CALIFORNIA PUBLIC UTILITIES COMMISSION
Safety and Enforcement Division
Incident Investigation Report

Report Date: January 27, 2016

Incident Number: G20150417-01

Utility: Pacific Gas and Electric (PG&E)

Date and Time of the Incident: April 17, 2015, 1433 hours

Location of the Incident: 7633 N. Weber Ave
Fresno, CA
Fresno County

A. Executive Summary

On April 17, 2015 at approximately 1433 hours, gas transmission pipeline L-118B, a 12-inch diameter natural gas pipeline owned and operated by PG&E, suffered outside force damage and ruptured in Fresno, California. Gas released by the rupture ignited, resulting in the loss of one life, injuries to 13 other people, and damage to adjacent Union Pacific rail lines, a John Deere Wheel Loader, several cars, and vegetation near the incident. The incident occurred at a Fresno County Sheriff's shooting range located at 7633 N. Weber Ave. in Fresno. A Fresno County Public Works employee was grading the area for an access bench for trucks, while nearby County Jail inmates were collecting lead bullets from an adjacent slope.

PG&E personnel arrived at the location at about 1442 hours. At about 1520 hours, PG&E began to shut off the flow of gas by closing upstream and downstream valves resulting in a gas flow stoppage at 1556 hours. The Fresno Fire District (FFD) and the Fresno Police Department (FPD) responded to the scene shortly after the explosion. The injured people were transported to the Community Medical Center in Fresno. One worker in critical condition was flown to the hospital by helicopter. The incident forced the temporary closure of the Railway and Highway 99 in both directions for several hours. The damage to PG&E's facilities, including the cost of gas, was determined to be approximately $1,951,700.

The Safety and Enforcement Division (SED) of the California Public Utilities Commission (CPUC) performed an investigation of this incident. SED's investigation revealed that the incident was caused by outside force damage resulting from a Fresno County employee grading the access bench and puncturing the steel pipe with a John Deere Wheel Loader 644. The puncture formed cracks, which propagated circumferentially around the pipe. The blast from the rupture and ignition of the gas created a large crater and ejected a piece of pipe about 34 feet from the point of failure.

The ignition spread flames that damaged the adjacent properties and injured 14 individuals, one of whom passed away on May 11, 2015.

The Fresno County Sheriff's Department's failure to follow Underground Service Alert's (USA) One Call (811) program requirements listed in California Government Code 4216 was a contributing factor to the incident. The depth of cover over the pipe at the incident location at the time of the incident was likely a contributing factor, but there is no evidence to suggest that PG&E failed to meet the minimum depth of cover requirement applicable during installation.

SED's investigation did not find any violations of the Commission's General Order (GO) 112[1] by PG&E.

Fatalities and Injuries

Inmates

Deceased: [redacted]
Injured: [redacted]
Injured: [redacted]
Injured: [redacted]
Injured: [redacted]
Injured: [redacted]
Injured: [redacted]
Injured: [redacted]
Injured: [redacted]
Injured: [redacted]
Injured: [redacted]
Injured: [redacted]
Injured: [redacted]

County of Fresno Public Works Department

14. Injured: [redacted]

Operator Property Damage

Approximately $1,951,700; including $1,871,700 damage to PG&E's gas facilities, and $80,000 in other damages, including the cost of gas.

Other Damages

A John Deere 644K Wheel Loader was destroyed. Its value was not determined.

Utility Facilities Involved

Pipe size: 12-inch nominal pipe size, 12.75-inch outside diameter (OD)
Pipe material and classification: Steel transmission line

[1] General Order 112-F was adopted by the Commission on June 25, 2015 via Decision 15-06-044

Segment / Milepoint (MP): Line 118B segment 101.5 (MP 0.26)
Maximum Allowable Operating Pressure (MAOP): 400 psig
Maximum Operating Pressure (MOP): 369 psig
Specified Minimum Yield Strength (SMYS): 1647 psig
% MAOP/SMYS: 24.3%
Installation Date: 1962
Class Location: 3[2]
Coating: Double wrapped

Witnesses

Mohammad Ali, CPUC Investigator
Terence Eng, CPUC
Dennis Lee, CPUC
Aimee Cauguiran, CPUC
Kenneth Bruno, CPUC
[redacted], Pipeline Hazardous Materials Safety Administration (PHMSA)
[redacted], PG&E Program Manager
[redacted], PG&E Supervising Gas Engineer
[redacted], PG&E Operation and Maintenance (O&M) Specialist
[redacted], Fresno County Sheriff's Office
[redacted], Fresno County Sheriff's Office
[redacted], Fresno County Sheriff's Office
[redacted], Fresno County Sheriff's Office
[redacted], Fresno County Sheriff's Office
[redacted], Fresno County Public Works Department
[redacted], Fresno County Public Works Department
[redacted], Fresno County Public Works Department
[redacted], PG&E Gas Dispatch
[redacted], PG&E Grid Control
[redacted], PG&E Gas System Planning Engineer
[redacted], PG&E Gas T&D Project Clearance Supervisor
[redacted], PG&E Gas Transmission Clearance Supervisor
[redacted], PG&E Senior Gas Transmission Coordinator
[redacted], PG&E Gas System Operator
[redacted], Canus Corporation, Contractor to PG&E
[redacted], Canus Corporation, Contractor to PG&E
[redacted], PG&E Employee
[redacted], PG&E Employee

Evidence

1. SED's field investigation
2. PG&E's initial and final incident reports
3. Exponent In-Service Rupture Analysis Report for PG&E Line 118B-Fresno, dated July 2015
4. Transcripts of interviews conducted in April/May 2015 at Fresno County Office
5. PG&E's responses to Fresno L-118B Incident Data Requests

[2] As identified from PG&E's December 2004 baseline assessment

6. Fresno Fire Department Report
7. Golder Associates Report dated 6/19/15

Responding Agencies

1. Fresno Police Department (FPD)
2. The County of Fresno Sheriff's Office
3. Fresno Fire District (FFD)
4. City of Fresno
5. County of Fresno

B. Incident Summary

An explosion occurred at approximately 1433 hours on April 17, 2015, erupting flames past the tops of nearby trees. Fresno Fire Department (FFD) responded to the incident with 15 fire engines, fire trucks, and water trucks within approximately five minutes of the explosion. Upon arrival, firefighters attacked the fire and provided medical assistance to the injured. One person in critical condition was flown to the hospital by helicopter. Thirteen others were rushed to the hospital for evaluation and treatment. One critically injured person passed away on May 11, 2015.

On April 17, 2015, at approximately 1433 hours, [redacted] of PG&E Gas Dispatch received a phone call from the Fresno County Sheriff's Department notifying him of an explosion to a gas line. [redacted] dispatched a PG&E Gas Service Representative (GSR) to the site of the incident and documented the incident in PG&E's Incident Management Tool (IMT). An electrician who was working at Herndon Substation, located across the street from the incident site, reported the rupture/fire to PG&E Electrical System Operator [redacted]. [redacted] immediately notified Gas Control of the rupture. Gas Control: i) communicated to all control room personnel that a rupture was just reported, ii) verified the pressure and flow conditions in the Herndon area through SCADA, iii) identified individual roles and responsibilities in the control room to take various actions, iv) accessed operating maps/diagrams/clearances as reference material to work with field personnel to coordinate the pending isolation plan[3], and, v) contacted Gas System Planning Engineer [redacted] and Gas T&D Project Clearance Supervisor [redacted].

At approximately 1436 hours, Gas Control called [redacted], who was on-site at 1444 hours, as he was performing clearance work for hydrotest T-028 on a parallel line (L118A) nearby. Gas Control took the following actions: i) determined the exact location of the event (approximate mile point and pipeline), ii) reviewed the Operating Map and discussed the accessible locations of isolation valves to control the situation, iii) discussed resource availability and their proximity to the valves, and, iv) determined the next steps needed to ensure customer gas supply once isolation takes place.

[redacted], Supervisor of Gas Transmission Clearance in Gas Control, provided maps and diagrams of the affected area and proposed isolation to [redacted]. [redacted], Senior Gas Transmission Coordinator in Gas Control sent an e-Page to notify PG&E employees of the incident. [redacted], Gas System Operator in Gas Control, sent an ePage to [redacted], Program Manager of Gas Regulatory Support, who was on on-call duty to report the incident to the CPUC.

[redacted], PG&E Gas Service Representative (GSR), also working on hydrotest T-028 on L118A nearby, arrived at the site at 1442 hours. At approximately 1459 hours, [redacted], Gas Transmission O&M Specialist, arrived on site and assumed the role of Incident Commander. A Gas T&D clearance crew, led by [redacted], began valve operations. The crew consisted of two PG&E contractors, [redacted] and [redacted], and two PG&E employees, [redacted] and [redacted]. The flow of gas

[3] Clearance procedure used to insure isolation and inerting of the pipeline after the incident site was secured

was shut-off at 1520 hours by closing valves upstream and downstream of the incident site. The gas flow stopped and the fire was extinguished at 1556 hours.

An investigative team that included Jason Dunphy of the Pipeline Hazardous Materials Safety Administration (PHMSA), SED representatives Terence Eng, Dennis Lee, Aimee Cauguiran, Mohammad Ali, and Kenneth Bruno, was formed. The investigation team held a series of meetings, conducted interviews, and field investigations from April 18, 2015 through August 25, 2015, in Fresno and San Francisco, to determine the cause of the incident and PG&E's role leading up to and in response to the incident.

Figure 1 shows the location of the incident at the County Sheriff's Shooting Range.

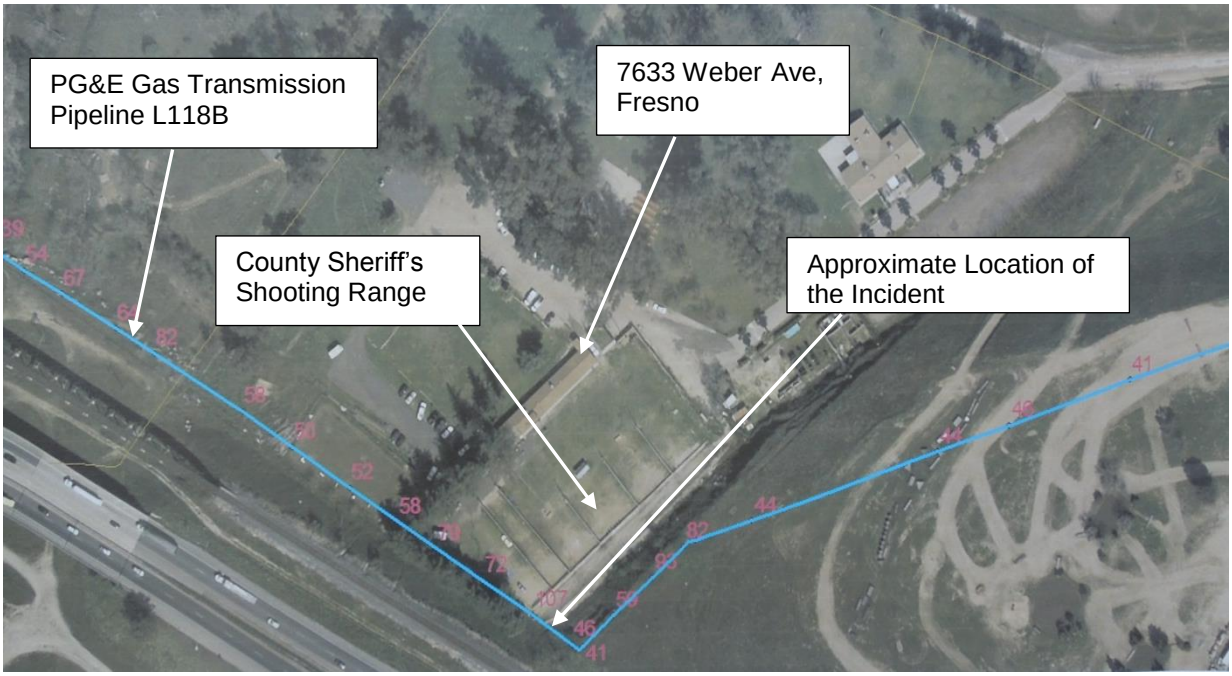
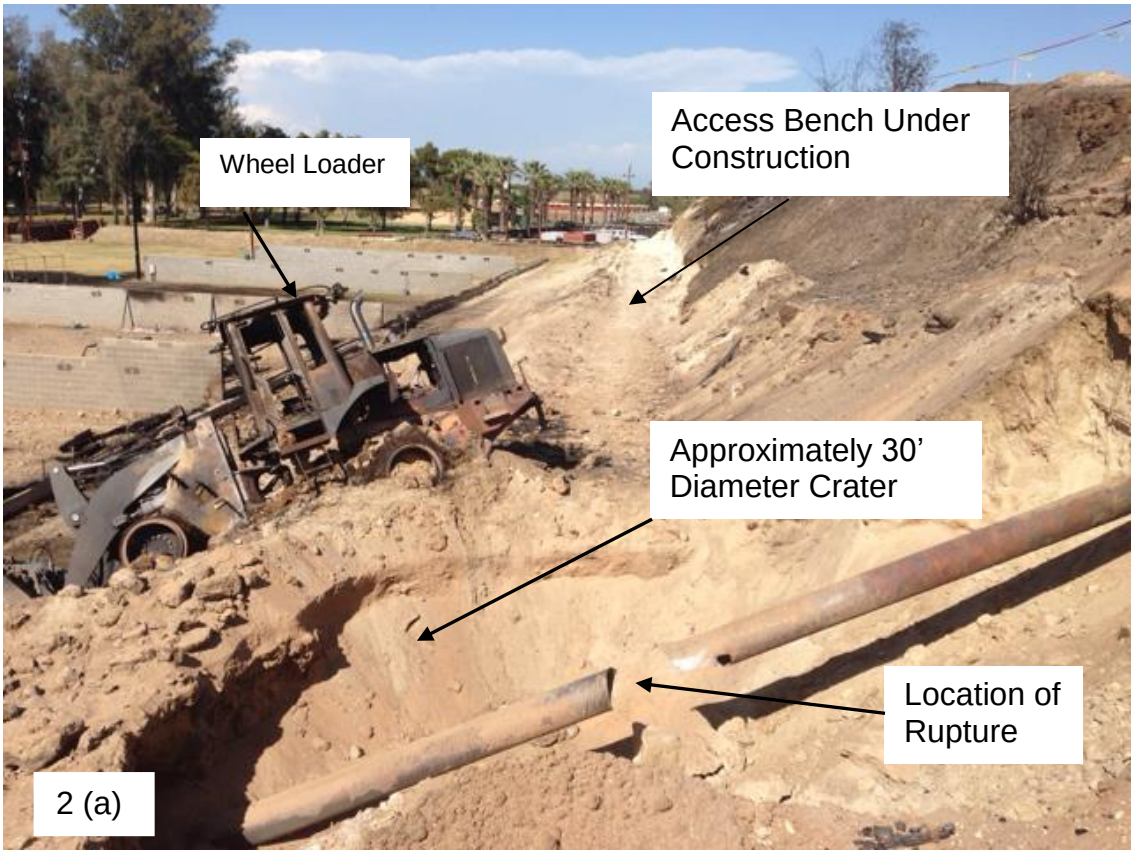


Figure 1: Aerial View of the Incident Location

Figure 2(a) shows the ruptured pipe with the loader and the access bench under construction with the surroundings destroyed by the fire, and 2(b) shows the expanded view of the access road. Piles of debris indicate that the road was recently graded.



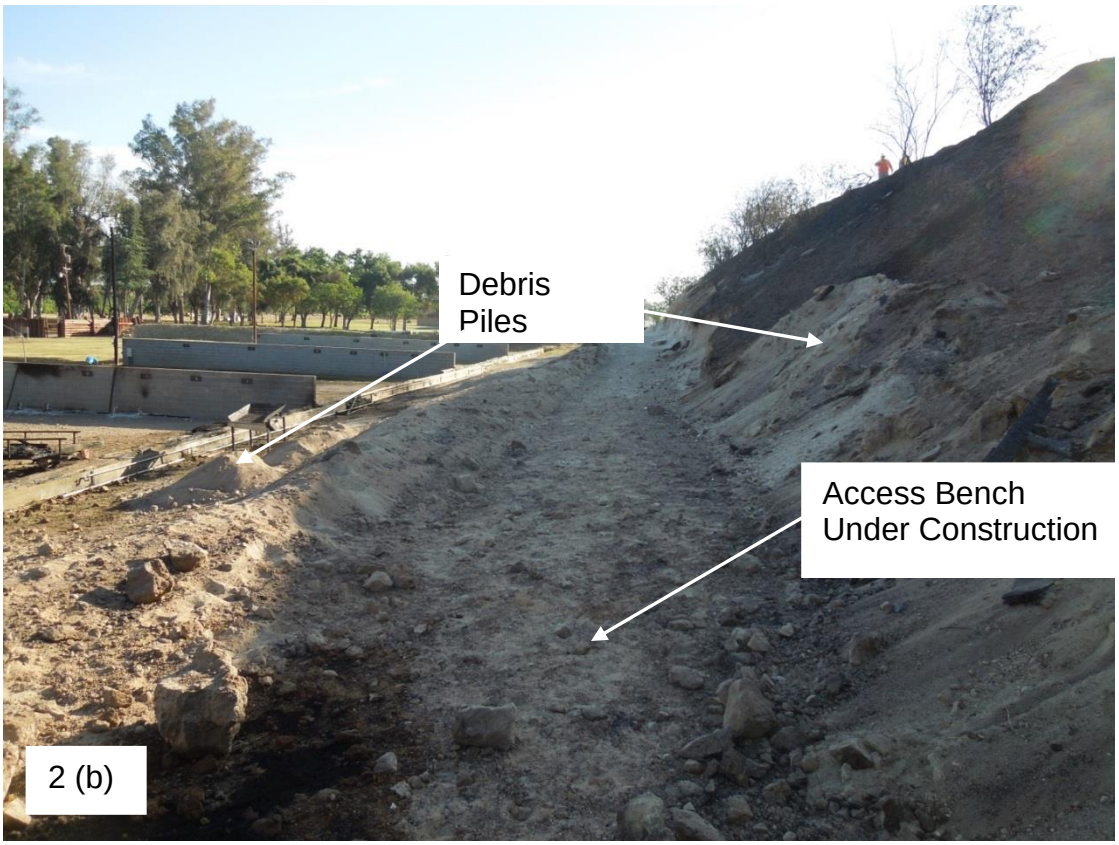


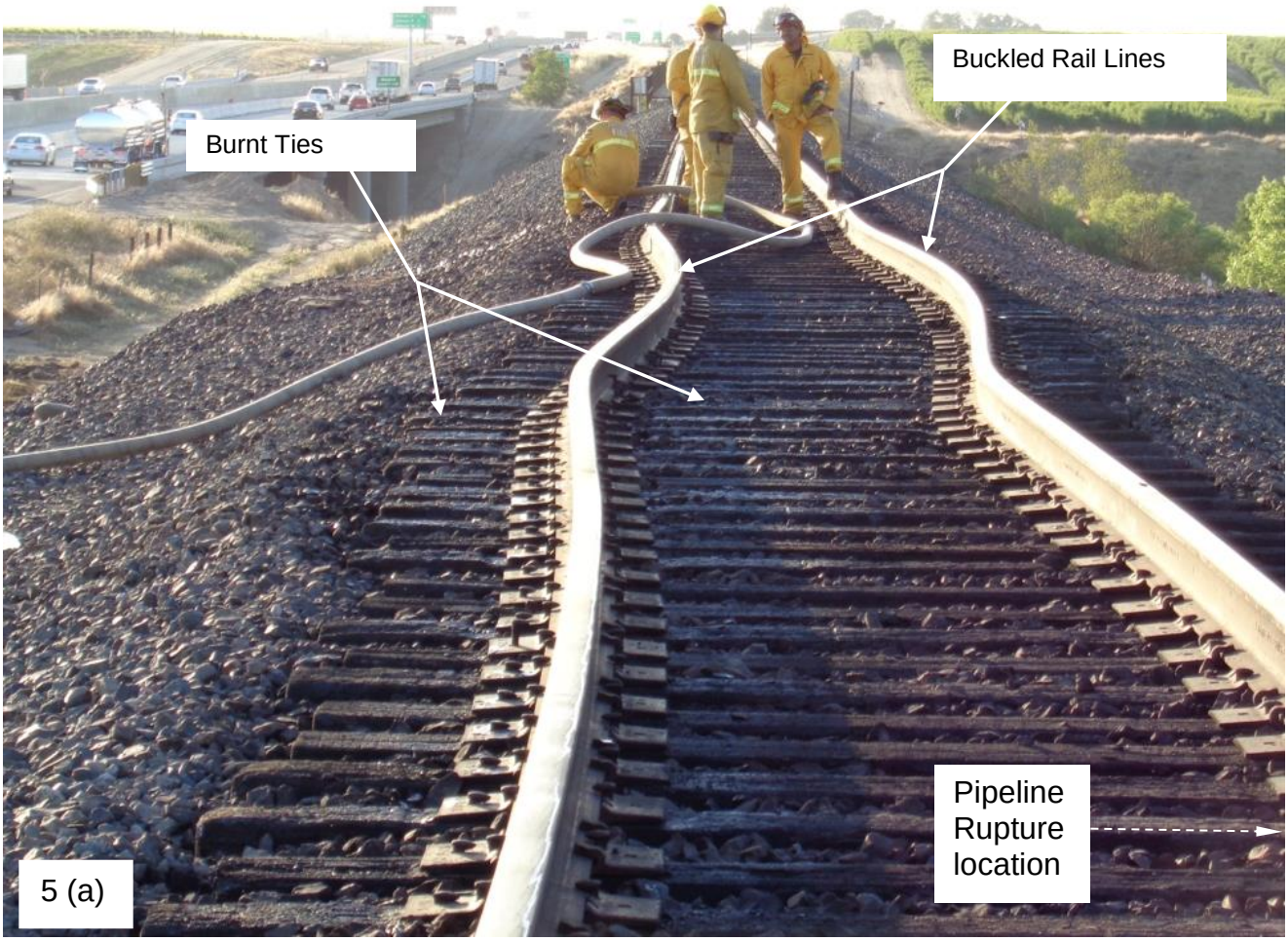
Figure 2: (a) Crater with the Ruptured Pipeline, Wheel Loader, and Access Bench; (b) An Expanded View of the Access Bench

Figure 3: Ruptured Pipeline and a Portion of the Shooting Range

Figure 4: Ejected Portion of the Pipeline

The pipeline rupture and subsequent ignition injured inmates working on the shooting range collecting lead bullets, and ejected a portion of the pipe about 34 feet away. Figure 3 shows the base of the slope, the slope where the access bench was under construction, the bucket of wheel loader, the damaged pipeline marker and the surrounding areas of the shooting range. Figure 4 shows the portion of pipeline that was ejected from the incident site. According to the Executive Summary of the Exponent Report (page iv), the significant gouging, scraping and deformation present could have only been caused by contact with the front-loader bucket. The Exponent Report concluded that the bucket punctured the pipeline and formed two cracks: each

propagated circumferentially in opposite directions around the pipe. The crack that propagated in a clockwise direction traveled approximately 1.5 inches where it intersected the longitudinal weld seam. This crack then propagated upstream and downstream along the seam in a relatively brittle manner for approximately 19 inches before turning into the base metal during final fracture. The other circumferential crack propagated counter-clockwise from the puncture in a ductile manner until final fracture.



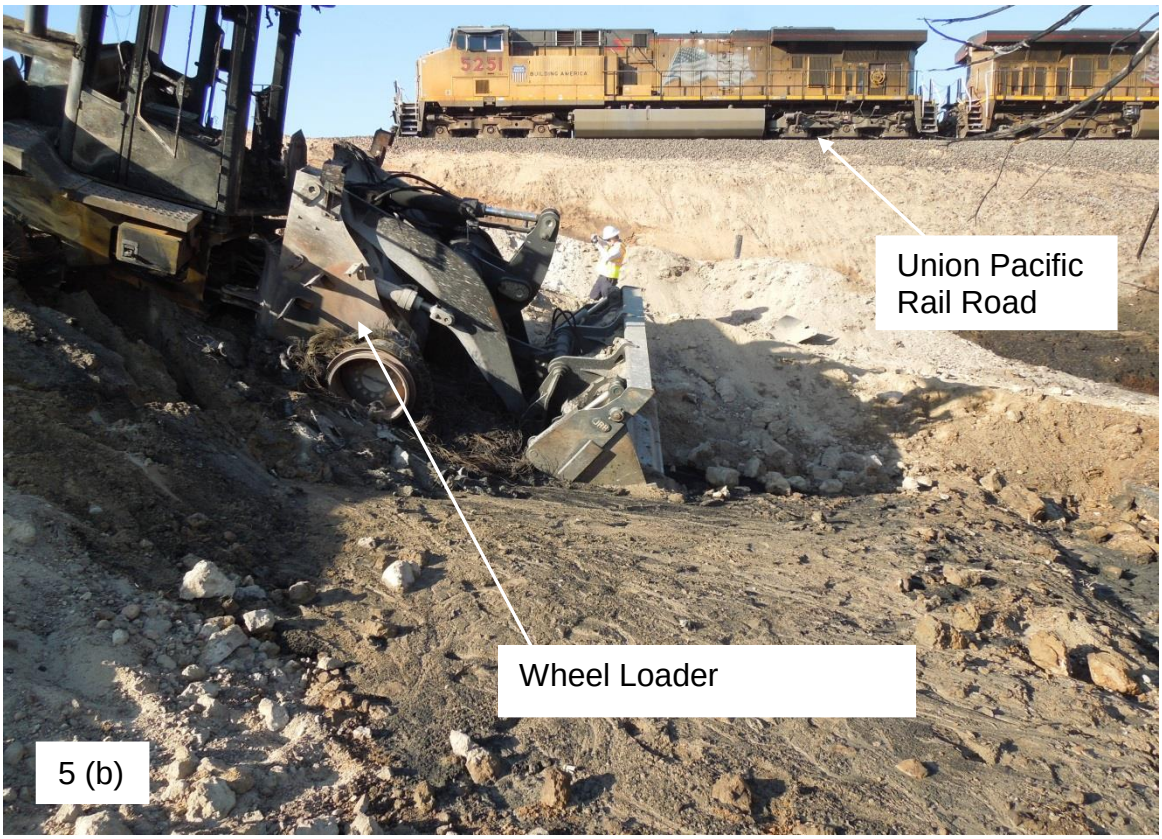


Figure 5: (a) Damaged Adjacent Union Pacific Railway Lines (b) the Wheel Loader

The rupture happened adjacent to the Union Pacific Railroad (UPRR) Mile point (MP) 194.75, at PG&E's Fresno Sub-Division Line 118-B. About 300 feet of railroad main track was damaged. The flames burned the ties and the stresses due to the train in combination with the heat from the fire may have damaged the rail. Approximately 200 feet of main track buckled. Figures 5 (a) and (b) show the damaged UPRR section of the rail lines and the wheel loader.

Law enforcement officials from FFD, Fresno Police Department, City of Fresno, Fresno County Sheriff's Department and California Highway Patrol (CHP) responded and assisted in traffic and pedestrian control and evacuation. The streets around the incident were cordoned off and residents living close to the explosion site were evacuated. Northbound and southbound Highway 99 and the adjacent Union Pacific Railroad were temporarily closed. Victims received care from medical personnel on site and were transported to the hospital for further treatment. Six of the injured, four in critical and two in serious condition, were taken to a nearby hospital.

Emergency Response crews remained on scene until approximately 2300 hours. PG&E personnel remained at the site until the consulting engineers assigned for the investigation completed their collection of samples from the incident site.

Table 1 shows a timeline of events that occurred on the day of the incident.

Table 1. Timeline of Events on April 17, 2015 at Fresno, CA

Time	Event
1433	PG&E Gas Dispatch ([redacted]) received the first call notifying PG&E of an explosion to a gas line. This call was from the Fresno Sheriff's Department. [redacted] dispatched a PG&E GSR to the site of the incident and documented the incident in PG&E's Incident Management Tool (IMT)
1436	Rupture/fire was reported to [redacted] (Electric System Operator from PG&E Grid Control) by an electrician who was at Herndon Substation (across the street from the rupture). [redacted] then notified Gas Control of the line rupture. Gas Control responded with the following actions: 1. Communicated to all control room personnel that an emergency event (rupture) was just reported to the control room. 2. Verified through SCADA the pressure and flow conditions in the Herndon area. 3. Identified individual roles and responsibilities in the control room to take various actions. 4. Accessed operating maps / diagrams/ clearances as reference material to work with the field to coordinate the pending isolation plan. 5. Contacted Gas System Planning Engineer, [redacted], and Gas T&D Project Clearance Supervisor, [redacted].
1444	[redacted] (Gas T&D Project Clearance Supervisor) called Gas Control to inform Gas Control that he was on-site and to begin discussion on the isolation clearance. Gas Control responded with the following actions: 1. Determined the exact location of the event (approximate mile point and pipeline). 2. Reviewed the Operating Map and discussed the accessible locations of isolation valves to control the situation. 3. Discussed resource availability and their proximity to the valves. 4. Determined the next steps needed to ensure customer gas supply once isolation takes place.
1445	[redacted] (Supervisor Gas Transmission Clearance in Gas Control) provided maps and diagrams of the affected area and proposed isolation to [redacted].
1452	[redacted] (Senior Gas Transmission Coordinator in Gas Control) sent an ePage to notify PG&E employees of the incident.
1456	[redacted] (Gas System Operator in Gas Control) sent ePage to [redacted] (Program Manager, Gas Regulatory Support - on-call for CPUC notification staff at the time of the incident).
1459	[redacted] (Gas Transmission O&M Specialist) arrived on site and assumed role of Incident Commander.
1500	Operating Emergency Center (OEC) and GEC (Gas Emergency Center) were activated.
1503	Gas T&D clearance crew (led by [redacted]) began valve operations. The crew consisted of two contractors ([redacted], [redacted]) and two PG&E employees ([redacted], [redacted]).
1520	Line isolated.
1556	Fire extinguished.

C. Investigation

On April 17, 2015, at approximately 1630 hours, SED engineer Mohammad Ali arrived at the incident site. Kenneth Bruno, Program Manager of the Gas Safety and Reliability Branch of the CPUC, arrived on site a few hours later. SED representatives, Ken Bruno and Mohammad Ali met with PG&E representatives and the Fresno Fire Department to conduct an initial field investigation of the incident.

On April 18, 2015, PG&E was requested to propose the names of possible vendors to perform failure analysis for investigating the cause of the rupture on pipeline L-118B. In response, PG&E forwarded the names of the following four vendors.

1) Exponent - Menlo Park, CA
2) Stress Engineering - Houston, TX
3) Intertek - Sunnyvale, CA
4) Structural Integrity Associates - Bay Area (Engineering office), Houston (Metallurgical Laboratory)

SED in consultation with PHMSA Western Region cleared the use of Exponent to carry out the task of metallurgical investigation. In July of 2015, Exponent submitted a comprehensive report on the causes of the incident. Exponent's investigation included the following testing and inspections:

1. Nondestructive Examination

i) Visual and Dimensional Inspection
ii) Nondestructive Testing
iii) Ultrasonic Thickness Inspection
iv) Detailed Visual and Magnetic Particle Inspection, Laser Scanning
v) Girth-Weld Radiographic Inspection

2. Fractography

i) Sectioning
ii) Detailed Visual Inspection of Fractographic Samples
iii) Mechanical Damage
iv) Visual
v) Microscopy and Energy Dispersive Spectroscopy
vi) Long Seam Fracture
vii) Visual
viii) Microscopy and Energy Dispersive Spectroscopy

3. Indication Examination

i) Sectioning
ii) Microscopy of Indications
iii) Microscopy of Other Samples

4. Mechanical Testing

i) Microhardness
ii) Tensile Testing
iii) Charpy Impact Testing

5. Chemical Analysis

D. Interviews by Fresno County Sheriff's Office

On April 21, 2015, [redacted] and [redacted] of the Fresno County Sheriff's Office conducted interviews of the staff who were present at the time of the incident. One representative from the CPUC was invited to observe the interview through a video screen. Lead investigator Mohammad Ali from the CPUC's Sacramento office attended the interviews. [redacted], Maintenance Supervisor of the shooting range, [redacted], Training Supervisor, and Deputy Sheriff [redacted] were interviewed.

According to the interviewees, there were a few projects initiated by the Sheriff's Office to bring the facility up to standards by restoring the slope of the shooting range. Since erosion had removed soil from the slope, it was decided to import clean soil for the berm slope. Part of the process was to clean the existing berm slope of lead before covering it with clean material. In order to bring new soil material in, it was necessary to widen the existing narrow bench to serve as a road for dump truck access. There were no permits for the proposed work, and nobody from the County Public Works was supervising the work. The County Public Works Officials indicated that maintenance work is typically performed by inmates. On the day of the incident, inmates were mining lead bullets from the adjacent slope while one County Public Works employee was grading the narrow road with a front loader for the proposed roadway access. The interviewees noted that they suddenly heard a huge explosion, throwing rocks and debris, followed by a secondary explosion with a huge fire. The three interviewees were involved in the initial rescue operation until fire and ambulance arrived at the incident site.

Fresno County Sheriff's Office conducted several other interviews with other County Sheriff's officials, inmates working on the day of the incident at the shooting range, County Public Work employees, and PG&E employees, among others. The CPUC does not have information about the contents of these interviews.

On April 24, 2015, Mohammad Ali of CPUC conducted an interview with [redacted]—Lead Supervisor, [redacted]—Supervisor, and [redacted]—Superintendent of the Road Maintenance Division of the Fresno County Public Works Department. According to [redacted], the Sheriff's office requested him for the grading work of an access bench at the shooting range and he assigned [redacted] for the project. [redacted] selected [redacted] for the grading work without mentioning any specific depth of excavation. [redacted] was operating a John Deere front loader for the grading work at the incident site on the day of the incident. All of them indicated that since they believed that no excavation was proposed, no USA ticket was requested for the work performed at the shooting range. The county officials responded that all of the communications regarding works at the shooting range were verbal, and no third party consultant was involved. No land survey identifying the existing land profile,

natural and man-made structures, or other physical features of the area was performed prior to the start of work. No detailed plans showing the existing land features superimposed over the proposed works were prepared. The county officials also indicated that detailed plans are prepared for projects managed by consultants only. Since grading involves cut and fill, the original depth of pipe at the incident area could not be accurately determined due to the absence of detailed plans.

SED made several attempts to interview [redacted], the wheel loader operator at the time of the rupture. According to the letter of [redacted] of Corey, Luzaich, de Ghitaldi, Nastari & Riddle LLP, written on August 10, 2015, to Pouneh Ghaffarian, CPUC, [redacted] was not available for an interview.

E. PG&E's Responses to CPUC Data Requests:

SED reviewed and analyzed PG&E's responses to SED's data requests. The investigation of potential contributing factors to the incident are discussed below:

Leak Survey:

PG&E submitted to SED routine leak survey records from 2010 to April 2015 for the affected pipeline. As part of its Pipeline Safety Enhancement Plan (PSEP), PG&E performed supplemental leak surveys in addition to routine leak surveys on L-118A and L-118B. These included PG&E's 2010 system-wide aerial leak survey, 2010 accelerated system-wide ground leak survey, and 2012-2015 aerial leak survey.

SED reviewed PG&E's leak survey records and did not find any leaks that were discovered in the area prior to the incident.

Patrolling:

SED reviewed PG&E patrolling records from 2013 through March 2015. For Line 118B, segment 101.5 (MP 0.26), SED obtained and reviewed records of 12 aerial patrols conducted in 2013, 16 aerial patrols conducted in 2014, and 3 aerial patrols conducted in 2015. PG&E performed further investigations via ground patrol at areas of concern identified during aerial patrols or other notifications. As a result, three ground patrols were performed. Of the three ground patrols, only one occurred in the vicinity of the incident. The record of the patrol, dated 3/24/14, noted "erosion on slope". However, further investigation by PG&E noted, "The slope where the pipe is located seems in good shape to me."

SED's investigation determined that PG&E's patrolling of the affected pipeline records did not indicate any outstanding areas of concern at the incident location.

Pipeline Markers:

Prior to the incident, PG&E had installed pipeline markers near the incident location. Figures 6 (a) (b) and (c) show the line markers closest to the incident site along with their respective GPS coordinates.

Figures 6 (a), (b), (c): Line markers and depth of cover in early 2013 at the incident location.

Centerline Survey:

PG&E's 2013 Pipeline Centerline Survey (PLCL) was a geospatial survey of its 6,750-mile gas transmission pipeline system, which included the section of pipe involved in the incident. Using survey-grade and mapping-grade Geospatial Positioning System devices, crews surveyed the centerline of transmission pipelines. This "centerline" survey activity located, marked and acquired GPS coordinates for the center of the pipeline, and checked the immediate zone (10' on either side of the pipeline) for any structures or vegetation that could interfere with PG&E's ability to maintain, inspect and safely operate the pipeline.

Contractors passed qualifying tests in December of 2012 to conduct the PLCL. Tools used to perform the 2013 Pipeline Centerline Survey of Line 118B in the immediate area of the April 17, 2015 incident in Fresno are shown in Table 2 below.

Table 2. Tasks and Equipment

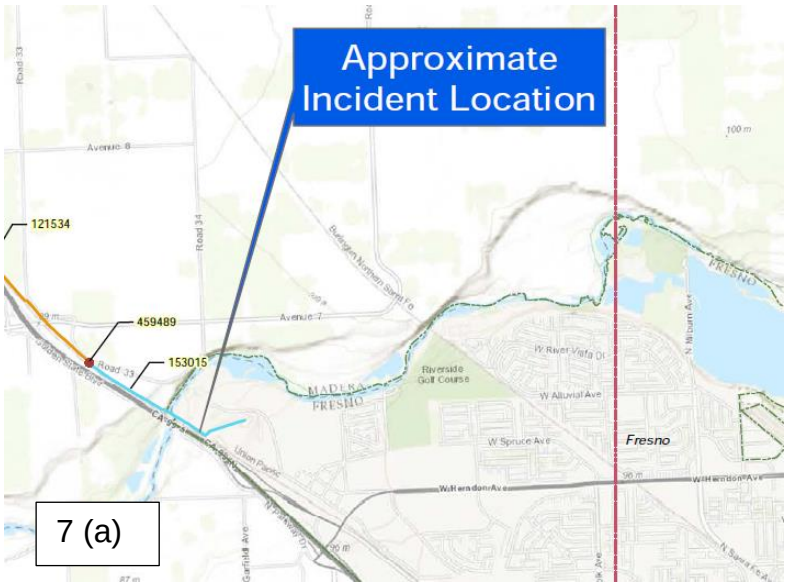
Task	Equipment Make/ Model
Locate and Mark	Radiodetection/ RD8000
Survey	TRIMBLE/ R8

In the immediate zone of the incident, the qualified contractors collected data every 50 feet. They captured the depth in inches to the center of pipe at each point, with a vertical tolerance of +/- 25% of the depth. Figure 6(d) shows that the survey found depth of cover at the points nearest to the location of where the pipeline was damaged of 41 inches, 46 inches and 107 inches.

Figure 6 (d): PG&E 2013 centerline survey results

Pipeline History and As-Built Drawing

PG&E gas pipeline L-118B was constructed in 1962. On September 5, 1962, a strength test conducted on the pipeline showed a holding pressure of 1575 psi for 24 hours, which is nearly four times the MAOP. The pipeline was placed into service on November 19, 1962. Easement records include restriction from diminishing or substantially adding to the ground cover over the pipeline. Figure 7(a) shows the location of the incident site and identifies drawing number 153015 that contains the as-built drawing. Figure 7(b) shows a portion of as-built drawing 153015 prepared in 1968 identifying facilities around the incident location. The as-built drawing does not specify the depth of cover over the pipeline.



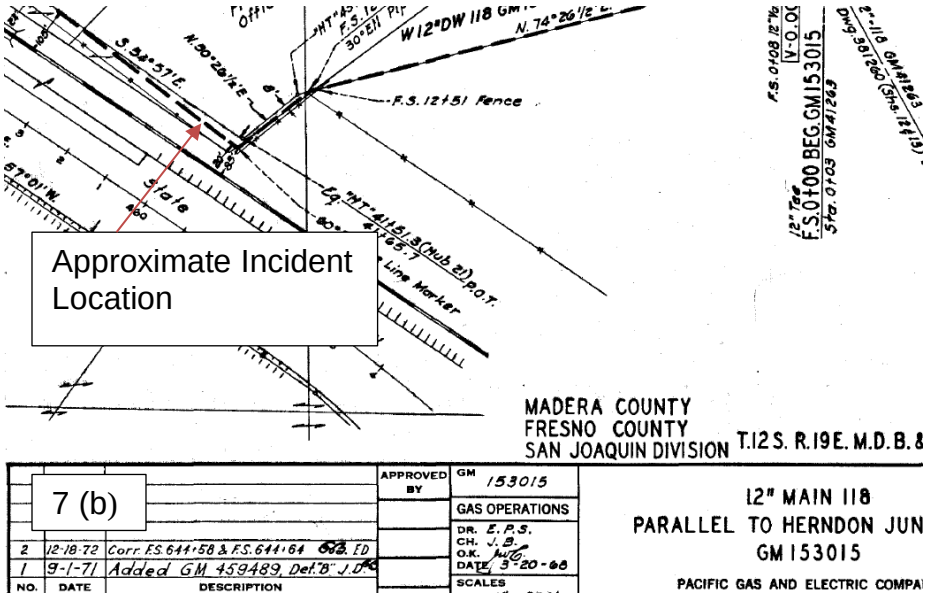


Figure 7 (a), (b): As built plans showing the installation of the pipeline in 1962

Odor Complaints:

PG&E queried all odor complaints received from April 10, 2015 to April 18, 2015 that were within one mile of the incident site. PG&E's records indicated that five odor complaints were received—four of which resulted from the L-118B incident. The one odor complaint not related to the incident was from a vehicle impact on a distribution line. None of the calls occurred prior to the incident.

Damage Prevention/811 Outreach:

Beginning in October of 2013, PG&E began hosting *811 Call Before You Dig* workshops, covering Government Code 4216 requirements, the 811 calling process,

and the use of hand digging tools. Dialing 811 is one of the first steps to prevent dig-ins (damage of underground facilities).

PG&E indicated that two such workshops were held in Fresno in April and November of 2014 and one in Modesto in March 2015. Two Fresno County employees, [redacted] and [redacted], attended the 811 workshop on November 6, 2014.

Through collaboration between PG&E's Local Government relations, Gas Operations and Local presence teams, PG&E has built partnerships with local city councils and counties, including Fresno County, to increase awareness about 811. SED investigation found PG&E's compliance with damage prevention procedures to be satisfactory.

USA 811 Presentations:

Underground Service Alert North 811 (USA North 811) provides Safety Awareness for Excavators (SAFE) educational presentations at pre-determined locations on an annual basis. PG&E, as required, is a member of USA North 811. As a service to its members, USA North 811 conducts a series of seminars focused on providing the excavator community with important legal requirements governing excavation within California. The presentation covers the legal requirements for California's One Call Law (California Government Code 4216) and Cal/OSHA Title 8 Construction Safety Order Chapter 4, Subchapter 4, Article 6, Section 1541.

SED reviewed PG&E's copies of invitations, lists of invitees, and sign-in sheets for SAFE events in Fresno by year. SED found PG&E's compliance with 811 activities to be satisfactory.

Request for USA One Call 811 Ticket:

During the interview with the County of Fresno Public Works Department officials and through data requests to PG&E, SED confirmed that no USA ticket was requested for the excavation work at the shooting range.

811 Advertising:

Damage Prevention 811 advertising consists of radio and billboards across the service territory. These advertising efforts include Fresno County.

Proximity Letter:

Every three years PG&E sends businesses and residents within 2,000 feet of PG&E owned gas transmission pipelines (operating at greater than 60 psig), including recipients located in Fresno County, a notification of their proximity to the transmission pipeline. The notification contains an envelope with a letter explaining why they are receiving the notification, and a gas safety brochure with information about how to locate nearby gas pipelines, damage prevention measures (811), how to identify gas leaks, and what to do in the event of a gas leak. The 2014 proximity letter batch was mailed the week of December 15, 2014, and included the incident location addressee

“Our Neighbors At 7633 N Weber Ave, Fresno, CA 93722”, delivered to the address on December 17, 2014.

Gas Transmission Right-of-Way Letters:

During non-proximity letter years (2010, 2012, 2013) PG&E notifies businesses and residents within 1,000 feet of a PG&E owned gas transmission pipeline (greater than 60 psig) of their proximity to the pipeline. These efforts also include recipients located in Fresno County. The safety piece contains information about how to locate nearby gas pipelines, how to avoid damaging them, how to identify gas leaks and what to do in the event of a gas leak. The notification was sent in 2010, 2012, and 2013. The 2015 program had not yet been executed at the time of SED’s investigation.

Summary of PG&E’s Damage Prevention Program Related to the Line 118B Incident Location since 2010

1. 811 Workshops: Two in Fresno (April & November 2014), One in Modesto (March 2015). Two Fresno County employees attended in November 2014.

2. Fresno County 811 Outreach: 21 Outreach meetings/events attended by Fresno county representatives

3. USA North 811 Presentations in Fresno County annually 2011 – 2015

4. 811 Advertising in Fresno County

5. Gas Emergency Preparedness Awareness Training included Fresno County first responders. Fresno County Sheriff’s office participated twice in 2014.

6. Public first responder workshops conducted in Fresno County 2011 – 2015

7. Proximity letters delivered to “Our Neighbors At 7633 N Weber Ave, Fresno, CA 93722” on Dec. 17, 2014

8. Gas Transmission Right-Of-Way Letters sent 2010, 2012 and 2013

9. Public Officials newsletter sent to Fresno County 2010-2014

10. Excavation Safety Guide-Pipeline Edition Mailers sent March 2014 to Fresno County Public Works Department

11. Emergency Response Guidebook & Newsletter sent October 2014 to i)Fresno County Sheriff’s Department - Sheriff , ii) Fresno County Sheriff’s Department - 911 Supervisor, iii) Fresno County Sheriff’s Office - Senior Officer

12. Gas Safety Bill Insert & Companion E-Bill Insert o Sent to 7633 N Weber Ave in Fresno in March, August, and October 2014

Depth of Cover:

Golder Associates of Redmond, WA was hired by PG&E to perform an investigation to determine the depth of cover of pipeline L-118B. The investigation included a site reconnaissance, review of historical aerial photographs, and quantitative analysis of high resolution Light Detection and Ranging (LiDAR) Digital Evaluation Models (DEMs) from 2014 and 2015 (post-rupture). LiDAR is a tool that sends out light pulses (like radar) and then measures the time it takes to return to its source. Comparing the difference between the 2014 and 2015 aerial LiDAR data, the average vertical accuracy appears to be about +/- 4.0 cm, according to Golder Associates' report dated June 2015. The DEM from March/April 2014 showed that in 2014 there was 4.7 feet vertical cover over the pipeline where the pipeline was damaged, and about 11 to 12 feet of soil laterally between the pipeline and the bench that was excavated in to the hillside as part of the firing range backstop.

According to Exponent's July 2015 report, the pipe was found to have minimal depth of cover at the strike location, on the uphill side of the bench cut into the hillside. Away from where the bench intersected the pipe, the depth of burial was measured to be between 44 and 46 inches, both upstream and downstream from the rupture.

Since the pipeline was installed in 1962, the utility was required to adhere to CPUC General Order 112, effective January 17, 1961, which states the following regarding depth of cover:

"Buried pipelines and mains operating or intended to be operated at hoop stresses of 20% or more of the specified minimum yield strength shall be installed with a minimum cover of 30" in Class 3 and Class 4 locations."

If the pipeline was in a Class 1 or 2 location at the time of installation, the depth of cover required was no less than 24 inches according to the industry standard[4] at the time.

There is no evidence to suggest that PG&E did not meet the minimum depth of cover requirement applicable during installation. However, SED's field investigators who visited the site a few hours after the rupture noted that the pipeline likely had minimal cover under the access bench. Therefore depth of cover at the time of the incident was likely a contributing factor. Events and findings pertaining to depth of cover in the area of the incident are shown below in Table 3.

Table 3. Timeline - Depth of Cover of the Pipeline (2013-2015)

Date	Findings	Source
5/24/2013	Depth of cover measured to be in the range of 46 to 107 inches in the area of the incident site.	PG&E Pipeline Centerline Survey
3/24/2014	PG&E noted, "Erosion on slope." PG&E follow-up response noted, "The slope where the pipe is located seems in good shape to me."	PG&E Ground Patrol

[3] American Standard Gas Transmission and Distribution Piping Systems (ASA B31.8-1958)

4/4/2014	In March/April of 2014, there was 4.7 feet (56.3 inches) vertical cover over the pipeline where the pipeline was damaged and about 11 to 12 feet of soil laterally between the pipeline and a bench that was excavated in to the hillside as part of the firing range backstop.	RE: Depth of Cover Analyses - Line 118B, Fresno, CA - Golder Associates
4/16/2015	Based on an aerial photograph taken on April 16, 2015, the soil cover vertically over the pipeline, and the soil cover next to the pipeline was undisturbed up until the morning of April 16, 2015, the day prior to the pipeline rupture.	RE: Depth of Cover Analyses - Line 118B, Fresno, CA - Golder Associates
4/17/2015	Pipeline damaged by Fresno County employee. Pipe was found to have minimal depth of cover at the strike location.	PG&E Line 118B Fresno In-Service Rupture Analysis - Exponent

California Government Code:

California Government Code 4216(b): "'Excavation' means any operation in which earth, rock, or other material in the ground is moved, removed, or otherwise displaced by means of tools, equipment, or explosives in any of the following ways: grading, trenching, digging, ditching, drilling, auguring, tunneling, scraping, cable or pipe plowing and driving, or any other way."

California Government Code 4216.2(a)(1): "Except in an emergency, any person planning to conduct any excavation shall contact the appropriate regional notification center, at least two working days, but not more than 14 calendar days, prior to commencing that excavation, if the excavation will be conducted in an area that is known, or reasonably should be known, to contain subsurface installations other than the underground facilities owned or operated by the excavator and, if practical, the excavator shall delineate with white paint or other suitable markings the area to be excavated."

California Government Code 4216.4(a): "When the excavation is within the approximate location of subsurface installation, the excavator shall determine the exact location of subsurface installations in conflict with the excavation by excavating with hand tools within the area of the approximate location of subsurface installations as provided by the operators…"

In construction, grading implies preparing the land to a desired elevation by either exporting (digging), or importing (fill) earth materials, and compacting to the required density. Grading for the preparation of the access way involved scraping, digging, and/or filling, and met the definition of excavation stated in California Government Code 4216(b).

California Government Code 4216.2(a)(1) indicates that any proposed excavation, except in an emergency, should be performed only after contacting the appropriate regional notification center.

Because the Fresno County Sheriff's Office did not contact the regional notification center before excavation, PG&E did not have an opportunity to mark its subsurface facilities (pipeline). The marking would notify the excavator the approximate location of the pipelines. The excavator would then be required to excavate with hand tools within the area of the approximate location of the pipeline, per California Government Code 4216.4(a). Therefore, the Fresno County Sheriff's Office's failure to contact the regional notification center was likely a contributing factor.

PG&E Pipeline Investigation Procedures:

PG&E's Utility Operations (UO) Standard S2333 and its Attachment 1-MPR Process Flow Chart requires that the following be conducted when a material problem is identified.

- Initiate corrective action
- Identify failure trends
- Correct undesirable operation and installation procedures
- File a claim with the manufacturer
- Remove or replace failed material

UO S2333 also states that the evaluator is responsible for determining the type and extent of the problem; leading the evaluation, completing the evaluation, reviewing and analyzing data and trends, and providing feedback to the operating departments as necessary.

Based on its investigation, SED found that PG&E followed their procedure in UO standard S2333 when conducting its pipeline investigation. No material problem was identified; damage to the pipeline was a result of excavation damage.

PG&E Emergency Plan and Evacuation Procedures:

PG&E's Gas Emergency Plan (GEP) states, "We will respond and make the situation safe. The company's top priority is to assure our customers that we are concerned about their physical safety and want to make the situation as safe as possible." PG&E trains company personnel how to implement emergency response procedures in a manner consistent with its GEP.

PG&E's GEP describes the specific duties that GSRs, who are generally the first company representatives on the scene, are required to perform. According to the GEP, the first responsibility of the GSR is to protect life and property. If the GSR is unable to do so, the GSR must immediately call for assistance. After the area is secure, the GSR assesses the situation and determines the necessary response including protecting people and property.

Additionally, PG&E's Work Procedure (WP) 6434-01 Gas Leak and Odor Investigation describes the criteria for determining and conducting the appropriate gas leak investigation method for gas leak and odor complaints and responsibilities of the Field Service (FS) employees to ensure customer and public safety. PG&E's UO Standard S6434 Gas Leak and Odor Response defines the term "Field Employees" as service mechanics, GSRs, and any other gas classifications appropriately qualified to perform this work.

WP 6434-01 states that if a hazardous leak is suspected:

> "1) Notify Dispatch Operations in the resource management center (RMC) and request additional assistance (e.g., crew, leak surveyor, supervisor, public agency - fire, police).
>
> "2) Take corrective action(s) to safeguard the property and public safety while assistance is en-route (e.g., evacuating building, ventilating buildings, investigating main and service leakage, shutting off curb valves, securing the site from foot traffic)."

SED's investigation found PG&E's compliance with its Emergency Plan and Evacuation procedures to be satisfactory.

F. Summary of Reports Submitted by Exponent:

Based on the analysis of the field data and laboratory test results, Exponent concluded that:

1. PG&E Line 118B ruptured when it was struck by a front loader that was operating in the area shown in Figures 8(a) and 8(b) at the time of the incident.

8(a)

Figure 8: (a) Aerial photograph of the incident site after the incident and pipe excavation. The area of pipe rupture is shown by a dotted red line; (b) Aerial photographs of the incident scene taken after the incident and pipe excavation.

2. The significant gouging, scraping, and deformation present at the Line 118B rupture location could have only been caused by contact with the front-loader bucket.

3. The pipe was found to have minimal depth of cover at the strike location, on the uphill side of the bench[5] cut into the hillside. Away from where the bench intersected the pipe, the depth of burial was measured to be between 44 and 46 inches, both upstream and downstream from the rupture. The depth of cover was not consistently 44–46 inches across the ruptured location: substantial amounts of soil had been removed to create the bench, particularly on the uphill side. The Exponent Report noted that it did not investigate the history behind the bench; however, it did note that fresh dirt was present on and around the bench, indicating recent activity that resulted in the movement of soil.

[5] The Exponent Report refers to the bench as a "dirt road."

Figure 9: (A) Incident scene after the rupture, and (B) A Three-dimensional Reconstruction of the Pipe Overlaid on the Incident Scene

4. The bucket punctured the pipeline and formed two cracks: each propagated circumferentially in opposite directions around the pipe. Figure 9(a) show the incident scene after the rupture and 9(b) shows a three-dimensional extrapolated reconstruction of the ruptured pipe.

5. There is no evidence that progressive damage such as corrosion, stress corrosion, or fatigue was present or contributed to the rupture.

G. Conclusion:

Based on its investigation, SED made the following conclusions regarding the incident.

1. The pipeline damage and subsequent rupture was caused by a Fresno County employee who struck the pipeline with the bucket of the front loader he was operating.

2. The Fresno County Sherriff's Department's failure to follow Underground Service Alert's (USA) One Call (811) program requirements listed in California Government Code 4216 was a contributing factor to the incident.

3. SED's field investigation a few hours after the rupture indicated that the point of contact on the pipeline had minimal cover, and this was a contributing factor to the incident.

4. The Fresno County Sherriff's Department's failure to seek professional assistance in its work on the shooting berm may have been a contributing factor to the incident.

5. SED found no evidence to suggest that PG&E did not meet the requirement for minimum cover at the time of installation.

6. Corrosion to the pipeline was not a contributing factor to this incident.

7. No GO 112 violations were committed by PG&E.