

**PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2022
Data Response**

PG&E Data Request No.:	OEIS_004-Q05		
PG&E File Name:	WMP-Discovery2022_DR_OEIS_004-Q05		
Request Date:	March 11, 2022	Requester DR No.:	OEIS-PG&E-22-004
Date Sent:	March 17, 2022	Requesting Party:	Office of Energy Infrastructure Safety
PG&E Witness:		Requester:	Kevin Miller

SUBJECT: TABLE 7.1

QUESTION 05

Regarding Table 7.1:

- a. Provide the number of events broken down by equipment type that fall in the “Other” category in Rows 20, 39, 65, and 91.
- b. Why is PG&E expecting an increase in wire-down events for the following from 2022 to 2023:
 - i. Vegetation contacts; and
 - ii. Connectors.
- c. How is PG&E planning on addressing the wildfire risk presented by the following equipment failures/event causes at the distribution level, which showed increase wire down and/or outage events in 2021? Describe any failure mode analyses evaluating the cause for the increases in 2021, and any associated changes in maintenance or inspections from lesson learned in 2021:
 - i. Transformers;
 - ii. Conductors;
 - iii. Fuses;
 - iv. Poles;
 - v. Crossarms;
 - vi. Connection devices;
 - vii. Other, including specific equipment types as delineated in part (a);
 - viii. Wire-to-wire contacts; and
 - ix. Vegetation contacts.

ANSWER 05

- a. PG&E has cause categories it uses for describing outage events and many align well with those designated in the requested WMP report format. However, many

categories are also different and require a translation to best fit the PG&E cause categories into the designated WMP report format.

The following table provides the number of events in 2021 broken out by equipment type in the "Other" category of Row 20 (also designated as metric 2.h. of Table 7.1). The data provided in this response is based on the current information in PG&E's outage data base, which may differ slightly from the data initially reported in the WMP Q4 report due to PG&E's post outage review process.

2021 Distribution Equipment Failure Wire Down Events - Details of "Other - Distribution": # 2.h.

Failed Equipment	Supplemental Cause			Total
	Overhead	Fire- pole	Electrical Overload	
Pole-Wood	164	46	0	210
Conductor- Overhead	0	7	4	11
Transformer (OH)	9	0	0	9
Other	5	0	0	5
Anchor or Guy	4	0	0	4
Switch (OH)	2	0	0	2
Woodpin	2	0	0	2
Transformer	1	0	0	1
Cutout- fuse holder	1	0	0	1
Pole - Tower- steel	1	0	0	1
Footings- Tower or Pole	1	0	0	1
Capacitor	1	0	0	1
Grand Total	191	53	4	248

The following table provides the number of events in 2021 broken out by equipment type in the "Other" category of Row 65 (also designated as metric 18.o. of Table 7.1).

2021 Distribution Equipment Failure Outage Events - Details of "Other - Distribution": # 18.o.

Failed Equipment	Supplemental Cause					Total
	Underground	Overhead	Electrical Overload	Fire- pole	Substation	
Conductor- Underground	651	0	2	4	0	657
Cutout- fuse holder	6	462	4	7	0	479
< Blank >	1	247	6	0	0	254
Elbow	218	0	2	0	0	220
Connector or Splice (UG)	202	1	3	0	0	206
Secondary	149	0	7	5	0	161
Other	42	106	4	2	3	157
Pothead(Riser Termination)	4	114	3	4	3	128
Service conductor	13	104	3	0	0	120
Conductor- Overhead	1	0	35	18	0	54
Woodpin	0	36	0	1	0	37
Customer Equipment	4	14	2	2	0	22
Circuit Breaker	0	0	7	0	6	13
Cable Termination(live front	12	0	0	0	0	12
Metering Equipment	2	8	0	0	1	11
PT/CCVT	1	8	1	0	0	10
Bus	5	4	0	0	0	9
Generator	1	0	0	0	2	3
Relay	0	1	0	0	2	3
SCADA	0	2	0	0	1	3
Street Light Equipment	0	3	0	0	0	3
Grand Total	1,312	1,110	79	43	18	2,562

Row 91

In the table below, we provide additional equipment type details for the 2021 events identified in Cause Category 26 and Sub-Cause Category 26.o:

YEAR	Cause Category	Cause Detail	Table 7.1 Cause Category	#	Table 7.1 Sub-Cause Category
2021	Equipment Failure	Equip Fail-other-station	26. Equipment / facility failure - Transmission	26.o.	Other - Transmission
2021	Equipment Failure	Equip Fail-other-station	26. Equipment / facility failure - Transmission	26.o.	Other - Transmission
2021	Equipment Failure	Equip Fail-other-station	26. Equipment / facility failure - Transmission	26.o.	Other - Transmission
2021	Equipment Failure	Equip Fail-other-station	26. Equipment / facility failure - Transmission	26.o.	Other - Transmission
2021	Equipment Failure	Equip Fail-other-station	26. Equipment / facility failure - Transmission	26.o.	Other - Transmission
2021	Equipment Failure	Equip Fail-other-station	26. Equipment / facility failure - Transmission	26.o.	Other - Transmission
2021	Equipment Failure	Equip Fail-reactive equipment	26. Equipment / facility failure - Transmission	26.o.	Other - Transmission
2021	Equipment Failure	Equip Fail-reactive equipment	26. Equipment / facility failure - Transmission	26.o.	Other - Transmission
2021	Equipment Failure	Equip Fail-relay	26. Equipment / facility failure - Transmission	26.o.	Other - Transmission
2021	Equipment Failure	Equip Fail-relay	26. Equipment / facility failure - Transmission	26.o.	Other - Transmission
2021	Equipment Failure	Equip Fail-relay	26. Equipment / facility failure - Transmission	26.o.	Other - Transmission
2021	Equipment Failure	Equip Fail-relay	26. Equipment / facility failure - Transmission	26.o.	Other - Transmission
2021	Equipment Failure	Equip Fail-relay	26. Equipment / facility failure - Transmission	26.o.	Other - Transmission
2021	Equipment Failure	Equip Fail-other-station	26. Equipment / facility failure - Transmission	26.o.	Other - Transmission
2021	Equipment Failure	Equip Fail-relay	26. Equipment / facility failure - Transmission	26.o.	Other - Transmission
2021	Equipment Failure	Equip Fail-other-station	26. Equipment / facility failure - Transmission	26.o.	Other - Transmission
2021	Equipment Failure	Equip Fail-relay	26. Equipment / facility failure - Transmission	26.o.	Other - Transmission
2021	Equipment Failure	Equip Fail-PT	26. Equipment / facility failure - Transmission	26.o.	Other - Transmission
2021	Equipment Failure	Equip Fail-PT	26. Equipment / facility failure - Transmission	26.o.	Other - Transmission
2021	Equipment Failure	Equip Fail-PT	26. Equipment / facility failure - Transmission	26.o.	Other - Transmission
2021	Equipment Failure	Equip Fail-PT	26. Equipment / facility failure - Transmission	26.o.	Other - Transmission
2021	Equipment Failure	Equip Fail-PT	26. Equipment / facility failure - Transmission	26.o.	Other - Transmission
2021	Equipment Failure	Equip Fail-reactive equipment	26. Equipment / facility failure - Transmission	26.o.	Other - Transmission
2021	Equipment Failure	Equip Fail-PT	26. Equipment / facility failure - Transmission	26.o.	Other - Transmission
2021	Equipment Failure	Equip Fail-PT	26. Equipment / facility failure - Transmission	26.o.	Other - Transmission

Row 39

Cause Category 10 and Sub-Cause Category 10.h. was used whenever we had a transmission line structure fail and cause a wire down event. PG&E considered using “10.c. Crossarm damage or failure – Transmission”, but this is more of a distribution structure failure rather than a transmission structure failure. Hence, the “10.h Other - transmission” category was chosen.

In the table below, we provide additional equipment type details for the 2021 events identified in Cause Category 10 and Sub-Cause Category 10.h:

YEAR	Cause Category	Cause Detail	Table 7.1 Cause Category	#	Table 7.1 Sub-Cause Category
2021	Equipment Failure	Equip Fail-structure-line	10. Equipment / facility failure - Transmission	10.h	Pole damage or failure - Transmission
2021	Equipment Failure	Equip Fail-structure-line	10. Equipment / facility failure - Transmission	10.h	Pole damage or failure - Transmission
2021	Equipment Failure	Equip Fail-structure-line	10. Equipment / facility failure - Transmission	10.h	Pole damage or failure - Transmission
2021	Equipment Failure	Equip Fail-structure-line	10. Equipment / facility failure - Transmission	10.h	Pole damage or failure - Transmission
2021	Equipment Failure	Equip Fail-structure-line	10. Equipment / facility failure - Transmission	10.h	Pole damage or failure - Transmission

- b. PG&E used the following methodology for projecting wire down events for each row (including those for vegetation contact and connectors):

2022 projections for Quarter X: are the average of 2020 and 2021 actuals for Quarter X

2023 projections for Quarter X: are the average of 2021 actuals and 2022 projections for Quarter X

The numbers in the projection columns reflect the methodology above. In this case, the year 2020 drops out of the 2023 forecast and is replaced by 2022 projections, which have a higher number of wires down incidents than 2020 actuals. As a result, our 2023 projections are greater than the 2022 projections.

- c. PG&E's System Hardening Program – Distribution, Section 7.3.3.17.1, focuses on mitigation of potential catastrophic wildfire risk caused by distribution overhead equipment failures, including vegetation contact incidents, in and near Tier 2 and 3 HFTDs in PG&E's service territory. This program targets the highest wildfire risk miles and applies various mitigation activities, including: (1) line removal, (2) conversion of distribution lines from overhead to underground, (3) application of Remote Grid alternatives, (4) mitigation of exposure through relocation of overhead facilities, and (5) in-place overhead system hardening. For 2022, the highest wildfire risk miles are separated into four categories:
 - 1) Top 20% of circuit segments as defined by PG&E's 2021 Wildfire Distribution Risk Model (WDRM) v2 for System Hardening,
 - 2) Fire and Major Emergency Rebuild within HFTD,
 - 3) PSPS mitigation projects, and
 - 4) Locations identified by PG&E's Public Safety Specialist (PSS) team as presenting elevated wildfire risk.

In addition to PG&E's System Hardening Program – Distribution, which addresses the listed equipment failures / event causes referenced in this question, PG&E has also developed other targeted programs to address these issues. The following summarizes these targeted programs and any associated failure analyses that were performed:

- i. Transformers: Please refer to Section 7.3.3.14, Transformers Maintenance and Replacement. PG&E has modified our preventative maintenance strategy by deploying oil temperature monitoring of transformers to allow us to detect anomalies in equipment heating that are potential signatures of equipment failure, as well as incorporating smart meter data and machine learnings to predict transformer failures before they occur. Both of these preventative maintenance strategies allow us to identify and address potential failures before they occur. Furthermore, PG&E has also expanded our maintenance and inspection strategy to perform infrared inspections of distribution electric lines and equipment (Section 7.3.4.4) to help detect abnormal "hot spots" by using infrared imaging and temperature measuring systems. Excessive heating gradients on transformers is a potential sign of potential equipment failure.

PG&E's failure analyses review of CPUC reportable ignitions from 2017-2021 has identified that transformer equipment failures were the third highest priority driver for equipment caused CPUC reportable ignitions.

- ii. Conductors: Aside from PG&E's System Hardening Program – Distribution,

Section 7.3.3.17.1, addressing conductor failures, PG&E has also expanded our maintenance and inspection strategy to perform infrared inspections of distribution electric lines and equipment (Section 7.3.4.4) to help detect abnormal “hot spots” by using infrared imaging and temperature measuring systems. Excessive heating gradients on line conductors are a potential sign of equipment failure.

PG&E’s failure analyses review of CPUC reportable ignitions from 2017-2021 has identified that conductor equipment failures was the top priority driver for equipment caused CPUC reportable ignitions.

- iii. Fuses: Please refer to Section 7.3.3.7, Expulsion Fuse Replacement. PG&E has also expanded our maintenance and inspection strategy to perform infrared inspections of distribution electric lines and equipment (Section 7.3.4.4) to help detect abnormal “hot spots” by using infrared imaging and temperature measuring systems. Excessive heating gradients on fuses are a potential sign of equipment failure.

PG&E’s review of CPUC reportable ignitions from 2017-2021 has identified that fuses were the sixth highest priority driver for equipment caused CPUC reportable ignitions.

- iv. Poles: Please refer to Section 7.3.3.6, Distribution Pole Replacement and Reinforcement, Including with Composite Poles. PG&E has modified our inspection and maintenance strategy to perform intrusive pole inspections for distribution poles (Section 7.3.4.6.1) to help detect potential rot that could lead to pole failures. We also leverage pole loading analysis to determine if distribution poles have an adequate safety factor and warrant replacement (Section 7.3.4.13).

PG&E’s review of CPUC reportable ignitions from 2017-2021 has identified that poles were the fourth highest priority driver for equipment caused CPUC reportable ignitions.

- v. Crossarms: Please refer to Section 7.3.3.5, Crossarm Maintenance, Repair, and Replacement and Section 7.3.3.6, Distribution Pole Replacement and Reinforcement, Including with Composite Poles. PG&E’s review of CPUC reportable ignitions from 2017-2021 has identified that crossarms were the ninth highest priority driver for equipment caused CPUC reportable ignitions.
- vi. Connection Devices: PG&E interprets “Connection Devices” to be splices, clamps or connectors. Aside from PG&E’s System Hardening Program – Distribution Section 7.3.3.17.1, PG&E has also expanded our maintenance and inspection strategy to perform infrared inspections of distribution electric lines and equipment (Section 7.3.4.4) to help detect abnormal “hot spots” by using infrared imaging and temperature measuring systems. Excessive heating gradients on splices, clamps or connectors are a potential sign of equipment failure.

PG&E’s failure analyses review of CPUC reportable ignitions from 2017-2021

has identified that splices, clamps or connector equipment failures were the second highest priority driver for equipment caused CPUC reportable ignitions.

- vii. Other, including specific equipment types as delineated in part (a): Aside from PG&E's System Hardening Program – Distribution Section 7.3.3.17.1, PG&E does not have another targeted program to address the equipment types considered as "Other", including specific equipment types delineated in part a of this question.
- viii. Wire-to-wire contacts: Aside from PG&E's System Hardening Program – Distribution Section 7.3.3.17.1, PG&E does not have another targeted program to address wire to wire contacts in the HFTD.
- ix. Vegetation Contacts: Please refer to Section 7.3.5.2, Detailed Inspections and Management Practices for Vegetation Clearances Around Distribution Electrical Lines and Equipment. PG&E's failure analyses review of CPUC reportable ignitions from 2017-2021 has identified vegetation contact as the top priority driver for CPUC reportable ignitions.