipe
2	L300B	0.0	<0.1	Unknown	Unknown	<ol style="list-style-type: none"> 1. Conduct research to identify 5 YR MOP 2. Reduce the MAOP by 20%, if deemed as an appropriate immediate mitigation measure 3. Research replacement options
4	1816-01	0.4	5.8	13.0%	Y	<ol style="list-style-type: none"> 1. Leverage industry expertise to obtain recommendation for potential activation of long seam threat and appropriate immediate mitigation measures <ol style="list-style-type: none"> a. Reduce the MAOP by 20%, if deemed as an appropriate immediate mitigation measure 2. Conduct a feasibility assessment to run a ILLI crack tool and/or hydro test 3. Research replacement options
Total		<0.5	<7.7			

¹Conduct records research to confirm GIS data



Potential Customer Impacts for Pressure Reduction¹

Pipeline Number	Customer Impacts	Comments
L148	Significant	Stage 1: Non-core curtailments would increase from 25% today to 100% Stage 2: Non-core curtailments would increase from 55% today to 100%. Additionally, the new proposed TID Almond power plant must be curtailed 100% during Stage 1 and 2 conditions.
1816-01	Significant	Stage 1: Non-core curtailments increased from 50% to 100% Stage 2: Non-core curtailments are 100% which is unchanged from current levels. Additionally, potential loss of 8,700 core customers
L300B (MP 140.64B)	Minimal	Impact service to 2 industrial customers. Additional information required from the Account Services Representative to identify impact to specific customers

*Pipelines with multiple pressure increase events

¹Reduction in MAOP by 20%



Event Details

Distribution ≤ 60 psig

Event	Date	Location/Line	Pipeline Designation (DOT Definition)	Max P reached (psig)	MAOP (psig)	% SMYS at MAOP ¹	% SMYS at Max P ¹	Root Cause	Immediate Corrective Action
10	01-Feb-06	Area 5, Yosemite Division, (Walnut and Cressy Wy., Atwater)	Distribution	145	60	N/A	N/A	Operations - debris caught in regulator station filters	Debris was removed from the HPRregulation equipment and the HPR was returned to normal operation.
11	06-Feb-07	Area 7, North Bay Division - Novato (Alameda Del Prado Regulator Station)	Distribution	63	50	N/A	N/A	Maintenance - sulfur accumulation in equipment	The regulator station was immediately inspected, with the regulators and pilots replaced with new equipment. The station was returned to normal operation.
12	09-Feb-07	Area 7, North Bay Division - Novato (Alameda Del Prado Regulator Station)	Distribution	59	50	N/A	N/A	Maintenance - sulfur accumulation in equipment	The regulator station was immediately inspected, with the regulators and pilots replaced with new equipment. The station was returned to normal operation.
13	16-Feb-07	Area 7, North Bay Division - Novato (Alameda Del Prado Regulator Station)	Distribution	82	50	N/A	N/A	Maintenance - sulfur accumulation in equipment	The regulator station was immediately inspected, with the regulators and pilots replaced with new equipment. The station was returned to normal operation.
14	29-Oct-07	Area 4, Fresno Division - Selma (Selma Low Pressure System)	Distribution	16" wc	10.5" wc	N/A	N/A	Operations - Flooding	The flooded station had the water pumped out and returned to normal operation. In addition, another station in which an automatic station shut off valve had tripped, was also returned to normal operation.
15	07-Apr-08	Area 3, Central Coast Division, Salinas (Customer HPR at #54 and #58 Hwy 68)	Distribution	240	60	N/A	N/A	Equipment- valve	The HPR downstream valve was opened and the HPR checked and returned to normal operation.
16	20-Nov-08	Area 3, De Anza Division, (Moffet Field, Bayshore E/Moffet Blvd, Mountain View)	Distribution	57.7	50	N/A	N/A	Operations - Design error	The employees quickly restored the system to the correct operating pressures.
17	04-Feb-09	Area 5, Yosemite Division, Modesto (Melrose and Scenic Regulator Stations)	Distribution	13" wc	10.5" wc	N/A	N/A	Equipment- Regulator	Reset the pressure to 9 inches of water column at the Melrose and Scenic District Regulation Station; water was cleared from the vent at this station and the vent lines were relocated to eliminate any potential build up of water.
18	17-Mar-09	Area 3, Central Coast Division, Santa Cruz (Hwy 17 Santa Cruz)	Distribution	42	30	N/A	N/A	Operations - Work procedure error	The valve was closed and the system restored to allowable pressure. A leak survey of the entire system (115,423 feet of pipeline and approx. 2,100 services) verified system integrity.

¹Maximum %SMYS of segment within the pipeline system



Event Details

Distribution ≤ 60 psig (cont'd)

Event	Date	Location/Line	Pipeline Designation (DOT Definition)	Max P reached (psig)	MAOP (psig)	% SMYS at MAOP ¹	% SMYS at Max P ¹	Root Cause	Immediate Corrective Action
19	23-Jul-09	Area 5, Yosemite Division, Customer Service off of (4" DFM7228-16 from Riverbank to Oakdale)	Distribution	175	60	N/A	N/A	Operations - Design error	Service to the meter set was immediately shut off and a new service was run from an adjacent property whose gas service was properly set up with an upstream high pressure regulator. The meterset was rebuilt, all customer appliances were checked and re-lit. Initiated a patrol of the remainder of the DFM to identify any other services without an HPR.
20	25-Sep-09	Area 5, Yosemite Division, (4" DFM from Riverbank to Oakdale)	Distribution	175	60	N/A	N/A	Operations - Design error	The 2 meter sets identified were immediately shut-off and the meters removed. A new HPR was installed, along with a new branch service and customer appliances in both homes were checked and re-lit.
21	10-May-10	Area 3, San Jose Division, Gilroy (Station H-83; Forest & 100F Gilroy)	Distribution	71	55	N/A	N/A	Operations - Work procedure error	The pressure was immediately reduced to an acceptable level. The maintenance group was tailboarded on proper procedures associated with regulator station maintenance. A leak survey was completed on 5/12/10.
22	08-Sep-10	Area 6, North Valley Division, Chico, (4th and Salem low pressure district regulator station and associated low pressure system)	Distribution	11" wc	10.5" wc	N/A	N/A	Outside Force - Flooding	The station was shut-in and normal system pressure restored, adjacent stations were allowed to handle the load. Maintenance was performed next day on the pilot regulator and the pilot regulator vents were raised up into the vault ventilation piping system

¹Maximum %SMYS of segment within the pipeline system



Operational Actions Taken Thus Far

Distribution ≤ 60 psig

Event	Date	Location/Line	Max P reached (psig)	MAOP (psig)	Root Cause	Immediate Corrective Action Performed	Additional Actions Recommended	Target Completion Date
10	01-Feb-06	Area 5, Yosemite Division, (Walnut and Cressy Wy., Atwater)	145	60	Operations - debris caught in regulator station filters	Debris was removed from the HPR regulation equipment and the HPR was returned to normal operation.	<ol style="list-style-type: none"> 1. Complete leak survey and repair record validation 2. Review A-forms associated with this line since Feb. 1, 2006 to determine cause of leak 	<ol style="list-style-type: none"> 1. 1/31/2011 2. 02/04/11
11	06-Feb-07	Area 7, North Bay Division- Novato (Alameda Del Prado Regulator Station)	63	50	Maintenance - sulfur accumulation in equipment	The regulator station was immediately inspected, with the regulators and pilots replaced with new equipment. The station was returned to normal operation.	<ol style="list-style-type: none"> 1. Complete leak survey and repair record validation 2. Validate regulator and pilot replacement based on records research 3. Assess feasibility of installing sulfagone filter to prevent future sulfur accumulation 4. Review A-forms associated with this line since Feb. 6, 2007 to determine cause of leak 	<ol style="list-style-type: none"> 1. 01/31/11 2. 01/31/11 3. 02/01/11 4. 02/04/11
12	09-Feb-07	Area 7, North Bay Division- Novato (Alameda Del Prado Regulator Station)	59	50	Maintenance - sulfur accumulation in equipment	The regulator station was immediately inspected, with the regulators and pilots replaced with new equipment. The station was returned to normal operation.	<ol style="list-style-type: none"> 1. Complete leak survey and repair record validation 2. Validate regulator and pilot replacement based on records research 3. Assess feasibility of installing sulfagone filter to prevent future sulfur accumulation 4. Review A-forms associated with this line since Feb. 16, 2007 to determine cause of leak 	<ol style="list-style-type: none"> 1. 01/31/11 2. 01/31/11 3. 02/01/11 4. 02/04/11
13	16-Feb-07	Area 7, North Bay Division- Novato (Alameda Del Prado Regulator Station)	82	50	Maintenance - sulfur accumulation in equipment	The regulator station was immediately inspected, with the regulators and pilots replaced with new equipment. The station was returned to normal operation.	<ol style="list-style-type: none"> 1. Complete leak survey and repair record validation 2. Validate regulator and pilot replacement based on records research 3. Assess feasibility of installing sulfagone filter to prevent future sulfur accumulation 4. Review A-forms associated with this line since Feb. 16, 2007 to determine cause of leak. 	<ol style="list-style-type: none"> 1. 01/31/11 2. 01/31/11 3. 02/01/11 4. 02/04/11
14	29-Oct-07	Area 4, Fresno Division - Selma (Selma Low Pressure System)	16" wc	10.5" wc	Operations - Flooding	The flooded station had the water pumped out and returned to normal operation. In addition, another station in which an automatic station shut off valve had tripped, was also returned to normal operation.	<ol style="list-style-type: none"> 1. Complete leak survey and repair record validation 2. Review station design to identify potential additional mitigation measures to prevent flooding 3. Review A-forms associated with this line since Oct. 29, 2007 to determine cause of leak. 	<ol style="list-style-type: none"> 1. 01/31/11 2. 02/01/11 3. 02/04/11



Operational Actions Taken Thus Far

Distribution \leq 60 psig (con't)

Event	Date	Location/Line	Max P reached (psig)	MAOP (psig)	Root Cause	Immediate Corrective Action Performed	Additional Actions Recommended	Target Completion Date
15	07-Apr-08	Area 3, Central Coast Division, Salinas (Customer HPR at #54 and #58 Hwy 68)	240	60	Equipment- valve	The HPR downstream valve was opened and the HPR checked and returned to normal operation.	<ol style="list-style-type: none"> 1. Complete leak survey and repair record validation 2. Confirm if any equipment changes were completed or are required 3. Review A-forms associated with this line since Apr. 7, 2008 to determine cause of leak. 	<ol style="list-style-type: none"> 1. 01/31/11 2. 02/01/11 3. 02/04/11
16	20-Nov-08	Area 3, De Anza Division, (Moffet Field, Bayshore E/Moffet Blvd, Mountain View)	57.7	50	Operations - Design error	The employees quickly restored the system to the correct operating pressures.	<ol style="list-style-type: none"> 1. Complete leak survey and repair record validation 2. Review A-forms associated with this line since Nov. 20, 2008 to determine cause of leak. 	<ol style="list-style-type: none"> 1. 1/31/2011 2. 02/04/11
17	04-Feb-09	Area 5, Yosemite Division Modesto (Melrose and Scenic Regulator Stations)	13" wc	10.5" wc	Equipment- Regulator	Reset the pressure to 9 inches of water column at the Melrose and Scenic District Regulation Station; water was cleared from the vent at this station and the vent lines were relocated to eliminate any potential build up of water.	<ol style="list-style-type: none"> 1. Complete leak survey and repair record validation 2. Validate vent relocation based on records research. 3. Review A-forms associated with this line since Feb. 4, 2009 to determine cause of leak. 	<ol style="list-style-type: none"> 1. 01/31/11 2. 01/31/11 3. 02/04/11
18	17-Mar-09	Area 3, Central Coast Division, Santa Cruz (Hwy 17 Santa Cruz)	42	30	Operations - Work procedure error	The valve was closed and the system restored to allowable pressure. A leak survey of the entire system (115,423 feet of pipeline and approx. 2,100 services) verified system integrity.	<ol style="list-style-type: none"> 1. Complete leak survey and repair record validation 2. Review A-forms associated with this line since Mar. 17, 2009 to determine cause of leak 	<ol style="list-style-type: none"> 1. 01/31/11 2. 02/04/11
19	23-Jul-09	Area 5, Yosemite Division Customer Service off of (4" DFM7228-16 from Riverbank to Oakdale)	175	60	Operations - Design error	Service to the meter set was immediately shut off and a new service was run from an adjacent property whose gas service was properly set up with an upstream high pressure regulator. The meter set was rebuilt, all customer appliances were checked and re-lit. Initiated a patrol of the remainder of the DFM to identify any other services without an HPR.	<ol style="list-style-type: none"> 1. Complete leak survey and repair record validation 2. Validate service replacement based on records research 	<ol style="list-style-type: none"> 1. 01/31/11 2. 01/31/11



Operational Actions Taken Thus Far

Distribution \leq 60 psig (con't)

	<i>Date</i>	<i>Location/Line</i>	<i>Max P reached (psig)</i>	<i>MAOP (psig)</i>	<i>Root Cause</i>	<i>Immediate Corrective Action Performed</i>	<i>Additional Actions Recommended</i>	<i>Target Completion Date</i>
20	25-Sep-09	Area 5, Yosemite Division, (4" DFM from Riverbank to Oakdale)	175	60	Operations- Design error	The 2 meter sets identified were immediately shut-off and the meters removed. A new HPR was installed, along with a new branch service and customer appliances in both homes were checked and re-lit.	<ol style="list-style-type: none"> 1. Complete leak survey and repair record validation 2. Validate HPR and service replacement based on records research 	<ol style="list-style-type: none"> 1. 01/31/11 2. 01/31/11
21	10-May-10	Area 3, San Jose Division, Gilroy (Station H-83; Forest & 100F Gilroy)	71	55	Operations - Work procedure error	The pressure was immediately reduced to an acceptable level. The maintenance group was tailboarded on proper procedures associated with regulator station maintenance. A leak survey was completed on 5/12/10.	<ol style="list-style-type: none"> 1. Complete leak survey and repair record validation 2. Validate tailboard was completed based on records research 3. Review A-forms associated with this line since May 10, 2009 to determine cause of leak. 	<ol style="list-style-type: none"> 1. 01/31/11 2. 01/31/11 3. 02/04/11
22	08-Sep-10	Area 6, North Valley Division, Chico, (4th and Salem low pressure district regulator station and associated low pressure system)	11" wc	10.5" wc	Outside Force - Flooding	The station was shut-in and normal system pressure restored, adjacent stations were allowed to handle the load. Maintenance was performed next day on the pilot regulator and the pilot regulator vents were raised up into the vault ventilation piping system	<ol style="list-style-type: none"> 1. Complete leak survey and repair record validation 2. Validate events raised based on records research 3. Review A-forms associated with this line since Sept 10, 2009 to determine cause of leak. 	<ol style="list-style-type: none"> 1. 01/31/11 2. 01/31/11 3. 02/04/11