Event Analysis Report

Murphys – Property Damage

EIR No.: EI200909A

Date of Event: September 09, 2020

Date Reported to the CPUC: September 09, 2020

CAP Issue No(s).: CAP # 121348467

Report Rev: 01

[redacted]	[redacted]	02/01/23
Leadership Approver	Signature	Date
[redacted]	[redacted]	02/01/23
Incident Investigator	Signature	Date

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

On September 09, 2020, at 1040 hours, PG&E conducted re-energization operations on the Stanislaus 1701 17kV Distribution Circuit after a planned Public Safety Power Shutoff ("PSPS"), which included required patrols following the "weather all clear." A fire reportedly started near a residential structure at [redacted] in Murphys ("Incident Location"), which is served by an underground ("UG") portion of the Stanislaus 1701 17kV Distribution Circuit ("Incident Circuit"). At 1046 hours, PG&E began receiving multiple SmartMeter™ auto-generated notifications that indicated an outage on the portion of the UG Incident Circuit, resulting in Line Recloser 7144 ("LR 7144") to lock-out, which impacted 745 downstream customers. At 1050 hours, troubleshooters responded to the Incident Location and observed fire at an AC Unit, sewer pump, two vehicles, and vegetation. At 1111 hours, CAL FIRE responded to extinguish the fire. Multiple faulted areas of direct bury ("DB") primary UG #2AL XLP-CONC-HDPE/#2AL-PE-CONC cables/splices were discovered in the same general area on the source side of the Incident Location, which affected all three phases of the circuit and were subsequently repaired.[1] The affected six splices and sections of cable were retained as evidence for subsequent examination.

The incident was reported in a timely manner to the CPUC on May 17, 2021, at 1310 hours under the Property Damage criterion after PG&E received and reviewed several claims associated with the Incident Location only, which collectively estimated be in excess of $50,000. The Electric Incident Investigations ("EII") group conducted an investigation and this report summarizes the findings of the investigation.

PG&E performed an event analysis, which included interviews with PG&E personnel, as well as a review of the cable asset history, maintenance history, a review of patrol and inspection records, maintenance history, field observations, residential solar/storage system analysis power quality analysis, SmartMeter™ data analysis, reliability analysis, failure analysis, weather analysis, fire department investigation report analysis, system protection analysis, control center analysis, and internal guidance analysis. This analysis concluded there is insufficient evidence to support that the PG&E outage caused any damage to customer equipment. We do not believe our equipment caused an above ground fire and we are unable to determine the direct

cause as well as origin of the fire, which could have originated at a customer-owned air conditioning ("AC") unit or by other unknown sources beyond our control.

PG&E's Applied Technology Services ("ATS") examined the six retained splices and associated cable segments. Analysis determined the incident likely resulted in three dielectric breakdown failures in two separate locations. One failure was of the cable near a splice, but not associated with the splice itself. The likely cause for the failure of the cable part of this sample was due to dielectric insulation breakdown of the cable shortly after switching operations to re-energize the Incident Circuit. The cause of the insulation dielectric breakdown could not be determined due to the severe arcing damage. Two splices failed, resulting in severe arcing damage that severed the conductor at the edge of the crimped connection and burned through the splice housing. The most likely cause of the failure is due to dielectric breakdown of the splice housing located at the edge of the conductor crimp shortly after switching operations to re-energize the Incident Circuit. The direct cause of splice insulation dielectric breakdown could not be determined due to the severe arcing damage. The failures occurred shortly after switching operations required to re-energize the Incident Circuit. Switching operations likely resulted in a momentary voltage transient, which although considered a normal electrical phenomenon, stressed the aged insulation initiating the failure sequence[2].

In 2017, PG&E identified near end-of-life underground cable infrastructure for replacement in the subject subdivision (Forest Meadows), including the Incident Location, through its current control – The 56A Reliability Related Cable Replacement Program, which was earmarked for replacement in phases. Infrastructure in the area was generally of 1979-1984 vintage. This included the faulted subject cables/splices, which were replaced after the incident as required for emergency repairs. All underground planned reliability hardening work (including, but not limited to: cables, transformers, an additional interrupter, sectionalizing switch, etc.) in the Forest Meadows subdivision, including Incident Location, was completed by June 20, 2021, mitigating the likelihood of unplanned outage recurrences.

PG&E prioritizes the safety of the public and its employees throughout its territory. PG&E's current risk model and asset management plans are sufficient given the circumstances and

[2] See DRU4406_Atch02_ATS Report_CONF.pdf

extent of condition. Namely, PG&E strikes a reasonable balance between the need to address aging underground facilities with priority overhead conductor replacements in High Fire Threat Districts as well as PG&E's ongoing commitment to wildfire risk mitigation work. This is achieved in part by monitoring asset condition through patrols and inspections consistent with General Order ("GO") 165, and targeted conductors that pose the highest risk of failure (i.e., likelihood and consequence), thereby reducing failures that could lead to an ignition or other safety hazard. PG&E will continue to evaluate the outcomes of hazard controls and assess if additional controls are needed to further mitigate the risk associated with this incident.

A cause-factor tree analysis was performed, and no corrective or general actions were identified as a result of the investigation beyond emergency repairs completed in September of 2020 and planned reliability enhancement work concluded in June of 2021. No non-compliances or non-conformances were identified.

Additional insights were made throughout the course of the investigation, resulting in updates to data requests submitted to the CPUC on December 03, 2021[3]. This report reflects those updates.

This report concludes PG&E's investigation into this incident. Unless otherwise noted herein, where there are conflicts between this report and previous PG&E reports related to this incident, this report shall take precedence. If additional information becomes available with the potential to affect the conclusions of this investigation, PG&E reserves the right to re-open this investigation. All times, customer counts, and measurements in this report are approximate.

2. PROBLEM STATEMENT

On September 09, 2020, at 1040 hours, PG&E conducted re-energization operations on the Stanislaus 1701 Distribution Circuit after a PSPS, which included required post event patrols. A fire reportedly started near a residential structure at the Incident Location, which is served by a UG portion of the Incident Circuit. At 1045 hours, PG&E received multiple SmartMeter™ auto-generated notifications indicating an outage on the portion of the UG Incident Circuit, resulting in LR 7144 to lock-out, impacting 745 downstream customers. At 1050 hours, troubleshooters

[3] PG&E submitted an updated data response to the CPUC on January 26, 2023, updating responses to questions 2, 3, 17, 18 and 22.

responded to the Incident Location and observed fire at an AC Unit, sewer pump, two vehicles, and vegetation. At 1111 hours, CAL FIRE responded to extinguish the fire. Several faulted areas of DB primary UG #2AL XLP-CONC-HDPE/#2AL-PE-CONC cables/splices were discovered in the same general area source side of the Incident Location, which affected all three phases of the circuit and were subsequently repaired.

The incident was reported to the CPUC on May 17, 2021, at 1310 hours under the Property Damage criterion after PG&E received and reviewed several claims associated to the Incident Location which collectively totaled in excess of $50,000, triggering an investigation by the Electric Incident Investigations ("EII") group. This report summarizes the findings of the investigation.

3. EXTENT OF CONDITION

An extent of condition ("EOC") analysis was performed to determine if the company is at risk for the same or similar occurring event(s). As the primary cause and origin of the fire is unknown, the primary focus was to find any similar company exposure that could adversely impact electric reliability to PG&E customers.

3.1. EIR Database

A search of PG&E's Electric Incident Reporting ("EIR") database was performed for a date range between 01/2017 to 10/2022 with the below criteria outlined in Table 2 (excluding this incident). Excluding duplicates, a total of 27 incidents were found[4]. Out of the 27 incidents, two underground equipment failures (one elbow failure and one elbow failure/reducer plug failure) occurred due to apparent insulation degradation, and one non-related event resulted in an apparent ignition[5]. However, the suspected initiating event was not identified as attributable to PG&E equipment.

[4] EI170611A, EI180820B, EI181108A, EI181108B, EI190414A, EI190518A, EI190628A, EI190822A, EI190906A, EI190915A, EI190920A, EI200212A, EI200413A, EI200507A, EI200525A, EI200621A, EI200809A, EI200814A, EI200814B, EI2000815A, EI200909A, EI201130A, EI210919A, EI210125B, EI210726A, EI220503A, EI220611A.
[5] EI200212A and EI200525A. One additional incident, EI220611A is under investigation and final results are not currently available.

Search Criteria	Number of Results[6]
"Cable" AND "Fail"	7
"Cable" AND "Fail" AND "UG"	2
"Cable" AND "Fail" AND "UG" AND "Fire"	1
"Cable" AND "Fail" AND "Fire"	4
"UG" AND "Cable" AND "Fail" AND "Ignition"	9
"UG Cable Fail" AND "Ignition"	1
"UG Cable Fail" AND "Fire"	1
"UG Cable" AND "Ignition"	4
"UG Cable" AND "Fire"	13

Table 2: 11/14/22 EIR Database search with applicable key words

3.2. Ignition Tracker Database

On November 30, 2022, a search was conducted of PG&E's Ignition Tracker Database to determine how many ignitions are believed to be possibly related, and attributable to PG&E electrical facilities based on the following criteria[7]:

- Distribution circuit
- Underground circuit
- Splice/clamp/connector failures

[6] Prior to 2020, the Ignitions Tracker Database did not track historical or comprehensive information of underground splice equipment and such, this data set may not be a full representation prior to this timeframe. "UG" = Underground. Duplicative search results in two or more instances: "Cable" AND "Fail" - 5; "Cable" AND "Fail" AND "UG" - 2, "Cable" AND "Fail" AND "UG" AND "Fire" – 1, "Cable" AND "Fail" AND "Fire" - 4, "UG" AND "Cable" AND "Fail" AND "Ignition" - 3, "UG Cable Fail" AND "Ignition" - 1, "UG Cable Fail" AND "Fire" – 1, "UG Cable" AND "Ignition" – 3, "UG Cable" AND "FIRE" - 4

[7] PG&E does not currently conduct a root-cause analysis for all suspected splice/connector failures and failure drivers are assigned based upon currently available data known at the time.

Five incidents were returned between 2020-2022 that met the above criteria. EII reviewed the data further to determine if there could be any potential parallel factors. Upon a high-level review, the following two incidents may have some commonalities as far as equipment failures[8]:

- 05/18/22 - Underground 600amp straight splice related to a 21kV circuit failed which resulted in an outage, and a fire within a utility box which spread to surrounding grass.
- 05/26/22 - Underground 600amp straight splice in a splice box related to a 21kV circuit failed which resulted in a vegetation fire.

Note: Subject splices related to this incident are 200amp.

3.3. Underground Cables

PG&E experiences roughly 1,000 cable system (cables, splices, elbows, and terminations) related equipment failures per year in its distribution cable systems. This does not factor in failures attributed to external forces such as 3rd party dig-ins, animals or weather related. Approximately 60% of these failures are cable failures; the remaining are splices, elbows, and other termination failures. The majority of these failures occur on local loop underground cables, predominately on unjacketed HMWPE Cable-in-Conduit. Cable failures on underground systems, such as this incident, do not typically release explosive levels of energy. However, cable analysis over the years has found unjacketed cables with varying degree of neutral corrosion throughout PG&E's system. Prior analysis suggests that severely deteriorated neutrals can cause stray voltages which can pose safety risk.[9]

Splices are not currently considered to be major equipment and are typically considered to be a continuation of the cable/conductor. As a result, PG&E does not keep comprehensive location records of underground splice locations. PG&E does not currently plan to begin tracking all installed or future underground splices due to reasons previously mentioned, and because from an overall Electric Operations asset class perspective, distribution underground connectors/splices are typically not considered high risk.

[8] One of the five incidents, EI211217A is currently still under investigation and results are not available.
[9] TD-8106 - See Distribution Line Underground Asset Management Plan (Excludes network cables, Publication Date: 11/05/21, Rev. 02). See Page 17 of 58. Stated information is subject to change based upon review of additional data/failure analysis.

Although PG&E does not have a proactive underground cable replacement program to replace aging cable assets, its current control is the 56A Reliability Related Cable Replacement Program which targets underground cables that have a history of two or more failures within five years.[10] The program currently allocates to replace about 18-20 miles of cables per year out of a total existing population of about 26,553 miles of primary cable (See Table 1 below) in its non-network distribution system.[11] Out of the 18-20 cable miles earmarked for replacement, about 40% are replaced every year due to risk prioritization as well as resource allocation that are currently focused on priority overhead conductor replacements in High Fire Threat Districts ("HFTD's") as well as PG&E's ongoing commitments to wildfire risk mitigation work.[12]

Cable Type	Total (miles)	Installed Year	Average Installed Year	Current Average Age (yrs)	PG&E Expected Average Life (yrs)[13]
EPR	10,365 (39%)	1995 - Current	2008	12	60
HMWPE	7,609 (29%)	1960-1978	1969	51	40
Other	173 (<1%)	NA	1970	50	40
PILC	589 (2%)	Prior to 1960	1945	75	80
XLPE	7,797 (29%)	Late 1960's - 1998	1984	37	50
Grand Total	**26,533**				

Table 1: TD-8106 - Distribution Line Asset Management Plan[14]

Primary XLPE cables (#2AL XLP-CON-HDPE/#2AL-PE-CONC cables in this particular case) in general were installed from the late 1960s through the late 1990s based upon a review of legacy as-built records. XLPE cable is typically installed in rigid duct or CIC. In this particular

[10] Reliability Related Cable Replacement – Projects are prioritized based on reliability performance (SO, CMI), construction type (mainline, 200A), and cable diagnostic results when available.
[11] TD-8106 - See Distribution Line Underground Asset Management Plan (Excludes network cables, Publication Date: 11/05/21, Rev. 02)
[12] 08/12/22 PG&E Asset Strategy internal email and PG&E's 2022 Wildfire Mitigation Plan as well.
[13] Many factors can contribute to the expected age of an asset, such as, but not limited to: Outage history, and external influences such as soil, weather conditions, cables utilized in conduit, dig-in activity, etc. Values provided are approximate and subject to change based upon current data analysis.
[14] Cross-Linked Polyethylene ("XLPE"), Ethylene Polypropylene Rubber ("EPR"), High Molecular Weight Polyethylene ("HMWPE"), Paper Insulated Lead Covered ("PILC"), High Density Polyethylene ("HDPE"), Polyethylene ("PE"), Ground Shield Composed Concentric Wire ("CONC"). Values provided in Table 1 are approximate and subject to change.

case, the cable was direct bury installed as was a historical practice in some applications. UG XLPE cable was sometimes historically phased in local electrical loops, but it did not become the preferred choice until the late 1970's. XLPE cable has an annual failure rate of about 1.8 failures per 100 miles, based on 2019 and 2013 averages.[15] Approximately 30 percent of XLPE cable is unjacketed. PG&E now installs EPR cable since the late 1990's in conduit and is utilized for most new installations. The annual failure rate of this cable is about .03 failures per 100 miles.

PG&E estimates that underground splices, as well as elbows and terminations, may have a lower expected life expectancy than values outlined in Table 1[16]. However, there can be other factors which can extend or diminish life expectancy of an asset.

4. EVENT SUMMARY

Please refer to the 20-Day Report submitted to the CPUC on June 15, 2021, as well as the Amended 20-Day Report submitted on June 22, 2021.

4.1. Event Timeline

2017

- PG&E Forest Meadows Reliability Project - PG&E identifies electrical UG infrastructure for replacement due to a history of UG cable failures utilizing a multi-phased approach. The Incident Location was identified as a '*Phase One*' priority.

September 07, 2020

- **2307 hours** - Proactive de-energization begins on Stanislaus 1701 Distribution Circuit ("Incident Circuit") for PSPS Event as the Incident Circuit is located in a HFTD. Circuit Breaker 1701/2 opened.
- **2307 hours** - Incident Location Electric SmartMeter™ powers down along with other SmartMeters™ on the Incident Circuit.

[15] See TD-8106 - Underground Cable Asset Management Plan (Publication Date: 11/05/21, Rev. 02), Page 13 of 58.
[16] See ATS report and internal PG&E email dated 11/29/22. Other factors may affect the life expectancy of assets. PG&E does not currently track this specific data.

- **2324 hours** - LR 7144 proactively opened via SCADA on the de-energized circuit.

September 09, 2020

- **1040 hours** - PG&E conducts re-energization/sectionalizing operations on the Stanislaus 1701 Distribution Circuit following the planned PSPS event, to the area downstream of LR 7144 prior to closing it.[17] No damages were found at the time.
- **1041 hours** - LR 1744 is closed via SCADA, restoring 745 downstream customers.
- **1041 hours to 1047 hours** - SmartMeters™ begin re-energizing, including the Incident Location.
- **Beginning at 1046 hours - 1047 hours** - PG&E receives multiple SmartMeter™ auto-generated notifications indicating an outage on the Incident Circuit, including the Incident Location.
- **1048 hours** - LR 1744 opens via Sensitive Ground Target ("SGT"), relays and locks open, resulting in a sustained outage affecting 745 customers[18]. Subsequent switching performed in order to isolate the area of the suspected underground trouble (Load side of LR 1744).
- **1050 hours** - PG&E dispatches a troubleshooter to patrol the circuit downstream from LR 1744 for possible trouble, including the Incident Location. A second troubleshooter is dispatched to assist.
- **1100 hours** - PG&E troubleshooters arrive in the area of the Incident Location.
    - Troubleshooters observe an AC unit, sewer pump, two vehicles and vegetation on fire at the Incident Location.
    - CAL FIRE personnel are subsequently observed extinguishing the vegetation fire[19].
- **1112 hours** - CAL FIRE receives a telephonic report of a structure fire at the Incident Location per fire report.
- **1114 hours** - L593 2 of 3 (2 & 3 blown) reported open by a responding troubleshooter found during patrols[20].
- **1125 hours** - CAL FIRE personnel arrive per fire report.

[17] See PG&E response to CPUC Data Request Q04, submitted on December 03, 2021.
[18] LR 7144's auto-reclosing functionality was disabled at the time as a result of the circuit or a portion thereof, residing inside a HFTD during fire season.
[19] It is unknown at exactly what time CAL FIRE personnel were first observed by PG&E first responders.
[20] This asset is a static device and the exact time the fuses opened is not known.

- **1335 hours** - PG&E proceeds with determining the underground fault location(s) through isolation and testing.
- **1350 hours** - CAL FIRE controls the fire per fire report.
- **1500 hours** - CAL FIRE personnel clear from the Incident Location per fire report.
- **1750 hours** - PG&E dispatches a repair crew. They subsequently arrive on scene and facilitate required replacement of damaged UG conductors/splices source-side of the Incident Location, between Transformers T4836 - T6583, and T6583 - T6006.
- **1900 hours** - Troubleshooters leave the Incident Location by this time.

September 10, 2020

- **By 2142 hours -** Final restoration at the Incident Location was completed and remaining customers are restored.

September 11, 2020

- PG&E Foreman completes/signs emergency repair work (Priority: A-Tag) resulting from the September 09, 2020, incident by replacing the affected cables/splices.[21]

July 20, 2021

- All targeted Forest Meadows Reliability Project underground assets were replaced by this date. This includes the subject UG cables/splices which were replaced with 3-1/0A EPR cables in 4" conduit, Transformer T6006 (Live Front) was replaced with a dead front unit, as well as additional sectionalizing switches/interrupter.[22]

5. HISTORY

5.1. Cable Asset History

Pre-Incident: It appears the Forest Meadows primary UG electrical backbone (#2AL PE-CONC) cables were of 1979 vintage in the development; however, the Incident Location parcel

[21] Completed EC Tags 119731471 and 119731474.
[22] See PM 74016420. T6006 live front transformer was replaced with a dead front transformer. Other hardening/sectionalizing equipment was also added such as an interrupter/switch, new UG cables, additional cable pull access points, etc.

was likely not developed at the time.[23] In 1981, additional circuit changes were implemented in the subdivision as required for applicant development, including the installation of T6006, which later served additional customers, including the Incident Location.[24]

In 1984, based upon further records research, primary UG #2AL XLP-CONC-HDPE cables were added with splices in preparation to serve additional customers off T6583.[25] Work began on November 27, 1984 and was completed on December 11, 1984[26]. Prior to the time, we believe the existing primary cables likely traveled from Transformer T4836 directly to Transformer T6006. Once T6583 was added (See Figure 1 below), cables were likely split between Transformer T4836 towards Transformer T6006, which required the addition of the subject UG cables and splices. This portion of the circuit changes were believed to be completed by PG&E.[27] The primary cables were DB.[28]

[23] PG&E Legacy Job: 179344-79. Not all related job numbers may be listed related to the Forest Hills Development. Discussion of legacy construction as-built records is provided to the best extent and accuracy currently available. We conducted additional analysis during the course of this cause-evaluation and are updating our response to Q17, submitted to the CPUC on December 03, 2021. Refer to amended CPUC Data Response, Q17, submitted on January 26, 2023.
[24] PG&E Legacy Job: 16592C-81.
[25] PG&E Legacy Job: 113842E-84.
[26] In response to CPUC Data Request Q17, submitted December 03, 2021, PG&E indicated the subject cable span was installed in 1979; however, after further investigation, we believe installation of the additional cables/splices occurred in 1984. Refer to amended CPUC Data Request Q17, submitted January 26, 2023.
[27] It appears the applicant/developer may have performed some of the initial excavation, backfilling, conduit installation, (See Job 179344-79) prior to 1979. Despite a reasonable search of legacy records, PG&E is not able to draw any further conclusions based upon available records. Refer to amended CPUC Data Request Q2.b, submitted January 26, 2023.
[28] Soil conditions are/were known to be rocky/lava rock which we believe may have made installation more challenging historically. Excavation tools and methods have generally improved over time. See As-Built Legacy Job 113842E-84.

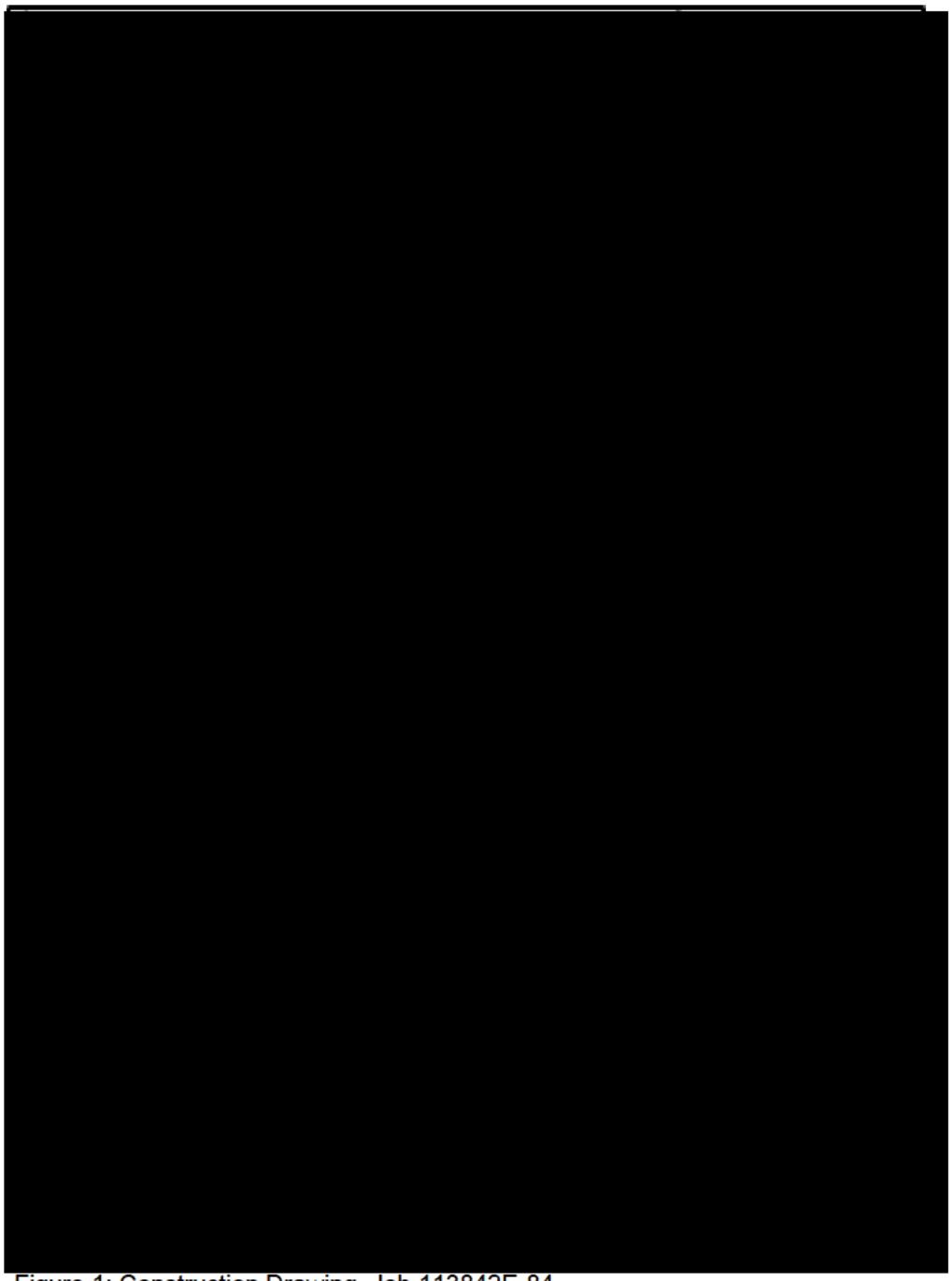
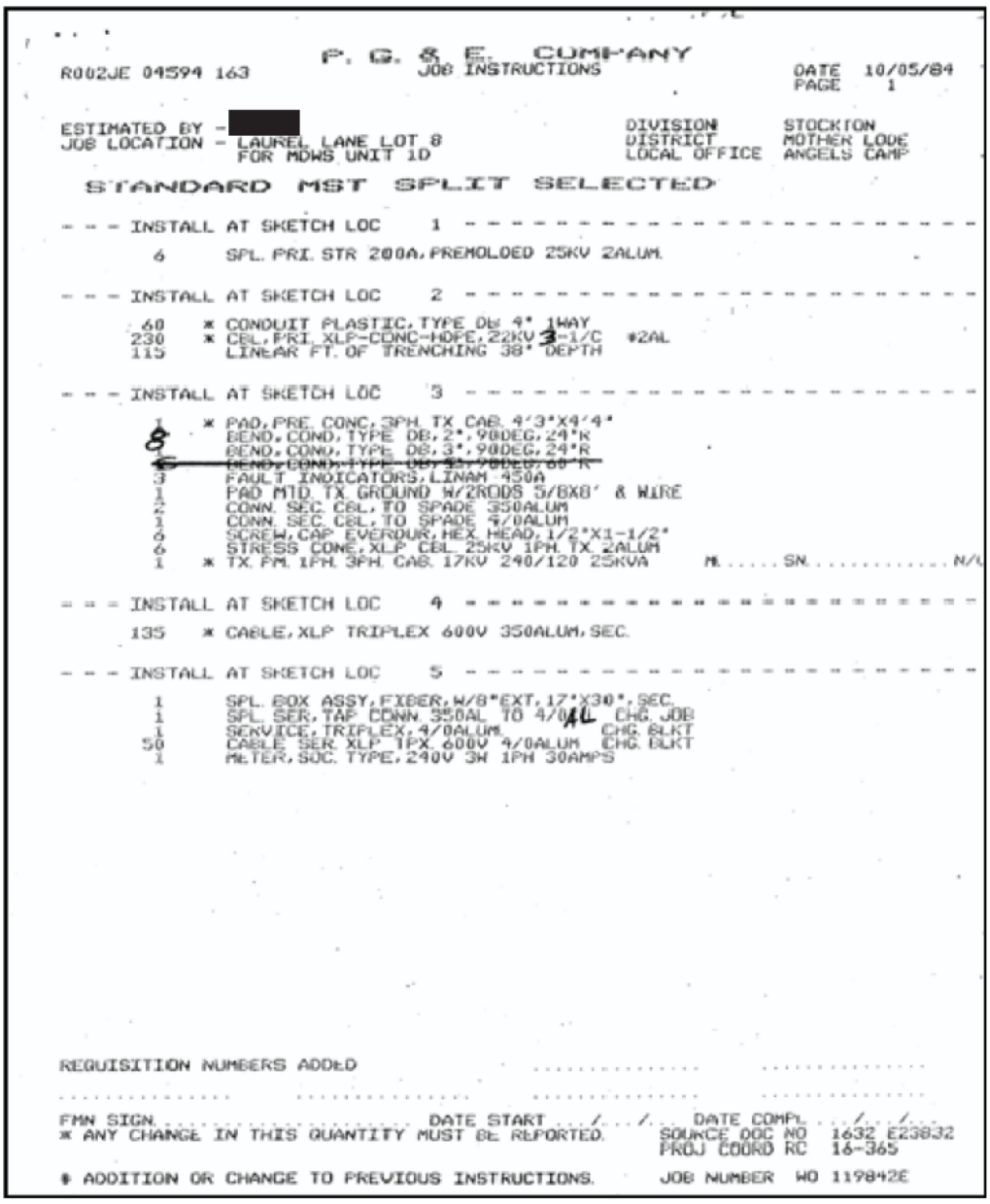


Figure 1: Construction Drawing, Job 113842E-84.



P. G. & E. COMPANY
R002JE 04594 163 JOB INSTRUCTIONS DATE 10/05/84 PAGE 1

ESTIMATED BY - [redacted]
JOB LOCATION - LAUREL LANE LOT 8 FOR MDWS UNIT 1D
DIVISION STOCKTON
DISTRICT MOTHER LODE
LOCAL OFFICE ANGELS CAMP

STANDARD MST SPLIT SELECTED

- - - INSTALL AT SKETCH LOC 1 -

6 SPL. PRI. STR 200A, PREMOLDED 25KV 2ALUM.

- - - INSTALL AT SKETCH LOC 2 -

60 * CONDUIT PLASTIC, TYPE DB 4" 1WAY
230 * CBL, PRI. XLP-CONC-HDPE, 22KV 3-1/C #2AL
115 LINEAR FT. OF TRENCHING 38" DEPTH

- - - INSTALL AT SKETCH LOC 3 -

1 * PAD, PRE. CONC, 3PH. TX CAB. 4'3"X4'4"
8 BEND, COND, TYPE DB, 2", 90DEG, 24"R
BEND, COND, TYPE DB, 3", 90DEG, 24"R
~~5 BEND, COND, TYPE DB, 4", 90DEG, 60"R~~
3 FAULT INDICATORS, LINAM 450A
1 PAD MTD TX GROUND W/2RODS 5/8X8' & WIRE
2 CONN. SEC CBL, TO SPADE 350ALUM
1 CONN. SEC CBL, TO SPADE 4/0ALUM
6 SCREW, CAP EVERDUR, HEX HEAD, 1/2"X1-1/2"
6 STRESS CONE, XLP CBL 25KV 1PH TX 2ALUM
1 * TX. PM. 1PH. 3PH. CAB. 17KV 240/120 25KVA M..... SN..... N/U

- - - INSTALL AT SKETCH LOC 4 -

135 * CABLE, XLP TRIPLEX 600V 350ALUM, SEC.

- - - INSTALL AT SKETCH LOC 5 -

1 SPL. BOX ASSY, FIBER, W/8"EXT, 17"X30", SEC.
1 SPL. SER. TAP CONN 350AL TO 4/0 AL CHG. JOB
1 SERVICE, TRIPLEX, 4/0ALUM CHG. BLKT
50 CABLE SER XLP 1PX 600V 4/0ALUM CHG. BLKT
1 METER, SOC. TYPE, 240V 3W 1PH 30AMPS

REQUISITION NUMBERS ADDED

FMN SIGN. DATE START .../.../... DATE COMPL .../.../...
* ANY CHANGE IN THIS QUANTITY MUST BE REPORTED. SOURCE DOC NO 1632 E23832
PROJ COORD RC 16-365
ADDITION OR CHANGE TO PREVIOUS INSTRUCTIONS. JOB NUMBER WO 119842E

Figure 2: Signed Job Instructions, Job 113842E-84.

Post-Incident Emergency Repairs: Following the occurrence of the September 09, 2020 incident, PG&E performed emergency repairs to the failed UG DB primary cables/splices as documented by EC Tag 119731471 and EC Tag 119731474 (Priority: A-Tags).

Forest Meadows Reliability Project: See Section 4 – Timeline and Section 6.1 – Field Observations.

5.2. GO 165 Patrol Records

GO 165 Patrol Records were reviewed, which showed no findings.

- June 29, 2018 – No abnormal conditions identified at the Incident Location or surrounding areas.
- August 25, 2019 – No abnormal conditions identified at the Incident Location or surrounding areas.

5.3. GO 165 Inspection Records

GO 165 Patrol Records were reviewed, which showed no findings.

- September 11, 2013 - No abnormal conditions identified at the Incident Location or surrounding areas.
- September 28, 2016 - No abnormal conditions identified at the Incident Location or surrounding areas.

Note: As primary UG assets (cables/splices) in the area were DB, patrols and inspections of the specific infrastructure were limited to available access/termination points (i.e. vaults, manholes, transformers, etc.) at the time.

5.4. Maintenance History

No equipment anomalies were noted which are believed to have caused and/or contributed to the cause of the fire. Moreover, there were no open, cancelled, or completed work orders at the time of the incident located within one span upstream and downstream of the subject underground cable span from two years prior to the incident[29].

EII conducted an additional search in SAP for an expanded time period from 1984 to September 09, 2020 to better understand the maintenance history of the UG cables/splices between[30]:

- Transformer T4836,
- Transformer T6583, and
- Transformer T6006

No related maintenance tags were found which suggested an equipment anomaly contributed to the fire.

[29] See PG&E responses to CPUC Data Request Q13, Q14, and Q15 submitted on December 03, 2021.
[30] See 20221110 SAP Excel Spreadsheet Data.

6. OBSERVATIONS & EVENT ANALYSIS

Analysis for this event included interviews with PG&E personnel, cable asset history, a review of patrol and inspection records, maintenance history, field observations, power quality analysis, SmartMeter™ data analysis, reliability analysis, failure analysis, residential solar/storage system analysis, weather analysis, fire department investigation report analysis, system protection analysis, control center analysis, and an internal guidance analysis. This analysis concluded there is insufficient evidence that a PG&E outage caused any damage to customer owned equipment or was the source of the fire. Moreover, due to inadequate physical, documentary, photographic, percipient witness statements, fire department cause-origin investigation (See Section 6.4 below), or ability to examine customer wiring/protection equipment at the time of the incident, PG&E is not able to establish the direct cause of the fire and resulting customer property damage.

6.1. Field Observations

On September 09, 2022, responding troubleshooters observed CAL FIRE personnel were on site and in the process of extinguishing an active vegetation fire. The troubleshooters observed an AC unit, a sewer pump, two vehicles, and vegetation on fire.

After the scene was deemed safe, the troubleshooters determined the fault occurred to DB underground cables/splices just source side of the circuit feeding the Incident Location (source side of Transformer T6006) as indicated in Figure 3 below. PG&E did not take acquire post-incident photographs of the damaged splices/cables in place after excavation and prior to repairs at the time. However, a responding troubleshooter did obtain digital images of the T6006, a portion of the Incident Location structure, some customer exterior wiring, plastic conduit, etc. The subject splices and small sections of cable inside were retained as evidence after removal; however, their originating location was not documented. We also do not know if other non-related utilities were in proximity PG&E's UG equipment at the time. PG&E continues to improve record keeping through improved standards such as TD-2060S – Emergency Electric Corrective Documentation Standard (Rev. 0, Publication Date: 06/07/22, Rev. 1) which enhances compliance with General Order 95, Rule 18. TD-2060S and requires that photos be

taken of abnormal conditions[31]. Additionally, a web based, First Responder Evidence Training (CORP-200WBT), was added since the occurrence of this incident, which reinforces PG&E's current evidence procedures[32].

Figure 3: Map showing the approximate location of faulted cables/splices.

Two customers receive power from T6006. To date, PG&E has only received claims from the Incident Location and not the other customer at [redacted] nor any other customers load side of LR 1744 in the Forest Meadows Subdivision. The lack of additional claims supports circumstantially that the fire/electrical outage could have started locally at the Incident Location's AC Unit or other unknown circumstances on the customer side of the electrical circuit. PG&E is not aware of any other reported property damage to customer equipment in the subdivision.

Additionally, T6006 remained in service after the incident without any required repairs (subsequently replaced as a result of the planned reliability project by 2021), which is also evidence that suggests the specific transformer was operating without any known equipment

[31] In rare and extreme cases where a photo cannot be taken, the field is directed to provide a detailed description/reason of the condition found in lieu of photos.
[32] LAW-3001P-01 – Claims Evidence Procedure (Effective Date: 03/19) and LAW-3001P-02 – First Responders Evidence Procedure (Effective Date: 06/21/19, Rev. 0).

issues. Moreover, no visible damage is seen in the post-incident troubleshooter images of T6006 below (Figures 4-5).

Transformer T6006, a 1981 vintage 25kV pad-mount unit (120/240 single-phase Low Side Voltage), was in service at the time of the incident, and was a self-protected unit[33]. Although the transformer was not equipped with High Side self-protection functionality, the Low Side had an internal circuit breaker ("CB"). The CB was designed to protect the transformer, not the secondary service feeder to the customer's main electrical panel. As noted in Section 4 above (Timeline), a responding troubleshooter observed 2 of 3 fuses open at L593 (source-side of the Incident Location), which is consistent with two High Side legs at T6006 subsequently being de-energized when the fuses opened. Theoretically, if this occurs, no current would be sent through the transformer's primary coil. This in turn would make it not feasible to generate secondary voltages on the Low Side of T6006 to the two customer service lines. Pursuant to Tariff Electric Rule 2 Section E, customers are required to have electrical protection devices:

- It shall be the applicant's responsibility to furnish, install, inspect, and keep in good and safe condition at his own risk and expense, all appropriate protective devices of any kind or character, which may be required to properly protect the applicant's facilities.

We do not know if the customer was in compliance with Tariff Electric Rule 2, Section E.

[33] See WO 16592C-81.

Figure 4: 09/09/20 PG&E troubleshooter image obtained post-incident of Transformer T6006

Figure 5: 09/09/20 PG&E troubleshooter image obtained post-incident of Transformer T6006

EII is unable to further assess the following additional factors as having caused and/or contributed to the fire[34]:

- Customer AC condenser issue resulting in AC circuit breaker to allegedly trip per fire department report (See Figures 6-7).
- AC unit manufacturing issue.

[34] Observations are based upon visual examination of available images and known incident data only.

Figure 6: 09/09/22 PG&E troubleshooter image obtained post-incident of AC units at Incident Location

Figure 7: 09/09/22 PG&E troubleshooter image obtained post-incident of AC units at Incident Location

- Customers are required to have a main service disconnect (circuit breaker) as well as separate feeder breakers per the Greenbook (Utility Manual: TD-7001M). Either one of these protection devices should have opened to protect customer's equipment and de-de-energize affected customer circuit(s), if there was fault activity detected on the customer side.

- If the AC unit feeder breaker opened (as was stated in the fire department report), it is indicative of a downstream fault affecting that particular customer circuit, outside of PG&E's control.

- Customer generator malfunction[35]
  - A responding troubleshooter observed a portable generator in use but is not able to attest as to how it was connected electrically (i.e., in parallel) to the customer-side of the circuit (See Section 6.7 – Fire Department Report Analysis).
  - Unknown if a transfer switch was installed, and/or if there was a malfunction.
- Unknown if any electrical tampering occurred or arson related (Figures 8-9).

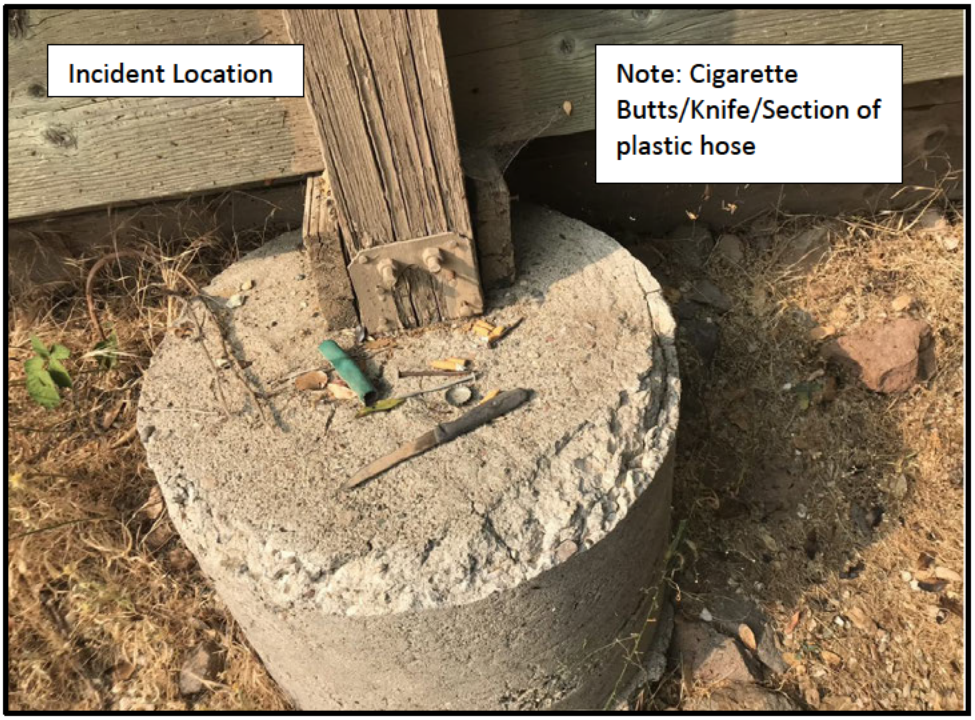


Figure 8: 09/09/22 PG&E troubleshooter image obtained post-incident of a knife, a hose section and burnt cigarette butts.

[35]Customer is responsible for following general protection requirements found in the PG&E Greenbook and the Distribution Interconnection Handbook Section 5, regarding customer backup generators and coordination, and other applicable regulations.

Figure 9: 09/09/22 PG&E troubleshooter image obtained post-incident of cigarette box near fire footprint – Incident Location.

- Unknown if customer-grounding/electrical issue existed (Figures 10-11). Note: Possible lose ground connector attached to metal conduit under electrical box without cover, and looped possible electrical type wire on the exterior of the residential structure at the Incident Location[36]:

[36] It is possible, but unknown, whether the cover was removed by fire department investigative personnel.

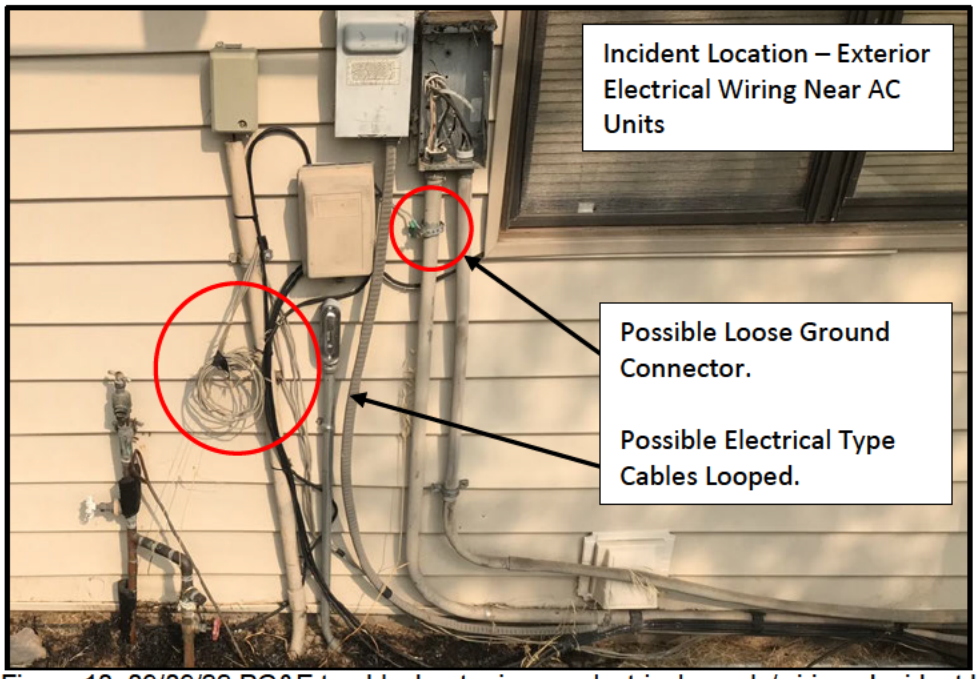


Figure 10: 09/09/22 PG&E troubleshooter image electrical panels/wiring– Incident Location

Figure 11: 09/09/22 PG&E troubleshooter Image – Apparent Grounding Rod with Possible Broken Wire - Incident Location

- Customer battery/storage or solar system malfunction causing (See below):
  - A potential customer electricity backfeed situation affecting PG&E's electrical grid.
  - Related customer-side voltage anomalies.

6.2. Residential Solar/Storage System Analysis

PG&E's Electric Grid Interconnection – Net Energy Metering group ("NEM") indicated the Incident Location had photovoltaic technology (solar system) as well as an Energy Storage System ("ESS" – Battery Storage). Table 3 below outlines historical solar/battery history installation for the Incident Location. PG&E engineering results determined the project's export capacity would have no impact on PG&E's Distribution System. Since there was a SmartMeter installed and an AC disconnect was not required per the Greenbook (Utility Manual: TD-7001M), a field inspection was not required (despite the customer adding a permitted AC disconnect) or performed by PG&E. As a result, PG&E did not find any substantive evidence to support if any abnormal solar/storage related conditions existed on the customer side of the circuit which could have caused/ contributed to the fire incident. However, as outlined in Section 6.3 (SmartMeter™ Data Analysis) below, it appears customer generation of returned energy to PG&E's grid, stopped about two months after a customer complaint regarding a high PG&E energy invoice (solar true-up invoice) and we do not know the relevancy, if any, to the cause of the fire.

Incident Location Solar/Battery Storage History	
Date:	**Action:**
11/04/17	Tesla (Installer) receives permits to install roof-mounted PV – 9.1Kv and an ESS - 5Kv) from Calaveras County Building Department - Authority Having Jurisdiction ("AHJ").
12/21/17	On-Line Permit B1702552 – Roof Mounted Solar was submitted to Calaveras County. Contractor: Solarcity Corp DBA Tesla Energy.
01/04/18	Permit B1702552 – Roof Mounted Solar Permit Approved and Issued.
01/16/18	Tesla receives an additional permit to upgrade the customer's panel to a 225 Amp unit for solar. Calaveras County Permit B1800083.
01/23/18	Calaveras County Permit B1800148, Application for reinspection-reinstatement fee: Plan Change - Add AC disconnect.
01/23/18	Building Permit Final for solar/electrical[37]
02/26/18	FAS Tag 9258234802 – Troubleshooter disconnects electrical service at the customer's request.
03/12/18	Green Tag Electrical Panel signed by AHJ.
03/12/18	FAS Tag 9259944746 – Troubleshooter verifies Green Tag and reconnects electrical service Panel upgrade is like-for-like. Solar ready panel.
05/21/18	Final Electrical Panel Upgrade sign-off from AHJ.
07/16/18	Application - Interconnection request submitted to PG&E, but a complete application was not received[38].

[37] Green Tag - Tag placed on inspected and approved Electrical Service Panel and to release the Meter to PG&E confirming that equipment is safe and ready to be energized by PG&E.

[38] PG&E records indicate that a required Interconnection Request Fee was not received as required. PG&E sent email correspondence on July 16, 2018 and August 24, 2018 to the installer as a result. After a fee was received, next steps proceeded as outlined in Table 3. Despite a reasonable search,

10/23/18	Tesla sends email correspondence to PG&E with a final permit. Tesla indicates the job was split (battery and solar) due to battery inventory shortages.
01/14/19	Final Permit with corrected scope of work submitted to PG&E.
02/20/19	Complete application received by PG&E.
02/27/19	PG&E grants Permission to Operate ("PTO")[39]
04/04/19	(Customer/renter contacts PG&E to have service setup at the Incident Location) as of 05/01/19.
05/11/20	FAS Tag 9256928126 – PG&E Metering Tech. engages SMOC to provision a newly installed SmartMeter™ Badge [redacted] for NEMS.

Table 3: Incident Location Solar/Battery Storage History

6.3. Power Quality Analysis

The current SmartMeter™ at the Incident Location records at a 60-minute interval, phase-to-phase (240V) so there is no visibility on the neutral. From the SmartMeter™ data, there is no data on the day of the incident (likely due to the PSPS event), but the data shows there was no abnormal steady-state voltage or usage leading up to the incident. Voltage was within Tariff Rule 2 limits, +/-5% of 240V (See Figure 12).

This location was being served by a 25kVA single phase 120/240V transformer. There are a total of two customers on the transformer. During the month of the incident (September of 2020), the peak demand on the transformer was 13.9kVA. This is below the 25kVA rating of the transformer, so the transformer was not overloaded at the time of the incident (See Figure 13).

Since there was no Power Quality Monitor installed at this location, PG&E is not able to leverage additional data to show what may have happened at the time of the incident. Monitors are typically installed when customers may raise concerns about potential power quality related issues. Monitors are also installed to gain a better understanding of possible electrical anomalies. They are not typically installed to record customer-side electrical equipment anomalies; however, PG&E continues to consider technology enhancements as business needs arise[40].

Interconnection was not able to find a copy of the submitted email correspondence in PG&E's system of record, SAP. However, PG&E does have record of a 07/16/18 acknowledgement email.

[39] Engineering results determined the project's export capacity would have no impact on PG&E's electrical grid (based upon provided values).

[40] See CAP 123571954 as an example – Recommendation to perform a feasibility assessment of single-phase [phase-to-phase] residential customer SmartMeters to determine if any alterations can be made to detect open neutral conditions. CAP initiated as a result of a non-related EII incident investigation.

Figure 12: [redacted] – SmartMeter™ [redacted] data.

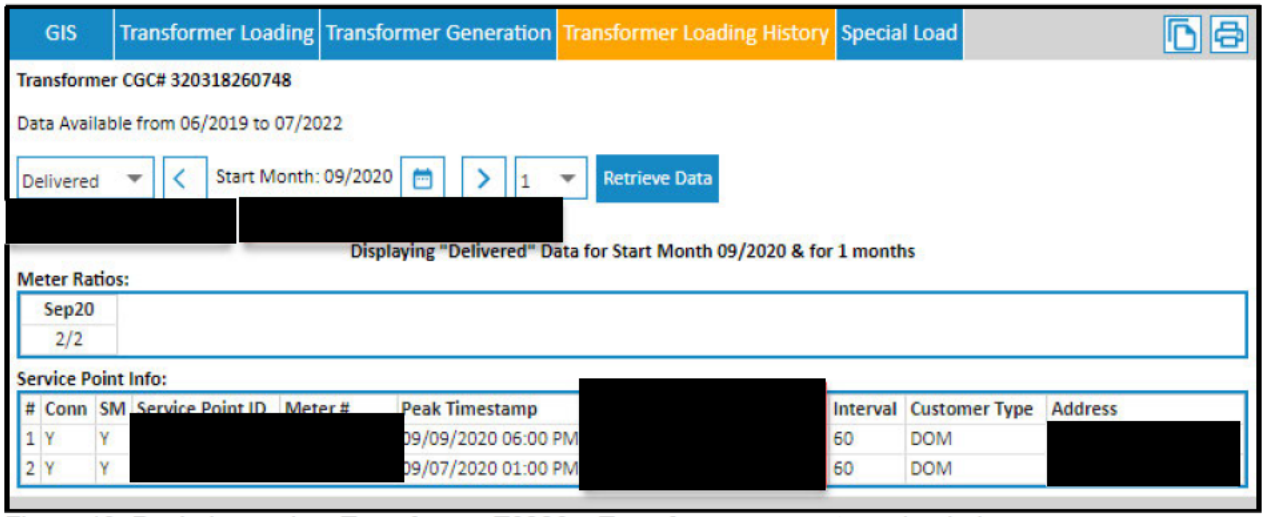


Figure 13: Peak demand on Transformer T6006 – Transformer was not overloaded.

The maximum rated load for the subject cable spans are[41]:

#2AL-XLP-CONC-HDPE:

- Summer Normal: 135 amps
- Winter Normal: 139 amps
- Summer Emergency: 166 amps

[41] Additional investigation was conducted during the course of this cause-evaluation and PG&E updates its response to CPUC Data Request Q22, submitted previously on December 03, 2021. Refer to amended CPUC Data Request Q22, submitted January 26, 2023.

- Winter Emergency: 168 amps

#2AL PE-CONC:

- Summer Normal: 178 amps
- Winter Normal: 183 amps
- Summer Emergency: 219
- Winter Emergency: 222

The average and peak load for the subject circuit (at the circuit breaker) for the 12 consecutive months prior to the incident was[42]:

- **12 Month Average:** 30.87355 AMPS
- **12 Month Peak:** 429.0109 AMPS

September 09, 2020 SCADA loading data from LR 7144 indicated no overloading conditions existed from 1030 hours to 1230 hours, which includes the reported fire's start time (See Figure 14 below).

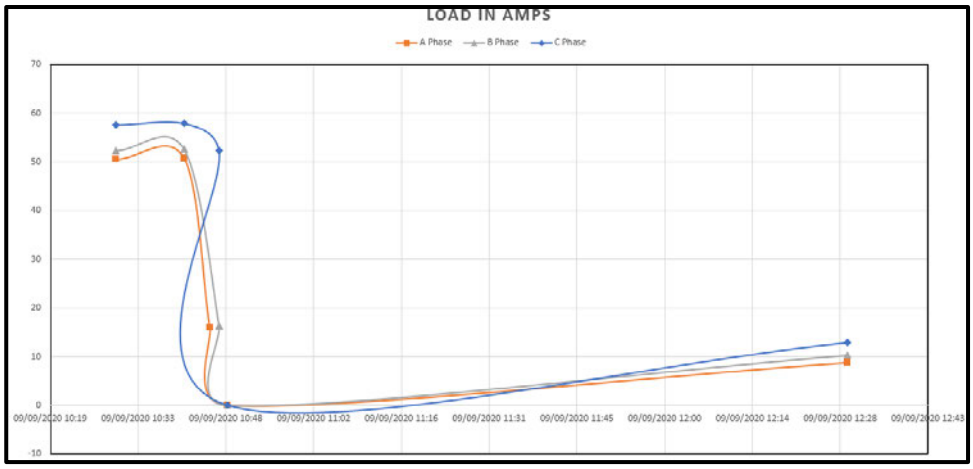


Figure 14: LR 1744 Loading Profile on September 09, 2020.

6.4. SmartMeter™ Data Analysis

The Incident Location SmartMeter™ Badge [redacted] was replaced on May 11, 2020 with a new SmartMeter™ Badge [redacted] after field testing was performed by a PG&E metering

[42] See PG&E response to CPUC Data Response Q20, submitted on December 03, 2021.

technician[43]. The existing meter tested within Tariff Rule 2 limits (Voltage: 247/123/123), and although no anomalies were found, the meter was swapped out as the technician thought it could be nearing end of life and wanted to avoid any potential unnecessary 'go-backs'.

SmartMeter™ event data was extracted from all electric meters on the Stanislaus 1701 Distribution Circuit and reviewed by EII. The below data is consistent with the Incident Timeline (PSPS re-energization to initial customer outage prior to restoration) outlined in Subsection 4.1 above.

Incident Circuit –SmartMeters Event Conclusions – Downstream from LR 1744[44]				
Date:	**Time:**	**Code(s)**	**Plausible Explanation**	**Grouping of SmartMeters™**
09/07/20	Beginning at 2307 hours	12007 - 'Last Gasp' 12024 - 'NIC Power Down'	Proactive PSPS De-energization	Yes
09/09/20	Beginning at 1041 hours-1047 hours	100007 -'NIC Power Restore'	Proactive PSPS Re-energization.	Yes
09/09/20	Beginning at 1046 hours-1047 hours	12007 -'Last Gasp' 12024 - 'NIC Power Down'	Suspected Fault(s) Activity	Yes

Table 4: Incident Circuit – General SmartMeter™ Plausible Event Explanations

Incident Location – [redacted] Murphys, SmartMeter Badge [redacted] Event Conclusions[45]			
Date:	**Time:**	**Code(s)**	**Plausible Explanation**
09/07/20	23:07:11 hours	12024 -'NIC Power Down'	Proactive PSPS De-energization
09/09/20	10:41:25 hours-10:41:30 hours	100007 -'NIC Power Restore'	Proactive PSPS Re-energization.
09/09/20	10:46:37 hours	12024 -'NIC Power Down'	Suspected Electrical Fault(s) Activity

Table 5: Incident Location – EII SmartMeter™ Badge [redacted] Plausible Event Conclusions

On November 23, 2022, EII extracted historical SmartMeter™ interval (usage) data from the Incident Location from January 01, 2020 to Jan 11, 2022[46]. Relevant data shows electricity delivery to the customer location and also encompasses excess electricity generated on the

[43] See FAS Tag 9256928126.
[44] Time provided to the nearest second. Time ranges provided are approximate. A 'NIC Power Down' event occurs when the SmartMeter loses power (below ~25% of nominal voltage or 60V). A 'Last Gasp' event occurs when a NIC loses power. A 'NIC Power Restore' event occurs when power is restored.
[45] Times provided in this table are provided to the nearest millisecond.
[46] See DRU4406_Atch05_TeradataInterval Data_Murphys_Incident Location_CONF.xlsx. Data includes SmartMeter™ Badge Numbers [redacted] and [redacted]

customer side, returned to PG&E's electrical grid.[47] During this time period, EII makes the following general observations:

- **Time Period 1:** From about January 01, 2020 to July 10, 2020, returned electricity from the customer's generation/storage system to PG&E's electrical grid was recorded and appears generally consistent as far as time range.
    - **Note:** On May 05, 2020, the customer contacted PG&E's solar department to dispute a ~$3,200 electric 'true-up' invoice which was escalated to a supervisor after multiple profanities were used by the customer (See Time Period 2 below).
- **Time Period 2:** From about July 11, 2020 to about January 11, 2021, no return electricity was recorded from the customer's solar generation system to PG&E's electrical grid. This time period includes the incident date.
- **Time Period 3:** From about January 12, 2021 to July 08, 2021, PG&E recorded sporadic electricity return from the customer to PG&E's electrical grid. The amount of returned electricity appears to be considerably less than Time Period 1.
- **Time Period 4:** From about November 08, 2021 to December 15, 2021, no return electricity was recorded from the customer's solar generation system to PG&E's electrical grid.

EII is unable to establish a direct link between the cause of the fire and the below SmartMeter™ data observations.

Of Note:

- No PG&E recorded SmartMeter™ data to support returned electricity during Time Period 2 from the customer to PG&E's electrical grid, including the date of the fire incident.
- Returned energy appears decreased from Time Period 3 versus Time Period 1.
- No recorded SmartMeter™ data to support return electricity during Time Period 4.

6.5. Reliability Analysis

EII conducted a search of the CC&B database for evidence of any reliability concerns regarding customers in the area of the Incident Location, Forest Meadows. An August 31, 2017, a CPUC

[47] DRU4406_Atch05_TeradataInterval Data_Murphys_Incident Location_CONF.xlsx. See Column 'H' – Energy Direction Codes. Value 'R' indicates electricity returned from the customer to PG&E's electrical grid and value 'D' signifies electricity delivery from PG&E's grid to the customer.

complaint initiated by a customer at [redacted] in Murphys (Forest Meadows) was received by PG&E, regarding a concern about historical electrical outages in the area. The customer is located load side of LR 1744/L593, but not in the immediate area of the Incident Location and off a different transformer. As a result, EII requested to review the complaint from PG&E's LCE Planning and Operations Group, who manages complaints submitted from the Consumer Affairs Branch ("CAB") of the CPUC against PG&E. The complaint details are as follows:

"This document contains confidential Private Customer Information throughout the document and the entire document is submitted under Section 583."

Customer Complaint

Account Number: [redacted]
Customer Name:
Customer Address:
Service City: MURPHYS-STOCKTON

Contact Phone: [redacted]

Commodity: ELECTRIC
Core Process: 3-D2
Escalator: 04A - GOES TO THE CPUC
Root Cause: PG&E EQUIPMENT FAILURE

CPUC File No.: 43-35-42
CPUC Employee:
Employee Name: [redacted]

Impound Amount:
Record ID: 208764

Service Guarantee: Met
Date Svc Gty Approved:
Smart Meter Issue: 9/12/2017

Complaint Info

Date	Type	Employee	Customer Complaint
08/31/17	CPW	[redacted]	SERVICE-Outage 08/29/2017 16:31 Consumer has concerns regarding the excessive outages she's experienced. Please review the complaint and respond to the consumer and the PUC.

Date Received: 08/31/17
Srv Guarantee Date: 09/14/17
Closed by PG&&E: 09/27/17

Supplemental Received:
Supplemental Closed:
Closed by CPUC:
Date Appeal Filed:
Date Appeal Closed:
Date Formal Filed:
Date Formal Closed:
CPUC Date Received:08/26/17

Complaint / Concern: In the last year, our electric service has suffered many electric outages some lasting up to several days. We have lost appliances, food, suffered under extreme heat without air conditioning. PG&E is aware of the seriously deteriorated condition of the underground facilities and is doing nothing to fix the situation. They do bandaid fixes until the next outage. In the last month we have had no less than 5 outages and are again experiencing another one. My husband has a medical condition which requires electrical services and we are getting nowhere with PG&E correcting the condition. Its time that someone intervened and told them they must replace the facilities that they cannot seem to keep working. Please help, its getting to be a serious situation.
Utility Comment: They simply paid us a check for one of our losses. They are doing nothing to make permanent replacement of the facilities. In this month alone, we have had at least 5-6 outages. We get a different story every time we talk to technicians or the company.
Request of CPUC: We need the CPUC to apply pressure to make the proper replacements of the deteriorated facilities.
Utility Name: P. G. & E

SERVICE-Delayed Orders/Missed Appointments

Customer Satisfaction:
Customer Concern:
1. Customer complains of recurring outages.

Resolution:
* Customer Relations reviewed Outage information history and confirmed that the customer has experienced 5 sustained outages and 2 momentary outages within the last 12 months
* 4 of the 5 outages are related to underground cable failure and 1 outage was due to a dig in
* Customer Relations spoke to the customer on 9/12/17 and confirmed that we have escalated the issue to the Underground Cable Manager for cable testing; once testing is complete, we will have a better scope of the work needed to improve reliability and scheduled for 2018
* Provided the CPUC with the resolution and completed closure

Figure 15: August 31, 2017 CPUC complaint.

The aforementioned complaint was recognized and incorporated into the Forest Meadows Reliability Project mentioned below.

EII also requested the following addresses be checked for prior power related complaints from September 09, 2020 to 2016 when PG&E's Voltage Reliability Team was formed. The below addresses were in close proximity to the Incident Location, with the exception of [redacted] as noted above. All locations are load side of LR 1744.

- [redacted] Murphys
- [redacted] Murphys
- [redacted] Murphys
- [redacted] Murphys

The Voltage Reliability Team does not have a record of complaints from any of the above customer locations.

Forest Meadows Reliability Project - In 2017, PG&E identified the existing electrical UG infrastructure for replacement due to a history of UG cable equipment cable failures downstream from Fuse L593 in phases, with consideration of risk prioritization and resource allocation.[48] As such, the section of cables/splices repaired as a result of the September 09, 2020 incident were not upgraded until 2021 pursuant to our Reliability Related Cable Replacement Program ("56A Program"). Since, PG&E's upgraded underground EPR cables are now in conduit, adding extra protection from potential external forces and increasing reliability. Live front transformers were also replaced with updated dead front transformers as well as related hardware in addition to additional sectionalizing devices.

On August 11, 2022, EII performed a FocalPoint outage query for the Incident Circuit for a time period between January 01, 2017 to August 04, 2022 to determine if additional outages occurred. An additional five unplanned outages were found which affected customers downstream from Fuse L593 in the Forest Hills Development.[49]

[48] 56A Reliability Related Cable Replacement Program. See PM 74016420 and PM 31360765.
[49] FocalPoint is PG&E's system of outage recording. Transformer level outages and above. See 20220811 FocalPoint 01_01_17__08_04_22_Stanislaus 1701.xls; ILIS: 18-0040591, 18-0056942, 18-0067890, 19-0079871, 20-0107252.

PG&E prioritizes the safety of the public and its employees throughout its territory. PG&E's current risk model and asset management plans are sufficient given the circumstances and extent of condition. Namely, PG&E strikes a reasonable balance between the need to address aging underground facilities with priority overhead conductor replacements in High Fire Threat Districts as well as PG&E's ongoing commitment to wildfire risk mitigation work. This is achieved in part by monitoring asset condition through patrols and inspections consistent with GO 165, and targeted conductors that pose the highest risk of failure (i.e. likelihood and consequence), thereby reducing failures that could lead to an ignition or other safety hazard. PG&E will continue to evaluate the outcomes of the hazard controls and assess if additional controls are needed to further mitigate the risk associated with this incident.

6.6. Failure Analysis[50]

Applied Technology Services ("ATS") conducted a non-destructive examination of the failed cables/splice(s). The cause for the vegetation fire as well as the property damage at the Incident Location due to the failed cables was beyond the scope of ATS investigation. Ultimately, ATS determined the failure of the splice and conductor was due to insulation dielectric breakdown during switching operations to re-energize the circuit. The cause of the insulation dielectric breakdown cannot be determined due to severe arcing damage.

The subject splices were identified as manufactured by Elastimold in 1984 and were of the Type 25s, 125kV BIL. This is consistent with the date of installation, outlined in Subsection 5.1 above. The splices are premolded permanent splices for underground cables. Cables were identified as XLPE and met construction standards at the time of installation.

Two of the splices failed due to arcing and resulted in complete separation of the aluminum conductor within the splice and complete burn through of the splice housing. Failure of the aluminum conductor occurred at the edge of one of the crimped splices adjacent to the XLPE. Melted metal and high-temperature oxidation from arcing obliterated any damage features that may point to why the conductor failed. However, close-up visual inspection of the strands of the

[50] See DRU4406_Atch02_ATS Report_CONF.pdf

aluminum conductor on the intact section of the splice revealed assembly defects such as cuts, nicks, and scrapes on the surface. Cuts, nicks, scratches, or scrapes which reduce the conductor's overall cross-sectional area, reduce the current carrying capability of the conductor due to the resulting increased resistance offered by the reduced cross-sectional area.

The cables at the Incident Location have a total connected load of 50kVA and a maximum expected load of 4.28 amps with both transformers loaded to 150 percent of rated capacity. The #2 7-strand AAC cable has a rated ampacity of approximately 160 amps (PG&E UG-1). Due to the cable at Incident Location only being loaded to approximately 3 percent of capacity, the slight reduction in current carrying capacity due to cuts, nicks, and scrapes is insignificant and did not contribute to the failure. The location of the splice failure is at the edge of the crimped cable termination which is likely the highest electrical stress inside the splice housing which likely dielectric breakdown of the splice housing insulation resulting in complete failure of the conductor and splice housing. The cause of the dielectric breakdown cannot be determined due to the significant arcing damage.

The incident resulted in three dielectric breakdown failures in two separate locations. Fault data indicates that this fault was a long duration high impedance line-to-ground fault. An initiating failure energized the concentric neutral system and due to the high impedance ground return path, the concentric neutral system likely experienced a voltage rise of approximately 10kV. This additional voltage put additional voltage stress on the intact phase cables and likely caused dielectric breakdown of the cable and splice.

Equipment Failure Mode:

- Failure of the splice and conductor due to insulation dielectric breakdown likely during switching operations to re-energize the circuit. Switching operations likely resulted in a momentary voltage transient that stressed the aged insulation initiating the failure sequence.

Direct Cause of Equipment Failure:

- The direct cause of insulation dielectric breakdown cannot be determined due to severe arcing damage.

The subject span cables submitted to ATS were examined and have the following attributes[51]:

- **Type:** #2AL-XLP-CON-HDPE[52]
- **Manufacturer:** Alcoa Kama
- **Size:** 2 AWG
- **Rating:** 22kV
- **Number of Strands:** 7
- **Complete Cable Diameter:** 0.292 Inches
- **Individual Strand Diameter:** .0974 Inches

Additionally, the below cable type, as mentioned in Section 5.1 (Cable Asset History) are known to have the following attributes[53]:

- **Type:** #2AL PE-CONC
- **Manufacturer:** Not known
- **Size:** 2AWG
- **Rating:** 22kV
- **Nominal O.D.** Over Jacket
- **Insulation Thickness:** 295 Mils
- **Semi-Conductor Jacket**: 30 Mils
- **Equiv. Cu Size of Concentric Neutral:** 4
- **Approximate Outside Diameter Over Concentric Wires:** 1.16 Inches

6.7. Weather Analysis

The closest weather observation site was approximately 2.61 miles north-northeast of the Incident Location. It was a seasonal and dry day at the Incident Location on September 09,

[51] This information supplements our response to CPUC Data Request Q16, submitted on November 03, 2021. Also see ATS report for further details.
[52] #2AL - Two aluminum conductors, XLP - Cross-linked polyethylene insulation, CON - Ground shield composed concentric wire/concentric neutral, HDPE - High-density polyethylene outer jacket (Plow-in Cable). Data provided resulted from examination of only one cable and PG&E is not able to provide additional data on the remaining cable segments. Response is provided to the extent data is reasonably available.
[53] Engineering Standard 039955 - Cables for Underground Distribution, Sheet No. 12, Rev.1, Dated: 05/17/83 - Material Code 29-8193. See Table 6 and 13. Response is provided to the extent data is reasonably available. ATS received only jacketed cables and values provided are strictly from the design drawing.

2020. A high temperature of 79.0% Fahrenheit was reached at 1220 hours. A low temperature of 64.8% Fahrenheit was reached at 0050 hours. The relative humidity was at its highest at 37% at 2250 hours and it was its lowest 11% at 0110 hours. The strongest wind gust recorded was 10.4 mph at 1620 hours.

On September 09, 2020, from 1000 hours to 1100 hours, the temperature was between 72% Fahrenheit to 76% Fahrenheit and relative humidity was between 23% to 26%. The strongest wind gust was 7.4 mph at 1100 hours.

EII did not identify weather as contributing to the fire and resulting property damage.

6.8. Fire Department Investigation Report Analysis

The latitude and longitude listed in the Fire Investigation Report was near [redacted]

Figure 17: Google Earth overhead view of CAL FIRE reported fire location

CAL FIRE indicated the probable general origin of the fire was located towards the Incident Location's AC condenser unit; however, the cause is listed as undetermined.

The report also indicates:

Wildland Fire Details:

- **Fuel Model at Origin:** Annual Grasses
- **Heat Source:** Undetermined

- **Factors Contributing:** Undetermined

Investigation:

- **Possible:** Electrical Power
- **Possible Explanation:** Power was turned back on after the wind event and tripped the air conditioner breaker.
- **Probable Explanation:** <Blank>
- **Probable:** None
- **Probable Explanation:** Fire origin area was near air conditioner condenser.
- **Investigation Attachments Included in Report:** Yes

The fire report investigation narrative indicates the following:

> *"On Wednesday September 9th 2020 at approximately 11:11 AM the CAL FIRE Emergency Command Center received a telephonic report of a structure fire in the area of [redacted] I was assigned to Engine 4479 as the company officer and responded as part of the dispatch.*
>
> *Upon my arrival at 11:25 Am I observed a vegetation fire approximately 1 acre in size with a slow rate of spread. The fire was spilt by a road with a half of a acre on each side of the road, the north side of the road had fire advancing uphill between two structures, the second half to the south was backing fire downhill away from the address [redacted] I conducted a preliminary fire investigation finding that the general [redacted] towards the bottom of [redacted] near the homes air conditioner condenser. (see Prevention Officers 4421 Supplemental report for origin and cause determination.*
>
> *Based on my experience, training, education and statements made to me by witnesses. I have determined the fire to be undetermined cause. I reserve the right to change my opinion based of new or additional information."*[54]

Weather:

Weather: 09/08/20 1252 hours
Wind Direction: Southeast
Air Temperature (F): 82
Wind Speed (mph): 1
Relative Humidity: 41%

PG&E Law-Claims attempted to obtain a copy of the fire department's supplemental cause-origin report on September 06, 2022, September 22, 2022 and September 28, 2022, but was unsuccessful[55]. As a result, EII is not able to conduct a further evaluation as to the potential cause of the incident. Additionally, the current investigation report indicates the 'Probable Cause' of the fire is undetermined. EII notes that the weather data listed in the fire report are for

[54] Text is highlighted and italicized for reference purposes by EII.
[55] See PG&E Law-Claims-EII Internal Email.

the day prior to the incident and may not reflect actual conditions on September 09, 2020, the date of the fire. EII does not know if CAL FIRE collected any potential physical evidence (customer equipment, photos, eye-witness statement[s]), etc. which could aid in the determination of the origin and cause of the fire. Moreover, Witness [redacted] (customer) was listed as an involved party in the CAL FIRE Investigation Report, but EII does not have access to her direct statement or have knowledge if it was obtained near or at the time of the occurrence of the incident[56].

Additionally, EII determined the following factors are currently unknown, and not mentioned in the fire department report:

- The fire report indicates when power was turned back on after the wind event, the AC conditioner breaker tripped; however, EII does not know if a precipitating event on the customer side of the electrical circuit caused and/or contributed to this action and subsequent fire.
- The fire report did not mention customer generator usage and EII does not know if a potential backfeed situation could have caused and/or contributed to the fire and/or PG&E UG cable/splice equipment failure.
    - A responding PG&E troubleshooter observed a generator was in use by the customer, but does not have any further details such as:
        - If the customer-supplied portable generation was in use at the time of the start of the fire or how it was connected electrically.
        - If there was any possible backfeed from customer-supplied generation to PG&E's electrical grid.

6.9. System Protection Analysis

As mentioned earlier, the portion of the circuit where the faulted primary cables/splices were located were DB underground assets. Required PSPS pre-energization patrols were conducted before energization and no potential hazards were found which are believed to have caused and/or contributed to the underground fault or fire. The patrol included overhead assets including LR 7144 where no damages or issues were found.[57]

[56] Witness accounts obtained in a timely fashion during or shortly after an incident can tend to be the most accurate.
[57] See PG&E response to Q04, submitted to the CPUC on December 03, 2021.

Although the Incident Location was in a Tier 2/3 HFTD, Enhanced Powerline Safety Settings ("EPSS") were not circuit enabled at the time as program implementation began in 2021[58]. The circuit is currently EPSS enabled.

Below is a single-line diagram ("SLD") from the circuit breaker to the Incident Location[59]:

Figure 16: Single-Line Diagram

At the time, the Incident Location was source protected by Fuse L593, LR 7144 and then CB 1701 as indicated in Figure 16 above. Analysis determined that there was no interrupter device source side of the fault location on the date of the incident. However, on July 09, 2021, a clearance was obtained to add Interrupter 353980 and reconfigure the circuit. The interrupter is now located upstream from the Incident Location and provides additional system protection.

6.10. Control Center Analysis

PG&E recognizes that when a circuit is re-energized (in this case after a PSPS event), there can be a temporary and expected in-rush of energy/switching transients which can place additional stress on near end-of-life assets. Typical electrical circuitry protection is designed with this in mind. Adding sectionalizing devices and access points, as was accomplished through the reliability program, not only enhances PG&E's ability to reduce customer outages, increase reliability, but also decrease the likelihood of the potential for temporary current in-rush upon re-energization.

The underground fault activity that occurred related to this incident led EII to consider the troubleshooting technique unique to underground circuits in PG&E's system. During an underground outage, the fault location may not be obvious. Unlike overhead circuits, there is no

[58] PG&E's Enhance Powerline Safety Settings (pge.com).
[59] After further research and investigation by PG&E Planning Engineering and EII, this diagram was provided as an updated response to Q18, submitted on January 26, 2023.

visual indication of failure, such as a downed wire, to confirm the fault location. There is also little SCADA visibility in PG&E's underground circuits. Operators and troubleshooters typically rely on devices such as interrupters and fault indicators ("FI's") to isolate an outage to a smaller section of the circuit. However, as mentioned above in Section 6.8, an interrupter was not part of the protection scheme at the time, but was added as an enhancement via the reliability project in 2021.

If an entire circuit trips, hazard reports are often the only clue that can lead to the fault location. However, if there is a hazard report it means that equipment may have already failed and as a result, troubleshooting typically begins in the suspected general area of the fault beginning where access points exist (if known – load side of L593), as was in this case.

To isolate a fault when the hazard area is not reported or the particular faulted section of circuit is not known, the operator coordinates with field personnel to energize, or "test," smaller and smaller sections of the circuit until it remains energized without tripping. When the next upstream protection device holds closed like this, it is referred to as "testing good." If the circuit trips again it is called "no good" ("NG") and indicates the fault is still included in the path that was just tested.

This methodical technique of testing a circuit enables the operator to locate an underground fault. However, multiple tests can damage good conductor by exposing it to fault current multiple times. It is also possible to further damage associated equipment at the fault location or cause arcing each time the fault location is re-energized, which could have occurred in this incident. Any additional UG fault activity that could occurred during testing, is believed to have occurred after the fire already began, and the Incident Location was already isolated from the primary electrical circuit (i.e., source transformer high-side cables were disconnected).

Absent the resources for extensive conductor replacement, adding additional UG cable access points, and additional SCADA installation, the above described technique is the currently accepted practice for locating an underground fault in the distribution system if other means of detecting the fault location are unavailable. Procedure TD- 2700P-11 includes instructions to select sectionalizing points to minimize danger to life and property and to minimize the number of tests.

6.11. Internal Guidance Analysis

Design Standard Document 039081- Premolded Permanent 200 AMP Splices for Primary Underground Cables – Engineering Standard (For Reference Only, 1971-1991)[60]
This document was in existence during the time period the splices/cables were installed. The document provides installation instructions related to several different manufactured straight splices, including Elastimold, G.E., and RTE brand.

The current version of the document, Design and Construction 039081 - 200-AMP Splices for Primary Underground Cables (Publication Date. 03/25/22, Rev 7.) provides ordering, installation, and application information for straight splices to be used with solid dielectric, non-lead cable. The straight splice may be direct-buried when splicing together sections of direct-buried PE-CONC or XLP-CONC-PVC cable. The splice should also be used to splice XLP-PVC, XLP-CONC-PVC, EPR-CONC-PE, and XLP-CONC to PE-CONC cable. This practice is allowed when making temporary repairs to re-establish operation capabilities while permanent repairs are completed. The current Premolded Straight Splice authorized for purchase is the 3M Company.

Design and Construction Document 039955 – Cables for Underground Distribution (Pub. Date: 12/01/19, Rev. #15)

- Current standard cables used in UG primary outdoor distribution applications (non-network) is EPR (Table 1).
- Direct bury cable is no longer permitted in new applications.

Design and Construction Document 038193 – Minimum Requirements for the Design and Installation of Electric Conduit, Insulated Cable, and Facilities (Pub. Date. 03/25/22, Rev. #15)

- Conduit requirements.

[60] Document current at the time of splice/cable installation: Premolded Permanent 200 AMP Splices for Primary Underground Cables 039081, 1968-1991 era, Rev's. 6-11. Prior version: Premolded Permanent 200 AMP Splices for Primary Underground Cables 039081, 1968-1991 era, Rev's. 6-11. Current version

Design Document 063927 - Methods and Requirements for Installing Residential Underground Electric Services 0-600V to Customer-Owned Facilities (Pub. Date: 03/25/22, Rev. #24)

- Conduit required for new residential services (Page 2 of 7)

Construction Document 066212 - Installation of Pad-Mounted, Load-Break Junctions (Pub. Date: 03/25/22, Rev. #09)

- Application, installation, and ordering information for steel, pad-mounted, load-break junctions using separable, insulated, load-break connectors.
- Pad-mounted, load-break junctions may be used to sectionalize energized primary circuits.

7. CAUSE & CONTRIBUTING CAUSES

A cause factor tree analysis was performed as part of this investigation. Based upon the availability of limited evidence, the cause of the fire is currently undetermined. It is possible a customer related electrical issue could have caused the fire, although insufficient evidence was found to support this hypothesis[61].

[61] See DRU4406_Atch01_Cause Factor Tree Analysis_CONF.pdf

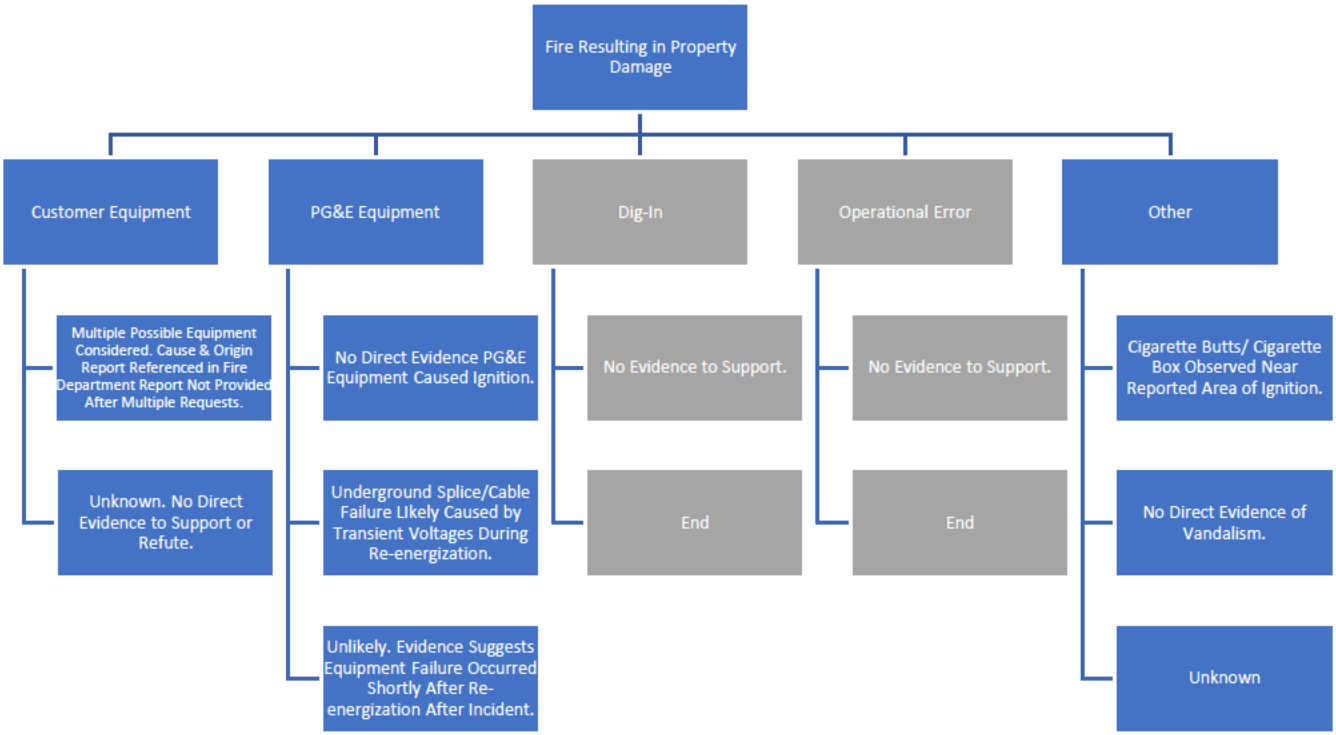


Table 6: Cause-Factor Tree

8. CORRECTIVE/GENERAL ACTIONS (CA/GA) SUMMARY

The following table summarizes the corrective or general actions identified as a result of this investigation.

NERC Code	Cause(s)	CA/GA #	CA Description	Action Owner	Due Date
AZB2C02	Damaged primary UG conductors/splices.	CA-1	Repair damaged UG cables/splices **Deliverable:** Completed EC Tag recorded in SAP	[redacted] Supervisor, Electric Distribution, Stockton	Completed 09/11/20 under EC Tags 119731471 and 119731474.
A2B6C04	Forest Meadows Reliability Project	CA-2	Replace aging UG infrastructure. **Deliverable:** Project Completion - SAP PM 74016420 - Operative date entered.	[redacted] Job Project Manager	Completed, 07/20/21

Table 7: Corrective Actions

9. POTENTIAL NON-CONFORMANCES AND NON-COMPLIANCES

No non-compliances or non-conformances were identified as a result of this investigation.

10. REFERENCES

Internal Documents

- Emails
- Bulletins
- Training
    - First Responder Evidence Training (CORP-0200WBT)
- Rules
    - Tariff Electric Rule 2
    - Tariff Electric Rule 16
- Standards/Procedures
    - Construction Document 066212 - Installation of Pad-Mounted, Load-Break Junctions (Pub. Date: 03/25/22, Rev. #09)
    - Design and Construction Document 038193 – Minimum Requirements for the Design and Installation of Electric Conduit, Insulated Cable, and Facilities (Pub. Date. 03/25/22, Rev. #15)
    - TD-9001M - Electric Design Manual (2018)
    - Design and Construction Document 039955 – Cables for Underground Distribution (Pub. Date: 12/01/19, Rev. #15)
    - Engineering Standard 039081 – Premolded Permanent 200 AMP Splices for Primary Underground Cables (Pub. Dates: 1968-1991 era, Rev. 06-11)
    - Interleaf Document 0309081B – Premolded Permanent 200 AMP Splices for Primary Underground Cables (Pub Date: 05/01/95, Rev. #00)
    - Design and Construction Document 039081 – 200 AMP Splices for Primary Underground Cables (Pub. Date: 03/25/22, Rev. #07)
    - Engineering Document 060436 – Replacement Cable for 12 and 22kV Cable-In-Conduit (CIC) (Pub. Date: 05/05/05, Rev. #02)
    - Design Document 063927 - Methods and Requirements for Installing Residential Underground Electric Services 0-600V to Customer-Owned Facilities (Date: 03/25/22, Rev. #24)
    - Design and Construction Document 039955 – Cables for Underground Distribution (Date: 12/01/19, Rev. #15)
    - TD-2700P-11 – Testing and Sectionizing Distribution Equipment (Publication Date: 08/15/20, Rev. #02)

  - TD-8106 – Distribution Line Underground Asset Management Plan (Publication Date: 11/05/21, Rev. #02)
  - Design and Construction Document 060559 (Pub. Date: 03/25/22, Rev. #06)
  - TD-2306 Distribution Interconnection Handbook
  - TD-7001M – PG&E Greenbook (Pub. Date: 06/24/22)
  - TD-2060S – Emergency Electric Corrective Documentation Standard (Rev. 0, Publication Date: 06/07/22, Pub. Date: 06/07/22, Rev. 1)
  - TD-2060P – Emergency Electric Corrective Documentation Standard (Rev. #01)
    - TD-2060P-01, “Estimating for Routine Emergency Electric Corrective Restoration”
    - TD-2060P-02, “Routine Emergency – No Estimate Required”
    - TD-2060P-03, “Damage Claim Emergency – Estimate Required”
    - TD-2060P-04, “Mapping for Emergency Electric Corrective Restoration” (*expected publication June 2022*)
    - TD-2060P-05, “First Responder for Emergency Electric Corrective Restoration” (*expected publication Q4 2022*)
    - TD-2060P-06, “Field Crew for Emergency Electric Corrective Restoration” (*expected publication Q4 2022*) TD-2060P-07, “Inspection Compliance for Emergency Electric Corrective Restoration” (*expected publication Q4 2022*)
    - TD-2060P-08, “Compliance for Emergency Electric Corrective Restoration”
  - LAW-3001P-01 – Claims Evidence Procedure (Effective Date: 03/19)
  - LAW-3001P-02 – First Responders Evidence Procedure (Effective Date: 06/19, Rev. 0).
- Legacy installation records
- ILIS Report
- 20220811 FocalPoint 01_01_17__08_04_22_Stanislaus 1701.xls
- Interconnection Research
- PSPS Playbook
- SmartMeter Data
- Job Sketches
- 2017 CPUC Customer Complaint
- Meteorology Data

- FAS Tags
    - Tag T005068274
    - Tag T005068574
    - Tag 9256928126
    - Tag 9258234802
    - Tag 9259944746
- SCADA Alarm Data
- PM 74016420 and 31360765 – MWC56A Cable Replacement Outage Background and Project Scope.
- PG&E Fire Damage Datasheet_Confidential.pdf
- PG&E Incident Report_Confidential 62-0719.pdf

External Documents

- Fire Report
- PG&E-CPUC Correspondence Email – Destructive Testing
- Calaveras County Building Permit Documentation

11. ATTACHMENTS

- DRU09783_Atch01_ATS Report_CONF.pdf
- DRU09783_Atch02_EC Tag 110731474_CONF.pdf
- DRU09783_Atch03_EC Tag 119731471_CONF.pdf
- DRU09783_Atch04_TeradataInterval Data_Murphys_Incident Location_CONF.xlsx
- DRU09783_Atch05_BadgeMeterList_Murphys_08122022_EventData_CONF.xlsx
- DRU09783_Atch06_Additional Troubleshooter Photos_CONF.pdf[62]

12. PREVIOUSLY COMPLETED REPORTS AND DATA REQUESTS

[62] PG&E supplemented its initial June 15, 2021, submittal of Attachment 07_Photos_CONF.pdf (Attachment with 20-day report, DRU-3699) by providing additional images that were taken by a troubleshooter shortly after the occurrence of the incident and provided to EII on November 01, 2022. These images, DRU09783_Atch06_Additional Troubleshooter Photos_CONF., were also provided with our amended data response, Q03 submitted on January 26, 2023.

20-Day Report

20-Day Report_EI200909A.pdf, submitted to the CPUC June 15, 2021

- Attachment 01_2015 patrol records_CONF.pdf
- Attachment 02_2017 patrol records_CONF.pdf
- Attachment 03_2016 inspection records_CONF.pdf
- [Attachment 04_GO 165 inspection record is not included with this submission and will be provided at a later date]
- Attachment 05_EC Tag_CONF.pdf
- Attachment 06_ILIS 20-0094369_CONF.pdf
- Attachment 07_ Photos.pdf
- Attachment 08_Evidence Photos_CONF.pdf
- Attachment 09_Fire Report_CONF.pdf
- Attachment 10_Incident Diagram.pdf

Amended 20-Day Report

20-Day Report_ EI200909A - Murphys – Property Damage_Amended_CONF.pdf, submitted to the CPUC June 22, 2021

- Attachment 01_2018 GO165 patrol records_Amended_CONF.pdf
- Attachment 02_2019 GO165 patrol records_Amended_CONF.pdf
- Attachment 03_2013 GO165 inspection records_Amended_CONF.pdf
- Attachment 04_2016 GO165 inspection records_Amended_CONF.pdf
- Attachment 05_EC Tag_CONF.pdf
- Attachment 06_ILIS 20-0094369_CONF.pdf
- Attachment 07_ Photos.pdf
- Attachment 08_Evidence Photos_CONF.pdf
- Attachment 09_Fire Report_CONF.pdf
- Attachment 10_Incident Diagram.pdf

Data Requests

PG&E - Data Request 1 - EI200909A - Murphys - Property Damage.pdf, Data Request submitted to the CPUC December 03, 2021.

- Attachment 01_Q01_2016 GO165 Inspection Records_CONF.pdf
- Attachment 02_Q05_TD-2700P-11 Section 11.pdf
- Attachment 03_Q07_EC Tag 119731474_CONF.pdf
- Attachment 04_Q07_EC Tag 119731471_CONF.pdf
- Attachment 05_Q18_Single Line Diagram Murphys_CONF.pdf
- Attachment 06_Q18_Fault span_CONF.pdf
- Attachment 07_Q20 SCADA LR7144 Load Data.xlsx
- Attachment 08_DRU-4406_Names_CONF.pdf

PG&E Amended Data Response – DRU09783, DRU09783_Electric Incident-EI200909A-Murphys-Property Damage_Data Request_CPUC_001.pdf, submitted to the CPUC on January 26, 2023.

- DRU09783_Q03_Atch01_Additional Troubleshooter Photos_CONF.pdf
- DRU09783_Q18_Atch01_Amended Single Line Diagram_CONF.pdf