

Public Incident Investigation Report

CALIFORNIA PUBLIC UTILITIES COMMISSION Safety and Enforcement Division Electric Safety and Reliability Branch

Incident Investigation Report

Report Date: March 29, 2017

Incident Number: E 20150916-01

Utility: Pacific Gas and Electric Company (PG&E)

Date and Time of the Incident: 9/9/2015, 2:26:00 PM

Location of the Incident: 17704 Butte Mountain Road
Jackson, CA
County: Amador

Summary of Incident:

On September 9, 2015, the “Butte Fire”, ignited at 17704 Butte Mountain Road in the city of Jackson in Amador County. The fire burned 70,868 acres, destroyed 921 structures (549 homes, 368 outbuildings, and 4 commercial properties), damaged 44 structures, and resulted in two “indirect” civilian fatalities and one injury.

The investigation found that a gray pine contacted a PG&E 12 kV overhead conductor and caused an ignition that started the fire.

Fatality / Injury: There were two fatalities and one injury.

Property Damage: \$108,976,189

Utility Facilities involved: Electra 1101, 12 kV Circuit

Public Incident Investigation Report

Witnesses:

	Name	Title	Phone
1	Ryan Yamamoto	CPUC Investigator	415-703-2192
2	[REDACTED]	PG&E - Sr. Compliance Specialist	[REDACTED]
3	[REDACTED]	PG&E - Supervisor - Regulatory Compliance	[REDACTED]
4	[REDACTED]	PG&E - Sr. Director - Transmission	
5	Gianni Muschetto	Battalion Chief, California Department of Forestry and Fire Protection (CAL FIRE)	530-708-2720
6	David Wiseman	CAL FIRE Attorney	916-657-0444
7	[REDACTED]	PG&E - Distribution Engineer, Supervisor	
8	[REDACTED]	PG&E Supervisor - Business Finance	
9	[REDACTED]	PG&E - Vegetation Management Supervisor	
10	[REDACTED]	PG&E - Principal VM Program Manager	
11	[REDACTED]	PG&E - Vegetation Management Sr. Manager	
12	[REDACTED]	PG&E - Vegetation Management QA Supervisor	
13	[REDACTED]	PG&E - Electric Distribution Supervisor	
14	[REDACTED]	PG&E - Transmission Line Superintendent	
15	[REDACTED]	PG&E - Emergency Management Director	
16	[REDACTED]	PG&E - Principal Meteorologist	
17	[REDACTED]	PG&E - Manager Electric Mapping/GIS	
18	[REDACTED]	PG&E - Distribution Operations Supervisor	
19	[REDACTED]	PG&E - Vegetation Management Supervisor	
20	[REDACTED]	PG&E - Compliance Supervisor	
21	[REDACTED]	PG&E - Chief Counsel	
22	[REDACTED]	PG&E - Investigator	
23	[REDACTED]	PG&E - Supervisor	
24	John Wasmer	Director of Operations - ACRT	
25	[REDACTED]	PG&E - Manager, Emergency Management & Public Safety	
26	Calaveras County	Coronor's Office	
27	Alan Jang	Jang & Associates, LLP	
28	Michael T Mahoney	Arborist for CAL FIRE	

Public Incident Investigation Report

Evidence:

	Source	Description
1	PG&E	Initial Online Incident Report
2	CPUC	Data Request #1, 9/23/15
3	PG&E	Data Request Response #1, 10/7/15, 10/8/15, 10/12-14/15
4	CPUC	Field visit, 9/18/15
5	CPUC	Evidence Inspection, 9/22/15
6	CPUC	Data Request #2, 9/25/15
7	PG&E	Data Request Response #2, 10/12/15, 10/14/15
8	PG&E	Tree Removal Notice, 10/19-20/15, 10/23/15
9	CAL FIRE	Investigation Report, 4/25/16
10	CPUC	Data Request #3, 6/6/16
11	PG&E	Data Request Response #3, 6/17/16
12	CPUC	Data Request #4, 6/17/16
13	PG&E	Data Request Response #4, 6/20/16
14	CPUC	Field visit, 7/11/16
15	CPUC	Data Request #5, 8/11/16
16	PG&E	Data Request Response #5, 10/28/16
17	CPUC	Data Request #6, 11/3/16
18	PG&E	Data Request Response #6, 11/18/16
19	CPUC	Data Request #7, 1/18/17
20	PG&E	Data Request Response #7, 1/27/17, 2/6/17
21	CPUC	Data Request #8, 1/19/17
22	PG&E	Data Request Response #8, 1/20/17, 1/27/17
23	CPUC	Data Request #9, 1/30/17
24	PG&E	Data Request Response #9, 2/15/17
25	CPUC	Data Request #10, 1/31/17
26	PG&E	Data Request Response #10, 2/1/17
27	CPUC	Data Request #11, 2/14/17
28	PG&E	Data Request Response #11, 2/17/17
29	CPUC	Data Request #12, 2/16/17
30	PG&E	Data Request Response #12, 2/23/17
31	CPUC	Data Request #13, 2/22/17
32	PG&E	Data Request Response #13, 2/24/17
33	CPUC	Follow-up question for DR #11, 2/21/17
34	Jang & Associates, LLP	Cross-complaint document, 1/12/17
35	PG&E	Follow-up Response for DR #11, 3/2/17
36	Michael T Mahoney	Arborist Report, 2/15/16

Public Incident Investigation Report

Background

On January 17, 2014, Governor Edmund G. Brown Jr. proclaimed a State of Emergency and directed state officials to take actions to mitigate conditions that could result from a drought and cause a fire. On June 12, 2014, the CPUC issued Resolution ESRB-4 directing all Investor Owned Electric Utilities to take remedial measures to reduce the likelihood of fires started by or threatening utility facilities.

On September 9, 2015 at approximately 1446 hours, a 44-foot gray pine tree contacted an overhead conductor of PG&E's Electra 1101 12 kV circuit located in the vicinity of the residence property at 17704 Butte Mountain Road in the city of Jackson in Amador County (see figure 1), starting the "Butte Fire". The fire burned 70,868 acres, destroyed 921 structures (549 homes, 268 outbuildings, and 4 commercial properties), damaged 44 structures, and resulted in two civilian "indirect" fatalities and one injury. Both death victims were residents of Calaveras County who refused to evacuate the area as recommended by local authorities. The coroner's reports indicated that the cause of death for both victims was "consumption by fire (residential conflagration)". The fire caused power interruptions to 3644 customers for 16,651,071 customer minutes, 6377 customers for 10,053,920 customer minutes and 4246 customers for 23,519,468 customer minutes. The 12 kV conductor did not fail and fall to the ground.

Weather station KCAJACKS6, located approximately four (4) miles northwest from the incident location, recorded average wind speed and gust of 1 mph and 7 mph, respectively. The ambient condition around the time of ignition was 102 degrees Fahrenheit and dry.¹

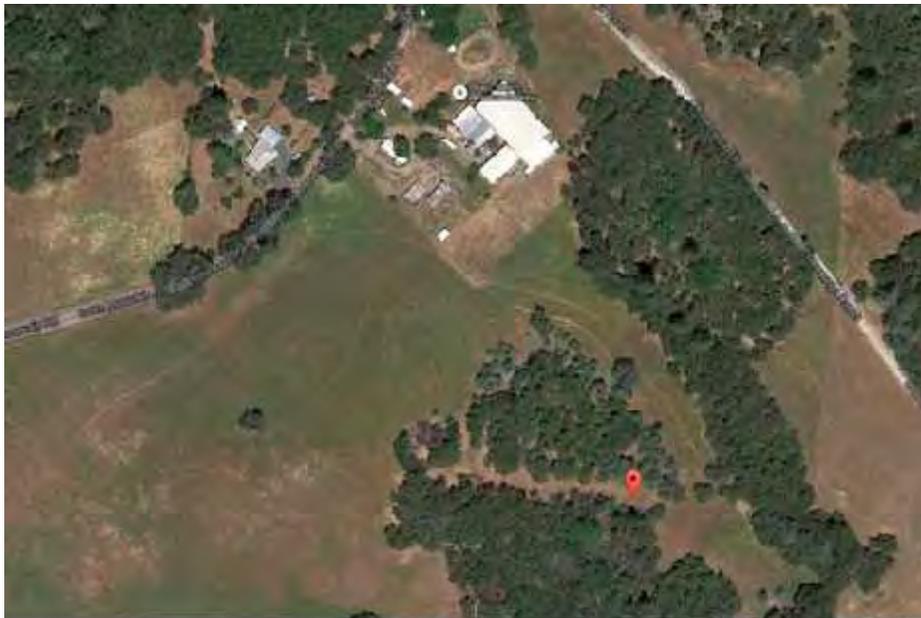


Figure 1: Ignition point/location

On September 16, 2015 at 1547 hours, seven days after the fire started, PG&E reported the incident to the Safety and Enforcement Division (SED).

¹ Per Weather Underground (www.wunderground.com)

Public Incident Investigation Report

PG&E's Vegetation Program at the Incident Location

PG&E performs annual patrols of all primary and secondary distribution lines. PG&E schedules circuits covered by routine patrol to be pruned on an annual basis by the Vegetation Program Manager. PG&E also uses a combination of LiDAR² and spectral imagery to allow Vegetation Management to identify hazardous trees in high fire danger areas. Trees identified using these technologies are then inspected from the ground and abated as necessary.

PG&E conducted Catastrophic Event Memorandum Account (CEMA) related inspections at the incident location on August 12, 2014 and August 23, 2014. CEMA is an account used to recover the costs associated with the restoration of service and facilities affected by catastrophic events that have been declared disasters or states of emergency by federal or state authorities. The reasonable balance in the CEMA will be recovered in rates after the CPUC reviews and audits the recorded CEMA balance.

PG&E used two contractors as part of its vegetation management. ACRT Inc. conducted the pre-inspection work and Trees Inc. conducted the vegetation management work. Pre-inspection is conducted by a Consulting Utility Forester (CUF), a qualified individual who inspects all vegetation that has the potential to grow into or fall into the primary conductors before the next annual trim and vegetation that is currently causing strain/abrasion of the secondary conductors.

The CUF has at least two years' experience in line clearance and tree pruning work, or equivalent experience as determined by PG&E. It is desired that a CUF have an AA Degree in forestry, arboriculture or a related field. The CUF is familiar with the proper arboricultural techniques and practices, proper integrated pest management practices, PG&E's Tree Pruning Specification, PG&E's pre-Inspection specification and requirements, and all applicable legal and regulatory requirements.

The subject pine tree was in the interior of a stand (a group of trees similar in age and shape). On October 17, 2014, ACRT's CUF, [REDACTED] who has a Bachelor of Science degree in Horticulture, an Associate of Science degree in Environmental Sciences, and is an ISA Certified Arborist, performed a pre-inspection of the stand and identified two gray pine trees on the edge of the stand that should be removed. The two trees were not identified as hazard trees, or dead, rotten or diseased, or with any portion that was dead, rotten or diseased. PG&E has stated: "At a deposition on February 28, 2017, the pre-inspector confirmed the two gray pine trees were removed because they had lateral branching that would likely grow into the minimum clearance zone and become a compliance issue."

PG&E's Vegetation Management Database noted one of the gray pines had a height of 30 feet and diameter at breast height (DBH) of 18 inches and the other gray pine had a height of 30 feet and DBH of 11 inches.

² LiDAR (an acronym of Light Detection And Ranging) is a surveying technology that measures distance by illuminating a target with a laser light. (Source: Wikipedia.)

Public Incident Investigation Report

PG&E's tree work prescription practices for removal of a tree are as follow:

- Trees of any DBH that will not hold compliance by pruning for a minimum of one year should be pursued as a removal.
- Trees less than 12-inch DBH should be removed rather than trimmed whenever possible.
- Trees equal to or greater than 12-inch and less than 24-inch DBH should be considered for removal if it is not possible to obtain a 2 year clearance through pruning.
- Trees equal to and greater than 24-inch DBH that are unlikely to encroach for a period greater than one year should be pruned rather than removed.

On January 6, 2015, Trees Inc., removed the identified two gray pine trees, and on June 25, 2015 and July 8-21, 2015, PG&E conducted additional CEMA related inspections, orthoimagery, LiDAR, and ground patrols, and did not identify the subject tree as hazardous or requiring trimming.

SED reviewed PG&E's 2011, 2012, 2013, and 2014 audits of PG&E's tree trimming contractors ACRT and Trees Inc. In the 2014 audit (the most recent audit prior to the incident), PG&E found 45 and 14 instances, respectively, in which the aforementioned contractors failed to note trees that needed to be trimmed ("non-compliant trees"), or that would have become non-compliant within 90 days. The majority of the missed hazard trees were trees whose growth would have caused the tree to be out of compliance with clearance requirements by the time of the next patrol. None of the missed hazard trees were trees that were in the interior of a stand of tree and had become exposed (and thus prone to failure).

PG&E's Hazardous Tree Rating Matrix includes the following two Failure Likelihoods: (1) Wind Exposure (topography and position in stand), and (2) Soil Support (whole tree).

Wind's effect on trees is wide ranging and well documented. Trees exposed to wind develop reaction wood and greater trunk diameter, giving the tree greater strength. In contrast, trees that are not exposed to as much wind – such as trees that are in the interior of a stand of trees – do not develop the degree of reaction wood and trunk diameter as exterior trees and are weaker and more prone to leaning to one side when the exterior trees are removed. PG&E's hazardous tree rating process states, "Consider the tree's exposure to wind ... is the tree is [sic] fully exposed or sheltered by other trees?" Additionally, trees exposed to more wind will develop a greater mass of roots (and exposed roots, which are roots that protrude from the ground and are indicative of stronger trees). In contrast, trees that are not exposed to as much wind have weaker root systems.

The above two Failure Likelihoods would apply to trees that are in the interior of a stand and become exposed such as in this incident. Therefore, PG&E's hazardous tree rating matrix did include criteria that could have been used to flag the tree that contacted PG&E's overhead conductor and caused the incident.

Public Incident Investigation Report

PG&E's vegetation management activities, such as tree trimming, are generally performed by specifically trained contractors who have extensive experience in vegetation related work. Thus, qualified tree contractors – after removing the exterior trees – should have noted that the newly exposed interior trees exhibited signs of trees that had not been exposed to wind and did not have the soil support of stronger trees (again, indicative of trees that are more slender and prone to failure).

Observations and Findings

The subject conductor was AWG 2/0 copper and was part of PG&E's Electra 1101 12 kV circuit. The conductor was installed in 1950. PG&E detail-inspected the Electra 1101 circuit on March 20, 2009 and July 23, 2012, and patrolled it on July 13, 2011 and May 20, 2014.

The 12 kV conductor was protected by a line recloser at Electra Substation, approximately two miles southeast of the incident location. A line recloser is a circuit breaker equipped with a device that automatically recloses the breaker after a fault. The fault that occurred when the tree contacted the overhead conductor did not have the sufficient duration and/or fault current magnitude to meet the relay's minimum time delay or minimum pickup current, respectively, in order for the relay to sense the fault and open the breaker, thus, the conductor remained energized after the contact occurred. The conductor ground clearance was measured at 33 feet. The span distance was approximately 345 feet. In addition, PG&E is not aware of any customer reporting a potentially hazardous tree along the Electra 1101 circuit prior to the Butte Fire.

On September 18, 2015, SED met with CAL FIRE Battalion Chief Gianni Muschetto, CAL FIRE Attorney David Wiseman, [REDACTED] and [REDACTED] of PG&E at the incident location. SED observed that the subject tree had been removed, and a section of the 12 kV conductor had been replaced. Although the 12 kV conductor did not fail and fall to the ground, CAL FIRE requested that PG&E cut and remove the section of the conductor that contacted the tree as part of CAL FIRE's evidence collection; CAL FIRE also cut down and retained the tree as evidence (see figures 2 and 3).

Public Incident Investigation Report



Figure 2 – Subject Tree Stump



Figure 3 – Replaced Conductor Section

On September 22, 2015, SED staff examined the subject tree and conductor at CAL FIRE's Auburn Headquarters; SED staff observed that the subject tree was cut into sections and also noticed discoloration on the section of the conductor that had been removed (see figures 4 and 5).

Public Incident Investigation Report

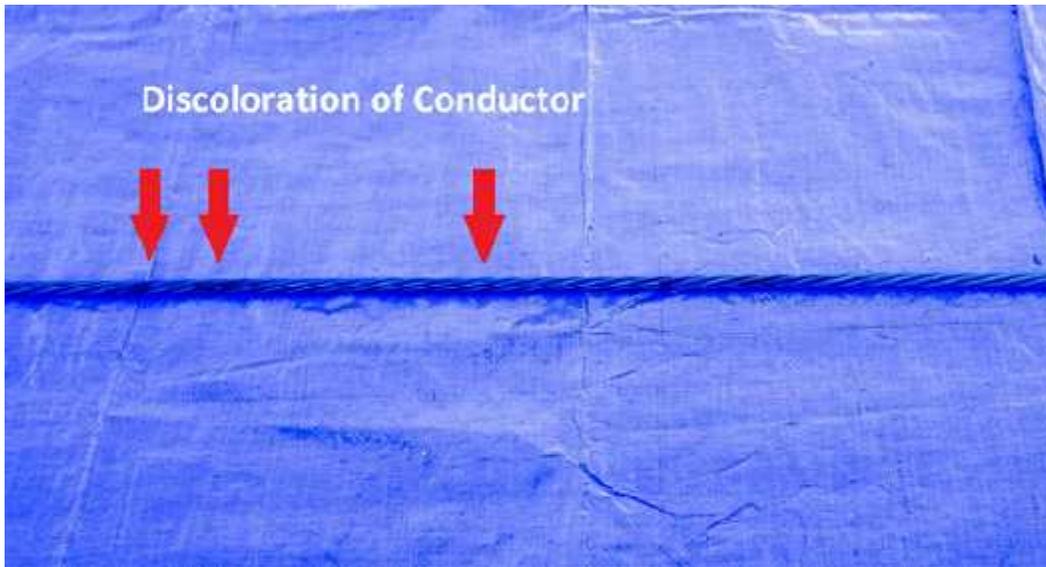


Figure 4 – Discoloration on Conductor (Enhanced)



Figure 5 – Sections of the tree

CAL FIRE's investigation report (see Attachment 1) determined that the subject Gray Pine tree leaned toward the ground, contacted the 12 kV conductor, and then continued to lean toward the

Public Incident Investigation Report

ground (see figures 6 and 7); when the tree contacted the conductor, the tree caught on fire, dropped burning embers onto dead fuels, and ignited the Butte Fire.³



Figure 6 -
The pine tree lying on the ground after contacting the 12 kV conductor

³ CAL FIRE's Investigation Report, Case Number: 15AAEU024918, Case Name: Butte Incident. (See Attachment 1.)

Public Incident Investigation Report



Figure 7 –
Burn marks on the pine tree which indicates contact

CAL FIRE found that the removal of the two gray pines left the interior trees, including the subject tree, exposed to the south, towards the path of the sun and the powerlines. When a stand is altered and the interior trees are exposed to open spaces, the interior trees are prone to failure.

CAL FIRE's arborist (see Attachment 2) stated that trees that are captured within the confines of a dense stand do not develop reaction wood, have poor trunk taper, and are inherently unstable. The additional exposure would cause secondary growth in the subject tree's canopy that would be most prolific on the southern side, facing the energized conductor. The new foliage and tip growth would cause the tree to fall to the south.

CAL FIRE determined that PG&E and/or its contractors ACRT and Trees, Inc. failed to identify the potential hazard of leaving weaker, inherently unstable trees on the edge of a stand without maintaining them, ultimately leading to the failure of the Gray Pine. CAL FIRE found PG&E in violation of PRC 4421 for having its facilities cause the fire; PRC 4435 for "negligence of the maintenance" of its facilities (conductors), thus resulting in having the fire escape from where it was originated; and Health and Safety Code 13007 and 13009 for allowing "the fire to be set to the property of another."

Based on the evidence that SED reviewed and on CAL FIRE's investigation, SED's investigation found the following:

Public Incident Investigation Report

General Order (GO) 95, Rule 31.1, states in part:

“Electrical supply and communication systems shall be designed, constructed, and maintained for their intended use, regard being given to the conditions under which they are to be operated, to enable the furnishing of safe, proper, and adequate service.

For all particulars not specified in these rules, design, construction, and maintenance should be done in accordance with accepted good practice for the given local conditions known at the time by those responsible for the design, construction, or maintenance of communication or supply lines and equipment.”

The subject tree was alive and healthy before and at the time CAL FIRE removed it. The subject tree was captured inside a tree stand and did not develop reaction wood, i.e. wood that forms in place of growing wood as a response to gravity. When PG&E’s contractor removed trees in the stand, it exposed the interior trees, including the subject tree, to additional sunlight and other natural elements, which caused secondary growth in the subject tree’s canopy on the (southern) side facing the overhead conductors. The additional weight from the new foliage and tip growth caused the tree to lean to the south and contact the conductor. Neither PG&E nor its contractor took appropriate steps to remedy the condition and consequences when they removed the surrounding trees in the stand; thus creating an unsafe and dangerous condition that resulted in the subject tree leaning and making contact with the 12 kV overhead conductor. Therefore, PG&E is in violation of GO 95, Rule 31.1, for failing to maintain its 12 kV overhead conductors safely and properly. PG&E created an unsafe condition when its contractor removed trees in the stand without taking appropriate steps to prevent the remaining subject pine tree from leaning and contacting the 12 kV overhead conductor, thus creating a dangerous condition that caused a fire.

GO 95, Rule 35, states in part:

“Where overhead conductors traverse trees and vegetation, safety and reliability of service demand that certain vegetation management activities be performed in order to establish necessary and reasonable clearances, the minimum clearances set forth in Table 1, Cases 13 and 14, measured between line conductors and vegetation under normal conditions shall be maintained. (Also see Appendix E for tree trimming guidelines.) These requirements apply to all overhead electrical supply and communication facilities that are covered by this General Order, including facilities on lands owned and maintained by California state and local agencies.”

GO 95, Rule 35 requires the minimum radial clearance between 12 kV overhead conductors and vegetation to be 18 inches. In this incident, the subject tree contacted PG&E’s 12 kV overhead conductor. Therefore, PG&E is in violation of GO 95, Rule 35, for failing to maintain the minimum required clearance between the 12 kV conductor and the subject tree.

Resolution E-4184, which modified Decision 06-04-055, requires utilities, such as PG&E, to report to the CPUC all reportable incidents within 2 hours of the incident during normal working hours or within 4 hours of the incident outside of normal working hours. Reportable incidents are

Public Incident Investigation Report

those which meet the following criteria: (a) result in fatality or personal injury rising to the level of in-patient hospitalization and attributable or allegedly attributable to utility owned facilities; (b) are the subject of significant public attention or media coverage and are attributable or allegedly attributable to utility facilities; or (c) involve damage to property of the utility or others estimated to exceed \$50,000.

The website <http://www.mymotherlode.com/community/fire/butte-fire-summary-timeline> indicates that the damage from the Butte fire exceeded \$50,000 soon after the fire was ignited on September 9, 2015, due to burning from 160 to 64,728 acres in three days.

In addition, on September 11, 2015, CAL FIRE's investigators requested PG&E to remove a section of PG&E's 12 kV overhead conductor because of suspicion of being related to the incident. PG&E was aware that its facilities may have been involved in a fire with damages that exceeded \$50,000, but did not report the incident to the CPUC until September 16, 2015, five (5) days after PG&E became aware that its facilities may have been involved in the fire. Therefore, PG&E violated Resolution E-4184 for reporting the incident late.

Preliminary Statement of Pertinent General Order, Public Utilities Code Requirements, and/or Federal Requirements:

		Violation
1 GO 95	Rule 31.1	Yes
2 GO 95	Rule 35	Yes
3 Resolution	E-4184	Yes

Conclusion:

The SED investigation found PG&E in violation of:

- GO 95, Rule 31.1, for failing to maintain its 12 KV overhead conductors safely and properly. PG&E created an unsafe condition when its contractor removed trees in the stand without taking appropriate steps to prevent the remaining subject pine tree from leaning and contacting the 12 kV overhead conductor, thus creating a dangerous condition that caused a fire.
- GO 95, Rule 35, for failing to maintain 18 inches of clearance between its 12 kV overhead conductor and the subject pine tree.
- Resolution E-4184 for reporting the incident late to the CPUC. CAL FIRE determined that contact started the Butte Fire. PG&E has not determined the cause of the fire but has not ruled out PG&E's facilities as being the cause of the fire.