



# ***Event Analysis Report***

*Event Strategy & Analysis*  
*Electric Compliance Investigations*

***Event Name:*** *Walnut Creek - Media*

***PG&E Reference Number:*** *EI190518A (CAP: [117297655](#))*

***Date of Event:*** *May 18, 2019*

***Date Reported to the CPUC:*** *May 19, 2019*

***Event Lead:*** [REDACTED]

***Report Rev:*** *00*

[REDACTED]

Manager Approval Signature

[REDACTED]

Event Lead Signature

[REDACTED]

Printed Name

[REDACTED]

Printed Name

9/12/2019

Date

9/12/19

Date

Internal



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## 1. **Problem Statement**

On May 18, 2019, at 1300 hours, an outage occurred in Walnut Creek that impacted 3,200 customers on the Lakewood 2225 21kV circuit. Due to reports of an explosion and smoke, there was a local television crew present during the repair. This media presence triggered the Media criterion for reportable event to the California Public Utilities Commission (CPUC) and required a 20-Day Report investigation by Pacific Gas & Electric's (PG&E) Event Strategy & Analysis (ESA) group. Based on preliminary forensic data from Applied Technology Services (ATS), the ESA lead identified mechanical failure as the direct cause of this failure. Data review found concerns regarding the use of the Material Problem Reporting (MPR) database.

## 2. **Extent of Condition**

The explosion of underground (UG) switches do not pose a significant threat to public safety due to the infrequency of UG elbow connector failures. Despite the uncommonness of this type of failure, the resulting explosion, fire, and ejection of the vault lid could potentially cause a significant public injury and therefore cannot be dismissed.

Based on the preliminary review of data collected as part of an additional CPUC data request, since 2011, PG&E found five Material Problem Reporting ("MPR") entries related to the failure of the UG elbow connectors – the same connector that failed in this incident (material code M303572). During the same time period, PG&E records indicate that 38,656 of these connectors have been purchased.

Although the MPR does not show all the UG connector failures that have occurred, based on the information from the available MPRs and field reports from crews and operators, there is no indication that there are significant problems with these connectors. Electric Distribution Asset Management does not recommend additional actions for these UG elbow connectors at this time. More comprehensive documentation of equipment failures is recommended before it is tracked in CAP.

## 3. **Event Summary**

See Attachment 1 – 20-day report for EI190518A – for a summary of the event.

### **Evidence Collection**

PG&E collected the damaged switch and one elbow connector (which includes a T-body, T-body adapter, bushing, elbow, and connector) into evidence.



**Pacific Gas and  
Electric Company**



*Figure 1-Parts of the damaged connector  
(collected as evidence)*



*Figure 2-Figure 6 - SW-14931 -  
removed from the vault*

#### **Timely Reporting**

On May 19, 2019, at 0655 hours, PG&E was notified of this incident through the EIR reportability hotline. At 0735 hours, it was determined that this incident met the Media criterion and was therefore reportable. Later that day, at 0855 hours, this incident was reported to the CPUC. This incident was reported in a timely manner in accordance with the Electric Incident Reporting On-Call Representative procedure.

#### **4. Event Analysis**

Based on the data uncovered during the investigation, follow up interviews with field personnel, and the ATS failure analysis (Report # 006-19.12 Rev. 1), the direct cause of the equipment explosion and resulting outage was the failure of the downstream external cable elbow connector of the T2 bushing. This resulted in a line-to-ground fault on the B-phase. This fault created the burning and arcing damage observed on and around the T2 bushing and tank (as seen in the images below).



*SW-14931 and connectors (view of the top)*



*Burn mark on SW-14931 and the connectors - close-up view*

The oil analysis, electrical testing, and visual inspection of the internal components did not reveal any defects or problems inside the switch. Based on this forensic data, it is reasonable to conclude the cable and elbow connection was the location of the fault. The downstream external cable was not damaged and was not replaced as a result of this incident.

The evaluation focused on if the connection failure was the result of material defects from either aging or manufacturing error. There was also an analysis of inadequate craftsmanship during the installation of the switch. These considerations were dismissed since the switch impacted by the faulty connector went into service in 1987 (see ATS Report) and had operated since then without failure until the May 2019 incident.

The T2 bushing elbow connection was badly damaged from the fault reaction. Connector material analysis, if conducted, may not be sufficient to provide the root cause of the connector failure. The assets at the incident location were patrolled in 2017 and inspected in 2018, neither of which indicated any issues. There were no records of the work performed on this switch (SAP ID 40007232) or the vault location in the last 10 years.

Prior to the incident, neither planned nor unplanned switching occurred on the Lakewood 2225 21kV circuit. Per SCADA data on CB 2225 on May 28, 2019, there were no unusual current fluctuations, indicating normal switch functioning. These observations rule out the possibility that power switching and loading conditions contributed to this failure.

Additionally, during a conversation with the UG switch asset owner it was discovered that this equipment did not have an MPR created. The MPR procedure (PG&E Procedure SCM-2106P-01) was implemented in 2015 to help sourcing, engineering, and field personnel identify and trend equipment failure of newly-installed assets. It was not used on legacy equipment failures due to the overwhelming scope and scale of legacy assets in PG&E's transmission and distribution network.



Furthermore, in trying to identify the actual frequency of the termination failures (from UG elbow connectors and other connectors), the following limitations with the MPR process were discussed:

- MPRs are not filed for every failure since they are only intended for premature failures of newer equipment (<5 years old)
- Some qualifying equipment do not get MPRs due to time or process awareness limitations of crews responsible for filing them
- The MPR database is not reviewed by enough entities in the company to make risk-based decisions
- The MPR information is not uniform in their equipment and failure mode classifications. This lack of data uniformity complicates data analysis

#### Input from Electric Distribution Asset Strategy

The connector that failed was identified as a T-body connector (M303572). PG&E records indicate that 38,656 of these connectors have been purchased since 2011. There have been 5 Material Problem Reports (MPR) issued on these connectors since 2011. Since the MPR program does not require that a report be submitted for every failure, MPR records will show only a portion of the failures that have occurred. Based on the information from the available MPRs and field reports from crews and operators, there is no indication that there are significant problems with these connectors. Therefore, no additional actions are recommended for these T-body connectors (M303572) at this time.

However, more comprehensive documentation of equipment failures is recommended:

- Either expand the current MPR process or develop a new tool and process to capture information from all failures
- Include this data capture as part of outage reporting as well as part of the required mobile platform data collected from repair crews

This additional data will allow a risk-based asset strategy to understand failure frequencies, consequences, and address issues more proactively.

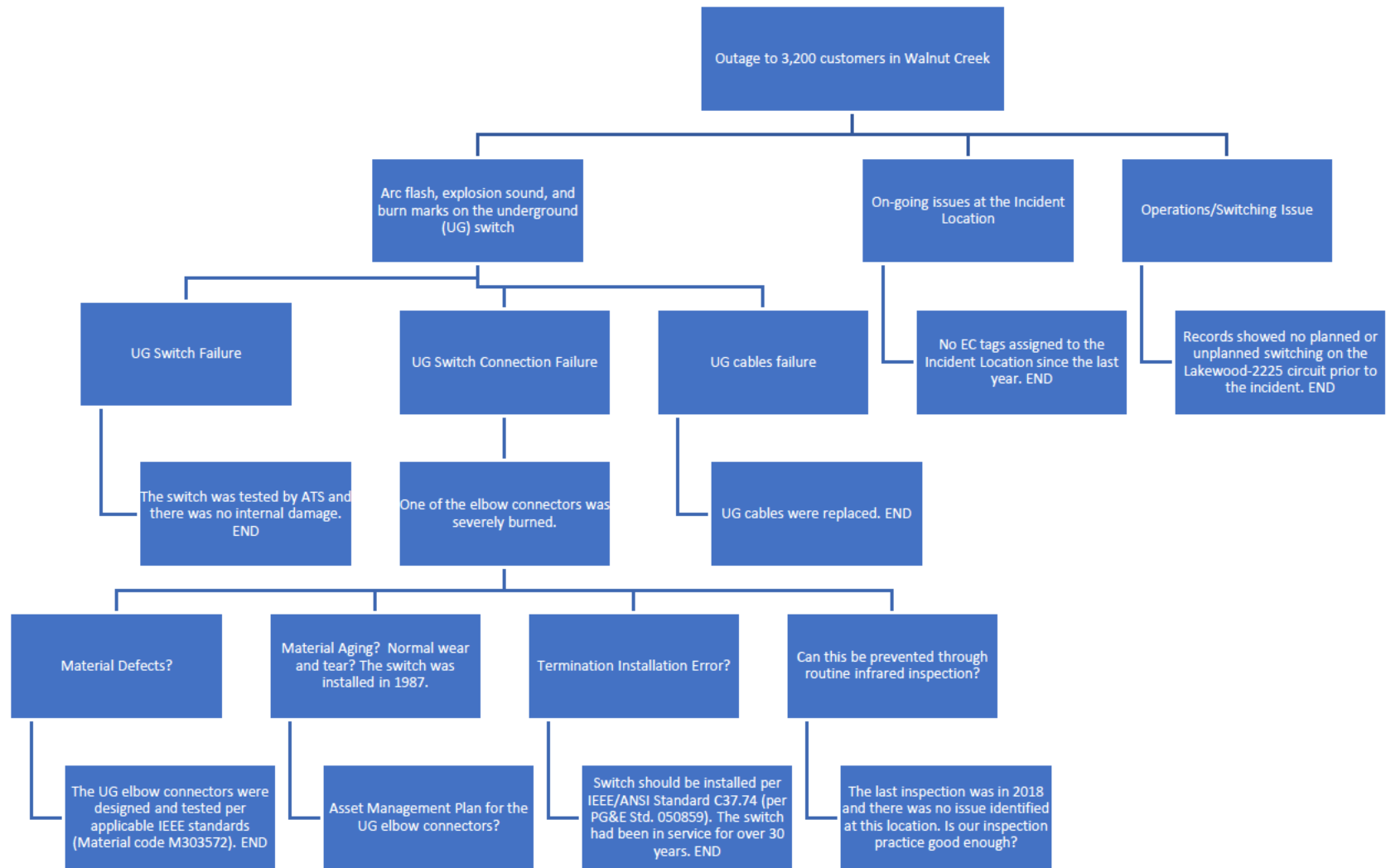
## **5. Cause and Contributing Causes**

The Direct Cause of this event is an external T-body connector termination, as outline in the ATS report. The failure caused an outage and resulted in a loud noise and smoke from the underground equipment.

A contributing cause was a lack of comprehensive documentation of equipment failures – including the failures of UG elbow connectors. A more comprehensive list of failures could help the proactive identification of signs of an impending failure.



Below is a factor tree examining possible causes and contributing causes:



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## 6. Corrective Actions (CA)/Actions Summary

Action items addressing the cause(s) and from the debrief meeting

Code	Issue(s)	CAP #	Description	Action Owner	Due Date
	PG&E does not have comprehensive documentation of equipment failures including the failures for the UG elbow connectors.	117874473	Develop and implement a risk-based asset strategy for UG equipment (including the UG elbow connectors) to understand failure frequencies, consequences and address issues more proactively.	Electric Distribution Asset Management	9/1/2021
	The last inspection in 2018 did not identify issues at the location. It was questioned whether the current P&I practice is effective and if additional scrutiny of the P&I could prevent the underground elbow connector from an unexpected failure	117874383	Determine if the underground patrol and inspection manual needs to be revised to provide better guidance on examining the elbow connectors.	Risk and Compliance & Inspection	12/30/19

## 7. Potential Non-Conformances

No potential non-conformances have been identified for this incident.

## 8. References

Data supporting the cause evaluation

- ATS Failure Analysis Report # 006-19.12 Rev. 1, providing the failure analysis
- Emergency Notifications 117272737 and 117384196., providing what was replaced post-incident.
- Emails and conversation with Electric Distribution Asset Management, the Troubleshooter, and ATS engineers.
- DRI-1523 Response
- PG&E Procedure SCM-2106P-01 – Material Problem Reporting Procedure
- Fire Department Report

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- Electric Distribution Preventive Maintenance Manual, 2016
- Switching Records on May 18, 2019
- SCADA data of CB 2225 May 17, 2019 to May 19, 2019

**Data gathered but not supporting the cause evaluation**

- FLISR Data for Walnut Creek SW 14931 on May 18, 2019
- 2015 and 2018 inspection records
- 2016 and 2017 patrol records
- Engineering Document 050859 – Installation of three-phase 600 Amp Subsurface Sectionalizing Switch
- Weather Data for Walnut Creek on May 18, 2019.
- Dispatch recording calls
- ILIS Report 19-0053659
- Outage Dispatch Tool OIS 384275
- Switch 14931 SAP Asset Details

9. **Attachments**

Attachment 1 – 20-day report for EI190518A

Attachment 2 – CAP 117874383

Attachment 3 – CAP 117874473