Pacific Gas and Electric Company

2022 Wildfire Mitigation Plan

Response to Revision Notice

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June 27, 2022

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Critical Issue RN-PG&E-22-01

Critical Issue Title: PG&E has not adequately documented the causes of, or direct lessons learned from, PG&E-ignited catastrophic wildfires.

Required Remedies: *For each PG&E-ignited catastrophic wildfire (greater than 500 acres) since 2017[1], PG&E must:*

a. *List the cause(s) of each catastrophic wildfire and any associated lessons learned, and*

b. *Detail the specific measures PG&E is taking to i) directly mitigate the causes of past PG&E-ignited catastrophic wildfires, and ii) integrate lessons learned from past PG&E-ignited wildfires into its wildfire mitigation strategy*

Response to Critical Issue RN-PG&E-22-01

In response to this Critical Issue, we are providing a description of each fire that: (1) occurred since 2017; (2) was greater than 500 acres; and (3) was determined by the California Department of Forestry and Fire Protection (CAL FIRE), a local fire suppression agency, the Safety and Enforcement Division, or the United States Forest Service (USFS) to have been caused by Pacific Gas and Electric Company (PG&E) or its assets.[2] We appreciate the feedback from the Office of Energy Infrastructure Safety (Energy Safety) regarding the need to provide lessons learned that are specifically related to the fire at issue. In this response and going forward in future Wildfire Mitigation Plans (WMP), we will identify lessons learned and specific mitigations related to the causes of specific fires.

For each fire below, in addition to the date of ignition and cause, we are describing the lessons learned, measures to mitigate the cause, and how the lessons learned have been integrated into our wildfire strategy. We note that:

- The cause indicated is based on available PG&E information and evaluations and/or reports or information provided by external parties. There may have been additional causes and/or contributing factors that were not evident based on the information available and/or identified in the reports received. In addition, for some of the fires below, PG&E was not able to confirm, based on available evidence, an external party's determination regarding the cause of the fire.

[1] Where CAL FIRE, USFS, or local fire suppression agencies determined PG&E or its assets caused the fire or the CPUC's Safety and Enforcement Division found PG&E in violation. Nothing in this response should be taken as an admission of causation, which is not essential to a lessons learned approach.

[2] We are not including the Wolf Fire which occurred on January 19, 2021. The Wolf Fire could have been contained at approximately 100 acres but was allowed to burn by fire authorities as part of a 'firing out' operation to remove fuels, ultimately reaching 685 acres.

- For the integration of lessons learned into our wildfire strategy, we identify programs in our 2022 WMP that integrate lessons learned. For brevity, we are not providing a lengthy description of each program identified but are instead providing a reference to where in the 2022 WMP a description of the program is provided.

- We are continuing evolve and strengthen our mitigations based on ongoing learnings. For example, although not implemented in response to the 2017 fires, the EPSS implemented in 2020 has substantially reduced ignitions.

Finally, PG&E is in the process of significantly enhancing our ignition investigation process. The enhanced ignition investigation process will impact lessons learned from ignitions and wildfires going forward. The Enhanced Ignition Analysis program is described in more detail in our response to Critical Issue RN-PG&E-22-06.

Fire Name: Railroad Fire	
Date of Ignition	August 29, 2017
Cause Based on Available Information	PG&E tree contractor inadvertently dropped dead Cedar tree that the contractor was working on into a PG&E distribution line.
Lessons Learned	PG&E did not perform a specific lessons learned analysis for the Railroad Fire. However, we have significantly improved PG&E employee and contractor training with regard to vegetation management.
Measures to mitigate cause	Not applicable.
Integration of Lessons Learned into Wildfire Strategy	While we did not implement specific mitigations related to the Railroad Fire, we have significantly improved the training of and minimum qualifications for vegetation management employees and contractors. These efforts include working with seven community colleges to develop and implement an extensive five-week training program for tree crews and workers. (2022 WMP, Section 7.3.5.14). PG&E has also implemented training programs for vegetation management employees and contractors who are responsible for vegetation management projects. (2022 WMP, Section 5.4.2)

Fire Name: October 2017 Wildfires	
Date of Ignition	Various (see details below for each fire)
Cause Based on Available Information	Vegetation contact and equipment failures in high winds (see details below for each fire)

Fire Name: October 2017 Wildfires	
Lessons Learned	The October 2017 wildfires occurred during high wind events that resulted in: (1) vegetation contact with electrical facilities; and/or (2) equipment failure. Our lessons learned focused on vegetation management, equipment failure, and high wind weather events.[3]
Measures to mitigate cause	<u>Vegetation Contact</u>: • Initiated Enhanced Vegetation Management (EVM) program in High Fire Threat District (HFTD) areas to go above and beyond regulatory requirements and address the highest risk Circuit Protection Zones (CPZs). • Increased vegetation inspection capabilities by employing enhanced technologies such as Light Detection and Ranging (LiDAR). By 2019, we had captured LiDAR and imagery data on almost all Tier 2 and Tier 3 HFTD distribution lines. • Implemented a digital record system for EVM data to better track vegetation and identify potential risks. • Disabled automatic reclosers in Tier 2 and Tier 3 HFTD areas to prevent potential ignitions from vegetation contact in high wind and weather events during fire season. • Implemented system hardening program to mitigate risks associated with vegetation contact. <u>Equipment Failures</u>: • Developed modeling and analytics to evaluate conductor to conductor contact (Cascade Fire). • Evaluated the types of materials used for distribution poles for strength and resiliency to mitigate pole failures (Sulphur Fire). <u>High Winds and Weather Leading to Potential Ignitions</u>: • Developed and began implementation of Public Safety Power Shutoff (PSPS) program in 2018 for distribution lines that traverse Tier 3 areas to mitigate potential ignitions from vegetation contact or equipment failure that could occur during high wind and other weather events. In 2019, PSPS was expanded to all distribution and transmission lines that traverse Tier 2 and Tier 3 HFTD areas. • Installed weather stations to be more aware of local weather and wind conditions.
Integration of Lessons Learned into Wildfire Strategy	<u>Vegetation Contact</u>: • EVM has been integrated into our vegetation management program and for the 2022 WMP is being performed on 1,800 of the highest risk ranked circuit miles. (2022 WMP, Section 7.5.3.2)

[3] PG&E notes that the California Public Utilities Commission (CPUC) is currently conducting a Root Cause Evaluation (RCE) of the October 2017 Wildfires. The results of the RCE may result in additional lessons learned.

<table>
<tr><th colspan="4">Fire Name: October 2017 Wildfires</th></tr>
<tr><td></td><td colspan="3">

We have incorporated LiDAR vegetation inspections for both distribution and transmission facilities and have plans to continue to capture and update our LiDAR datasets. (2022 WMP, Sections 7.3.5.7 and 7.3.5.8)
We have continued to enhance and are developing our One Vegetation Management platform which will allow for digital work packages, tracking, and records for vegetation management. (2022 WMP, p. 773)
We have SCADA-enabled many reclosers and for reclosers that are automatic, we are continuing to disable them in HFTDs during fire season. (2022 WMP, Section 7.3.6.1)
We have significantly expanded our system hardening program, including undergrounding, which is intended to mitigate the potential for vegetation caused ignitions. (2022 WMP, Section 7.3.3.17)

<u>Equipment Failure</u>:

We are focusing our pole loading and replacement program on Tier 2 and Tier 3 HFTD areas to address potential pole failures that may lead to an ignition, such as the pole failure related to the Sulphur Fire. In 2021, we performed a pole loading analysis on 61,000 of the highest risk poles. (2022 WMP, Section 7.3.3.13). In addition, as a part of our system hardening program, we are evaluating and where needed replacing poles with stronger composite poles that reduce the risk of failure during wildfires. (2022 WMP, p. 539)
Our PSPS program addresses weather conditions including high wind events. Because conductor to conductor contact typically occurs during high wind events, the PSPS program can mitigate the wire-to-wire contact that occurred in the Cascade Fire. (2022 WMP, Section 8.)

<u>High Winds and Weather</u>:

We have continued to evaluate and refine our PSPS program which is intended to prevent ignitions during high wind and other weather conditions, such as Red Flag Warnings. (2022 WMP, Section 8.2.3)
We are continuing to install weather stations and high definition cameras for situational awareness of high winds and weather events. (2022 WMP, Sections 7.3.2.1.3 and 7.3.2.1.4)

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<tr><th>October 2017 Wildfire Details</th><th>Fire Name</th><th>Ignition Date</th><th>Cause</th></tr>
<tr><td></td><td>CHEROKEE</td><td>10/8/2017</td><td>Vegetation Contact</td></tr>
<tr><td></td><td>ADOBE</td><td>10/8/2017</td><td>Vegetation Contact</td></tr>
<tr><td></td><td>NUNS</td><td>10/8/2017</td><td>Vegetation Contact</td></tr>
<tr><td></td><td>SULPHUR</td><td>10/8/2017</td><td>Pole Failure</td></tr>
</table>

Fire Name: October 2017 Wildfires			
	LA PORTE	10/8/2017	Conductor Failure
	PRESSLEY	10/8/2017	Vegetation Contact
	NORRBOM	10/8/2017	Vegetation Contact
	REDWOOD VALLEY	10/8/2017	Vegetation Contact
	CASCADE	10/8/2017	Wire-Wire Contact in High Wind
	PARTRICK	10/8/2017	Vegetation Contact
	ATLAS	10/8/2017	Vegetation Contact
	LOBO	10/9/2017	Vegetation Contact
	PYTHIAN/OAKMONT	10/17/2017	Vegetation Contact
	POCKET	10/21/2017	Vegetation Contact

Fire Name: Airline Fire	
Date of Ignition	June 4, 2018
Cause Based on Available Information	The Eastern and Airline Fires started at two different points and had two different apparent causes but are related: (1) the Eastern Fire resulted from a healthy tree branch that leaned into a distribution pole in high winds breaking one of three conductors (CAL FIRE determined that tree-trim activities were sufficient); and (2) the Airline Fire was a result of the Eastern Fire vegetation contact which caused a fault current resulting in a conductor failure on a long span and a wire down. The long span did not have vibration dampers which may have weakened the conductor that failed.
Lessons Learned	The tree which caused the initial ignition (Eastern Fire) was healthy and CAL FIRE determined that tree-trim activities were sufficient. However, a contributing cause leading to the second ignition (Airline Fire) may have been missing vibration dampers which were not identified in previous inspections and maintenance.
Measures to mitigate cause	We are currently in the process of reviewing our existing maintenance tags for tags that identify missing vibration dampers and are also reviewing our guidance to inspectors so that they properly identify missing vibration dampers during inspections.

Fire Name: Airline Fire	
Integration of Lessons Learned into Wildfire Strategy	As described above, we are currently reviewing existing maintenance tags for missing vibration dampers and reviewing guidance that we give to inspectors with regard to vibration dampers. More generally, we have improved the scope and quality of our inspection processes to identify and create maintenance tags for equipment issues. Our detailed inspection processes are described generally in Sections 7.3.4.1 and 7.3.4.2 of the 2022 WMP. Improvements that we are making to the quality of our inspections are described in the response to Critical Issue RN-PG&E-22-08.

Fire Name: Camp Fire	
Date of Ignition	November 8, 2018
Cause Based on Available Information	Connection Device (C-Hook) Failure on overhead transmission line. Red Flag Warning (RFW) the day of ignition.
Lessons Learned	The Camp Fire resulted from a connection device (C-Hook) failure that caused an ignition. The lessons learned from the Camp Fire include: (1) the need for rigorous equipment inspections and maintenance; and (2) using risk modeling to prioritize inspection and maintenance work so that maintenance is performed in the highest risk area for wildfires. In the enhanced inspection process, wear on C-Hooks and other equipment was specifically addressed.
Measures to mitigate cause	<u>Enhanced Asset Inspections</u>: • Initiated Wildfire Safety Inspection Program (WSIP) in 2019 to perform enhanced inspections of all PG&E overhead transmission and distribution equipment and facilities in HFTD areas. This program, which became the foundation of our current enhanced inspection program, was informed by a Failure Modes and Effects Analysis (FMEA) that PG&E conducted after the Camp Fire. The FMEA identified multiple potential points of failure on transmission assets that could cause ignitions, including wear on C-hooks and other insulator attachment hardware, and the failure points capable of visual observation were incorporated into WSIP inspection forms. A similar approach was utilized for WSIP inspections of distribution facilities.

Fire Name: Camp Fire	
	• PG&E's enhanced WSIP inspections differed from our prior routine inspections in various ways, including, for transmission towers in elevated and extreme high fire-threat areas, the use of climbing and drones equipped with high-resolution cameras; inspection forms that specifically required inspectors to check for certain potential failure modes (including worn cold-end hardware) and document the condition of various components (including cold-end hardware), regardless of whether they required repair; review of drone photographs by members of the Drone Inspection Review Team; and review and prioritization of inspection findings by Centralized Inspection Review Team (CIRT), composed of qualified personnel with collective experience in engineering, inspections and maintenance. <u>Risk Modeling and Prioritized Inspections and Maintenance</u>: • Develop risk models that specifically evaluate the potential for asset or equipment failure, including failure associated with asset age, environmental factors such as wind speed and direction, corrosion and other relevant risk drivers where such a failure may result in a wildfire ignition. • Use risk models to inform prioritization of highest risk maintenance tag work <u>Expanded PSPS Program</u>: • In 2019, PSPS was expanded to all distribution and transmission lines that traverse Tier 2 and Tier 3 HFTD areas.
Integration of Lessons Learned into Wildfire Strategy	<u>Enhanced Asset Inspections</u>: • We have implemented detailed asset inspections which are now a part of wildfire strategy for both distribution and transmission facilities in HFTD and High Fire Risk Areas (HFRA). (2022 WMP, Sections 7.3.4.1 and 7.3.4.2) <u>Risk Modeling and Prioritized Inspections and Maintenance</u>: • We are developing sub-models for our risk modeling that specifically evaluate the potential for equipment failure. (2022 WMP, Sections 4.5.1 and 7.3.1.3, as well as Initiative Targets A.01 and A.02) • We have also used risk modeling to prioritize inspections for transmission facilities. For example, the annualized Operability Assessment Model which was used in conjunction with the Wildfire Consequence Model to develop transmission wildfire risk scores. (2022 WMP, Section 7.3.4.2) • In 2021, PG&E began to utilize risk modeling to proactively reduce risk from the current backlog of maintenance tags by prioritizing the highest risk tags. (2022 WMP, pp. 316-317)

Fire Name: Lonoak Fire	
Date of Ignition	June 25, 2019
Cause Based on Available Information	Bird strike mid-span resulted in fault stress on wire and caused #2 gauge Aluminum Conductor Steel Reinforced (ACSR) wire to fail. In addition, the Alcoa Stockbridge vibration dampers may have contributed to the failure of the conductor wire.
Lessons Learned	Periodic inspection and maintenance of the equipment was not adequate for the wires or the vibration damper. In addition, vibration damper may have accelerated crack propagation in wires.
Measures to mitigate cause	Corrective Action Program (CAP) event assigned to determine ongoing risk from vibration dampers in the field and deployed on #2 ACSR and #4 ACSR conductor wires. Specifically, the team evaluated extent of risk between 2 ACSR and Alcoa Stockbridge dampers. PG&E Procedure TD-2305-JA02 (job aid) was updated with photographs from this incident to demonstrate what to look for in inspections with regard to broken wire stands at the vibration damper.
Integration of Lessons Learned into Wildfire Strategy	We have updated our job with regard to inspections for broken wire near vibration dampers. More generally, we have implemented detail inspections and are working to improve inspection quality. Our detailed inspection processes are described generally in Sections 7.3.4.1 and 7.3.4.2 of the 2022 WMP. Improvements that we are making to the quality of our inspections are described in the response to Critical Issue RN-PG&E-22-08.

Fire Name: Kincade Fire	
Date of Ignition	October 23, 2019
Cause Based on Available Information	One of the open jumpers on a transmission tower located along the Sonoma and Lake County border broke due to wear induced by wind and caused an ignition near the base of the tower.
Lessons Learned	The Kincade Fire resulted from an electrical line that was not being used at the time but that was still energized and the jumpers were electrically connected. Lessons learned involved: (1) evaluating whether idle facilities should remain energized and/or be removed; and (2) equipment failure resulting from weather conditions.
Measures to mitigate cause	<u>Removal of Idle Facilities and Jumpers</u>: • Immediately after the Kincade Fire, PG&E reviewed all transmission lines to determine if other energized spans not serving customer load remained. Based on the review, one line in an HFTD area was identified and de-energized.

Fire Name: Kincade Fire	
	• Revised guidance issued for employees and contractors regarding idle facilities and open jumpers and issued guidance on open jumpers to be cut as short as practical, typically 2-3 feet in length. • Surveyed transmission system to identify and remediate open jumpers not in compliance with new guidance. • Revised inspection forms so that inspectors are required to report facilities that are not serving customer load. • Removed remaining idle facilities in the area where the Kincade Fire was initiated. • Implemented plan to remove conductor and structures (where applicable) associated with approximately 70 permanently abandoned transmission lines or portions of transmission lines. <u>Risk Modeling</u>: • Developed risk modeling intended to focus on the probability of asset failure to prioritize asset management work. <u>Enhanced Asset Inspections and Maintenance</u>: • Implemented enhanced inspections and risk prioritized maintenance programs to address items identified during inspection.
Integration of Lessons Learned into Wildfire Strategy	<u>Idle Facilities</u>: • We have included the removal of idle distribution and transmission facilities as a part of our overall system hardening program. (2022 WMP, Sections 7.3.3.17.1 and 7.3.3.17.2) <u>Risk Modeling:</u> • We have developed the Wildfire Transmission Risk Model (WTRM) to assess risk based on the probability of equipment or an asset failure. (2022 WMP, Sections 4.5.1 and 7.3.1.3, as well as Initiative Target A.02). <u>Enhanced Asset Inspections and Maintenance</u>: • We have been implementing enhanced inspections in HFTD and HFRA areas and prioritizing maintenance. These programs are described in more detail above in the discussion of the Camp Fire.

Fire Name: Grizzly Fire	
Date of Ignition	October 27, 2019
Cause Based on Available Information	Grass fire occurred in a wildlife area utilized for bird and elk hunting. PG&E did not evaluate or collect physical evidence at the time because none of the authorities or media reports suggested that PG&E's facilities were implicated. The fire could have resulted from overhead electrical equipment, but we are unable to determine the precipitating event(s) which may have caused an equipment failure. There was a RFW the day of ignition.

Fire Name: Grizzly Fire	
Lessons Learned	Although PG&E was unable to determine the apparent and/or contributing causes, three mitigation measures were implemented.
Measures to mitigate cause	Special Patrol of Circuit: Following investigation of the incident, and out of an abundance of caution, an additional patrol was initiated downstream from a line recloser source-side of the fire's suspected area of origin to: • Verify raptor construction. • Identify any spans where the conductor may be too close together, where spreader brackets could be installed, if needed. • Identification of any poles that were leaning and causing too much slack on the conductors. • Identification of splice counts on each span (pole to pole). Use of Wooden Pole Elk Guards: • Elk guards utilized to add additional protection to wooden poles near the suspected area of origin. Evaluation of Line Spreader Devices: • Assessment to determine if the use of line spreader devices or other protective devices could be effective in reducing the likelihood of a potential line-to-line fault at the Incident Location (Tier 1 Non-HFTD).
Integration of Lessons Learned into Wildfire Strategy	Because the cause of the fire was not definitively determined, we have not been able to include specific lessons learned into our wildfire strategy, but we performed mitigations related to the specific incident location. However, our enhanced inspection program, described above in the discussion of the Camp Fire, identifies asset conditions that may result in ignitions and prioritizes high risk maintenance work to mitigate the potential for ignitions.

Fire Name: Drum/Lompoc Fire	
Date of Ignition	June 14, 2020
Cause Based on Available Information	Electrical conductor between two poles failed midspan and contacted the ground igniting vegetation. The specific cause of the failure could not be determined.
Lessons Learned	We were not able to determine the specific cause of the conductor failure. There was no vegetation in the area and although there is bird activity, no bird carcass was found afterwards. We are improving our ignition investigation capability to be able to do more extensive analyses of these types of ignitions in the future. In addition, to the extent the fire was the result of equipment failure, our enhanced inspection program is intended to review all of our equipment and identify equipment that may fail and cause a wildfire ignition.

Fire Name: Drum/Lompoc Fire	
Measures to mitigate cause	*See* Camp Wildfire (describing enhanced inspection measures).
Integration of Lessons Learned into Wildfire Strategy	*See* Camp Wildfire (describing enhanced inspection measures). In early 2021, PG&E established the Enhanced Ignition Analysis (EIA) program, uniting experts in different departments, including equipment failure experts in Applied Technology Services (ATS) and Asset Failure Analysis (newly established to support this process), to better understand the causes of PG&E facility ignitions and recommend targeted corrective actions to reduce the risk of wildfires. In regard to ignitions where equipment failure is the suspected cause, the EIA team will coordinate the collection of failed assets for testing and analysis then analyze remaining risk (Extent of Condition) to inform wildfire mitigation strategies.

Fire Name: Zogg Fire	
Date of Ignition	September 27, 2020
Cause Based on Available Information	Vegetation Contact. RFW the day of ignition.
Lessons Learned	Our analysis of the Zogg Fire led us to further evaluate the propensity for tree-related outages and overstrike tree potential, specifically during certain weather conditions such as RFW days, and to pilot programs to perform more detailed inspections of potential strike trees on routine vegetation management patrols.
Measures to mitigate cause	<u>Vegetation Contact</u>: • See October 2017 Fires for discussion of mitigations implemented regarding vegetation contact. <u>Public Safety Power Shutoff (PSPS)</u>: • We modified our PSPS Protocols to include locations with tree over-strike potential in the 70th percentile or above. This was described in more detail in our 2021 WMP. (2021 WMP, p. 980)
Integration of Lessons Learned into Wildfire Strategy	<u>Vegetation Contact</u>: • EVM has been integrated into our vegetation management program and for the 2022 WMP is being performed on 1,800 of the highest risk ranked circuit miles. (2022 WMP, Section 7.5.3.2) • We are continuing a pilot program in 2022 to perform a visual inspection of all sides of a potential strike tree on routine vegetation management patrols in HFTD areas. • We have incorporated LiDAR vegetation inspections for both distribution and transmission facilities and have plans to continue to capture and update our LiDAR datasets. (2022 WMP, Sections 7.3.5.7 and 7.3.5.8)

Fire Name: Zogg Fire	
	• We have SCADA-enabled many reclosers and for reclosers that are automatic, we are continuing to disable them in HFTD Tier 2 and 3 areas during fire season. (2022 WMP, Section 7.3.6.1) • We have significantly expanded our system hardening program, including undergrounding, which is intended to mitigate the potential for vegetation caused ignitions. (2022 WMP, Section 7.3.3.17) <u>PSPS</u>: • We have continued to evaluate and evolve our PSPS protocols. We have incorporated tree-overstrike potential as a key attribute in our PSPS models that are based on artificial intelligence and machine learning. (2022 WMP, Section 8.2.3.2) • We have incorporated high-risk vegetation and asset tags into our PSPS protocols so that we can inform the scope of PSPS events, appropriately, to address this potential risk. (2022 WMP, Section 8.2.3.2)

Fire Name: Dixie Fire	
Date of Ignition	July 13, 2021
Cause Based on Available Information	Ignited when a tree fell onto an overhead distribution line and two of three conductors opened but the third conductor remained energized because the fuse remained closed.
Lessons Learned	Even on non-RFW days and/or days with no weather or wind events, an ignition can occur when vegetation or other objects contact an energized powerline.
Measures to mitigate cause	<u>Enhanced Powerline Safety Settings (EPSS)</u>: • The EPSS program has been implemented to reduce the potential for vegetation contact resulting in an ignition on non-RFW and/or high wind days. PSPS is weather dependent. However, EPSS will be enabled on all HFTD and HFRA distribution circuits in our service territory based on Fire Potential Index (FPI) conditions and criteria approved by our Wildfire Risk Governance Steering Committee. <u>Outage Response Times</u>: • We have revised our response time standard to respond to outages in HFTD areas, where we can safely do so, within 60 minutes as compared to the prior standard which required a response within 24 hours to a low level outage such as the one experienced on the circuit associated with the Dixie Fire.
Integration of Lessons Learned into Wildfire Strategy	<u>EPSS</u>: • EPSS has been integrated into our wildfire strategy in 2021 (pilot on approx. 170 HFTD circuits) and 2022 (all HFTD/HFRA circuits). (2022 WMP, Section 7.3.6.8)

Fire Name: Dixie Fire	
	Outage Response Times: • We have revised our response time to outages in HFTD areas to within 60 minutes. (2022 WMP, p. 774)

Critical Issue RN-PG&E-22-06

Critical Issue Title: PG&E does not sufficiently explain its increase in distribution-level ignitions from equipment failure, nor provide a remediation plan

Remedy # 1:

1. *PG&E must provide a plan to address increases in ignitions from equipment failures categorized by equipment type, which must include the following:*

    a. *Conductors*

    b. *Switches*

    c. *Crossarms*

    d. *Reclosers*

    e. *Connection devices*

Response to Critical Issue RN-PG&E-22-06 Remedy # 1

In response to Remedy #1, we are first providing some background information regarding equipment-related ignition trends and then describe our plan to address equipment-related ignitions.

a. Background Data Regarding Equipment Failure Related Ignition Trends

For clarification, the Revision Notice reference to increases in equipment-related ignitions from 2020 to 2021 refers to system-wide ignitions.[4] However, in 2021, PG&E observed a 12.9% decrease in California Public Utilities Commission (CPUC)-reportable ignitions in HFTD areas where the suspected cause was PG&E equipment failure. In 2021, there were 27 equipment failure related ignitions, as compared to 31 equipment failure related ignitions in 2020. For all suspected causes of reportable ignitions in HFTD areas, PG&E observed a 14.2% decrease in 2021 (133 ignitions) compared to 2020 (155 ignitions).

Thus, while system-wide ignitions from equipment failure did increase from 2020 to 2021, the ignitions most likely to cause harm to persons, property, or natural resources from wildfires actually decreased from 2020 to 2021. Moreover, as we explain below in Remedy #3 and Table RN-PG&E-22-06-04, we are forecasting a system-wide reduction in equipment failure related ignitions in 2022 as a result of our wildfire mitigation measures.

[4] Revision Notice, p. 14.

Table RN-PG&E-22-06-01 provides information regarding CPUC-reportable equipment failure related ignitions in HFTD areas for 2020, 2021, and from January 1 through May 31, 2022, as well as the three year average from 2019-2021, for the five types of equipment identified in Remedy #1.

Table RN-PG&E-22-06-01: CPUC-Reportable Ignitions in HFTD Areas by Component Type

HFTD Ignition Counts by Component Type				
	3-previous year averages (2019 – 2021)	2020	2021	1/1/2022 – 5/31/2022
Conductor	11	7	9	1
Switch	1	1	1	0
Crossarm	1	0	2	0
Recloser	0	1	0	0
Connection Device	3	8	10	1

Equipment failure ignition rates by equipment type are highly variable and 2021's HFTD ignition results for conductor, switch, crossarm, and recloser are in the general range of prior years. The apparent increase in connection device failure in 2021, compared to prior years, may be a result of PG&E's newly established forensic and granular cause evaluation approach to equipment failure ignitions and our ability to better identify the specific equipment failure mode. As an example, a failure on a transformer connection device may have been identified as a transformer failure prior to our new evaluation approach being implemented. The new evaluation approach is described in more detail below in response to Remedy #2.

b. Plan to Mitigate Equipment-Related Ignitions

As described in our 2022 Wildfire Mitigation Plan (WMP), PG&E is executing comprehensive programs and plans that focus on reducing ignition events in locations that have high probability of ignition from equipment failure and high wildfire consequence. Table RN-PG&E-22-06-02 below summarizes the programs and plans that we have implemented or are implementing to address ignition risk by equipment type.

Table RN-PG&E-22-06-02: Mitigation Programs for Equipment Failure by Equipment Type, etc.

#	Equipment Type	WMP Reference	Mitigation
	All Equipment	7.3.3.16	• EPSS: EPSS was implemented in 2021 on approximately 170 circuits, comprising approximately 11,500 miles of distribution circuits (45% of the circuit mileage in HFTD), which resulted in an 80% overall decrease in ignitions on EPSS enabled circuits compared to

#	Equipment Type	WMP Reference	Mitigation
			the past three-year average. In the event of equipment failure, EPSS can de-energize electrical facilities so that an ignition does not result from the equipment failure. Based on learnings from our initial implementation of EPSS in 2021, we have expanded our implementation to all HFTD, HFRA and associated adjacent areas while simultaneously improving the program settings on certain circuits with high outage frequency. EPPS will reduce equipment failure related ignitions by reducing the fault energy from electrical facilities when potential equipment failure occurs. • Undergrounding: Undergrounding of electric distribution lines in the highest fire-risk areas is the best long-term solution for keeping customers and communities safe and eliminating the potential for ignition related to overhead electrical facilities. Therefore, in order to make our system safer, we have committed to underground 10,000 distribution circuit miles in and near high wildfire risk areas and have begun implementing our commitment. Undergrounding reduces equipment failure related ignitions by: (1) replacing existing facilities that may be older and thus more likely to experience equipment failure; and (2) placing new facilities underground.
1	Primary Overhead (OH) Conductor and Connection Devices	7.3.3.3, 7.3.2.2.3, 7.3.3.9.2, 7.3.3.17.4, 7.3.3.4	• Covered conductor installation: Installation of covered conductor reduces the occurrence of equipment-caused ignitions due to phase-to-phase contacts. As with all our system hardening initiatives, we have focused our covered conductor work in the circuits that exhibit the most risk.[5] In 2022, PG&E will complete at least 470 circuit miles of system hardening initiatives, which included undergrounding, on distribution lines in HFTD or buffer zone areas.[6] For more specifics on our work installing covered conductor, please see Section 7.3.3.17.1 in our 2022 WMP. • Single Phase Recloser Automation Device Installation: These recloser devices replace

[5] We also consider prioritizing rebuilding areas after a fire or other major emergency, as well as areas that will help mitigate future PSPS events.

[6] Installation of covered conductor is included in this system hardening work, as is undergrounding and removal of overhead lines.

#	Equipment Type	WMP Reference	Mitigation
			fuses and act as a single phase recloser with the capability to trip all phases, hence reducing the ignition risk associated with a wire down event where the downed wire could remain energized due to back-feed condition from another phase of the circuit. In 2022, we will install at least 80 single phase recloser sets in HFTD or HFRA locations, an increase from the 71 we installed in 2021. • Infrared Inspections of Distribution Electric Lines and Equipment: Infrared provides the opportunity to identify abnormal conditions "hot spots" by utilizing infrared imaging and temperature measuring. Based on historical infrared results, we expect infrared inspections to detect abnormal heat associated with following assets: conductors, connection devices (jumpers, splices, connectors), transformers, fuses, cutouts, arrester and switches. In 2022, we will perform infrared inspections on a minimum of 9,000 distribution circuit miles that are in HFTD areas or HFRA. • Rapid Earth Fault Current Limiter (REFCL) pilot: PG&E is testing the REFCL systems that are intended to address ignition risk by detecting line to ground faults and limiting the fault current to below ignition threshold. Therefore, it reduces the risk of ignition related to line contact to ground and can also detect high impedance ground fault which are difficult to detect with traditional overcurrent protection system. We have completed our REFCL pilot program and, in 2022, will continue to seek to improve and explore how this technology can best help to mitigate wildfires. • Distribution Fault Anticipation (DFA) and Early Fault Detection (EFD) installation: DFA and EFD technology, which measure different electric parameters over the distribution circuit, could detect conductor degradation issues like bird-caging and broken strands of conductor before they fail. These are issues that are extremely difficult to detect during ground visual inspection. In 2022, we will install EFD technology on two circuits, and DFA technology on approximately 40 circuits to complete our strategic assessment of this technology and its mitigation capabilities.
2	Switches	7.3.3.4	• This equipment is inspected as part of our Infrared Inspections of Distribution Electric Lines

#	Equipment Type	WMP Reference	Mitigation
			and Equipment, which are described above in Line 1 of this table.
3	Overhead Transformers	7.3.3.14	• General Order (GO) 165 Inspection Program: As part of the GO 165 overhead inspection program, all overhead transformers are comprehensively inspected for corrosion, leak/sweep, and other issues that could lead to conductor failure and ignition risk. Issues identified through inspections are prioritized and addressed based on wildfire risk. • Overloaded Transformer replacement program: Overloaded transfers are regularly identified and prioritized for replacement based on the probability of failure and consequence of ignition. In 2021, we replaced 81 overloaded transformers, and we will continue this work in 2022. *See* 2022 WMP, Section 7.3.3.14. • Smart Meter Based Data Analytics: PG&E is operationalizing a machine learning model to predict and address transformer failures before they occur. In this initiative, our Sensor IQ software works with our SmartMeters to capture and store high resolution, real-time voltage and outage data to enable predictive maintenance of transformers and other types of equipment. • Transformer Oil Temperature Monitoring: PG&E is deploying temperature monitoring devices on overhead transformers to test its ability to detect overloaded transformers before they fail and may result in ignitions. This emerging technology is part of our Electric Program Investment Charge (EPIC) work and monitors the oil temperature in the transformer, helping to predict failure.
4	Distribution Poles/Crossarms	7.3.3.13, 7.3.3.6	• Pole Hardening and Replacement Based on Pole Loading Assessment Program: Replacing overloaded poles removes the risk associated with pole failures, including potential ignition risk. This program also reduces risk by providing asset intelligence and, thus, providing a better understanding of overall factors that may cause a pole to fail. In 2022, we plan to perform pole loading calculations on approximately 180,000 poles in HFTD or HFRA locations. • GO165 and Pole Test and Treat (PTT) inspections: Distribution poles are regularly inspected and evaluated to determine their condition. When inspecting distribution poles as

#	Equipment Type	WMP Reference	Mitigation
			part of GO 165 inspections and PTT program, PG&E gains an understanding of what decay and degradation issues poles are experiencing, and where the decay is located. The pole degradation found through inspections are prioritized based on wildfire risk and are addressed by proactively replacing or stubbing poles. In 2021, we improved this program by upgrading our field hardware and software tools to enhance our recordkeeping and data systems integration. This new technology will improve our efforts in 2022 by automating processes that used to require significant manual effort.
5	Capacitor/Recloser/Regulators	7.3.4.9	• Maintenance of Miscellaneous Overhead and Underground Equipment Outside of GO165: As part of this program PG&E tests the functionality of all line reclosers, capacitors, and regulators. This testing and maintenance work not only reduces the frequency of ignition events, it improves system reliability by reducing the number of customers impacted by outages. In 2021, all electric distribution overhead and underground equipment was inspected and maintained pursuant to standards and this work will continue in 2022.

In addition to the above programs, PG&E is tracking emerging issues with equipment causing ignitions such as the increase in leakage current incidents, leading to electrical tracking over crossarms and causing pole fires. When such issues are identified, PG&E's Enhanced Ignition Analysis program investigates the issues and takes necessary near-term and long-term corrective actions to mitigate the wildfire risk. More details about the EIA program are provided in the response to Remedy #2 below.

Remedy #2

2. *The plan must include any additional efforts, if any, PG&E will undertake that are informed by a root cause analysis outside those efforts PG&E completes as part of its routine maintenance program or as part of program-level WMP initiatives.*

    a. *As applicable, PG&E must include descriptions of root analyses completed by equipment type and explain any trends that inform changes to its inspections and maintenance programs.*

    b. *If such root cause analyses have not already been performed, PG&E must explain why, as well as how it has otherwise identified trends and reoccurring issues.*

Response to Critical Issue RN-PG&E-22-06 Remedy #2

In early 2021, we established the Enhanced Ignition Analysis (EIA) program, consisting of a dedicated matrixed team of approximately 20 employees reporting to Wildfire Risk Management (and supported by experts throughout the PG&E) tasked with expanding upon PG&E's legacy ignition investigation process to more fully understand ignition events including:

- Apparent Cause(s) that led to the ignition;
- Failed or insufficient barriers to prevent the incident;
- Extent of Condition (identify where associated risk exists elsewhere in the system);
- Development of Corrective Actions to mitigate newly understood and/or emerging risk(s); and
- Inform other wildfire mitigation strategies.

Through this increased insight on the contributing causes of ignition events and associated corrective actions, we believe the EIA program has made (and will continue to make) positive impacts to identify trends and reoccurring items related to ignitions, including ignitions from equipment failures.

In addition to failure-mode specific corrective actions, the EIA program has informed corrective maintenance and Enhanced Vegetation Management (EVM) work priorities, informed inspection strategies, generated additional patrols and post-event safety assessments, created new and re-funded legacy proactive maintenance programs, and produced/revised guidance documents related to equipment handling and end of life care. It is important to note that the results of this team have made immediate positive impacts that will reduce the potential for ignitions within year and actions that will yield long-term benefits, so the extent of the impact of EIA to reduce ignitions will increase in the future.

When an ignition is EIA-prequalified[7] during the data intake and Ignition Investigations' Daily Operating Review (DOR) meeting, the EIA process is triggered and several teams begin a collaborative effort to understand the failure, where risk exists elsewhere, and what corrective actions are appropriate to mitigate that risk. Each team's responsibilities include, but are not limited to:

- **Ignition Investigations (II)**

[7] A prequalified ignition is attributable to PG&E equipment, CPUC-reportable, and occurs in an HFTD area.

- Data intake (asset info, fire size/location, environmental conditions, response details, customer impact, etc.);
- Material collection and transport to Applied Technology Services (ATS);
- First Responder interviews;
- Site visit (as required); and,
- Producing a Preliminary Ignition Investigation Report (PIIR).

- **Vegetation Asset Strategy and Analytics (VASA)**
  - Coordinates post-ignition vegetation management inspection of approximately 10 spans adjacent to ignition incident location to review emerging risk from on-site vegetation and identify vegetation failure sub-driver. Based on the results of this initial extent of condition, the inspection scope can be expanded to appropriately assess the risk on the circuit and more broadly.

- **Applied Technology Services (ATS)**
  - Initial Analysis Summary conducted of physical material collected; and,
  - Further specialized or destructive testing as requested.

- **Asset Failure Analysis (AFA)**
  - Coordinates post-ignition Safety Condition Assessment Review (SCAR) of approximately 10 poles adjacent to incident pole(s), to review for localized damage or risk, assess any open tags, and collect missing data to support EIA investigation;
  - Affirms Apparent Cause and findings of PIIR;
  - Intakes ATS findings;
  - Identifies failed or insufficient barriers leading to the incident;
  - Evaluates where newly or better understood risk exists elsewhere in PG&E's system;
  - Recommends additional Evaluative Actions or Corrective Actions to mitigate risk of future incidents:
    - Corrective Action Plans (CAPs are generated and assigned); and,
  - Aggregates all data from EIA process into an Extent of Condition report.

Table RN-PG&E-22-06-03 below provides a summary of nine Extent of Condition reports of CPUC-reportable equipment failure caused ignitions in 2021 where there was a relevant open work tag on the asset at the time of ignition. This is an example of the kind of work being performed by the EIA program. The table includes the PG&E Ignition Index number, equipment component involved, and actions taken in response to the ignition evaluation.

Table RN-PG&E-22-06-03: 2021 Extent of Condition Reports for Equipment-Related Ignitions

	PG&E Ignition Index	Equipment Component Failure/Ignition Sub Driver	Actions Taken
1	381	Insulator tracking/missing bonding wire	• Apparent Cause Evaluation (ACE) report initiated to understand all sustained outage causes on Melones-Curtis 115 kV Line in 2021. This evaluation is still in-progress.
2	418	Conductor	• Safety Condition Assessment Review of incident location to mitigate risk at incident location.
3	450	Pole failure	• Corrective Action: Changes to PG&E's idle facility tag process.
4	816	Crossarm	• Corrective Action: Prioritization of the highest-risk crossarm replacement work.
5	1013	Switch	• Corrective Action: Changes to PG&E's work management processes to prevent corrective work identified in infrared inspection from being cancelled.
6	1021	Insulator let go of pole as a result of an earthquake	• Corrective Action: Establish rapid post-earthquake emergency inspection procedure for pole and crossarm Electric Distribution tags in the area impacted by an earthquake.
7	1506	Insulator tracking	• Corrective Action: Establish insulator wash program in high occurrence areas.
8	1718	Crossarm	• Safety Condition Assessment Review of incident location to mitigate risk at incident location.
9	1910	Wire-to-wire contact	• Corrective Action: Incorporate the ability to consider different cross arm sizes into PG&E's line slap model and re-prioritize for modifications.

	PG&E Ignition Index	Equipment Component Failure/Ignition Sub Driver	Actions Taken
			• Corrective Action: Update 2023 overhead inspection checklist to record crossarm type and length to be mapped into GIS.

Remedy #3

3. *PG&E must explain why it does not predict decreases in ignitions for equipment failures from 2022 to 2023, broken down by equipment type.*

Response to Critical Issue RN-PG&E-22-06 Remedy #3

In Table RN-PG&E-22-06-04 below, we are providing revised projections for equipment related ignitions in 2022 and 2023. We are forecasting a decrease in ignitions for equipment failure from 2021 to 2023, mainly in HFTD areas where the work is prioritized on where the wildfire risk resides.

The reason for the revised projections is described in detail in our response to Remedy RN-PG&E-22-07, which explains our overall methodology for forecasting wildfire ignitions in 2022 and 2023. At a high level:

- The projected changes in 2022 ignitions as compared to 2021 in HFTD areas is largely accounted for by the combination of the application of EPSS and continued execution of the larger wildfire mitigation programs.

- The projected changes in 2023 ignitions as compared to 2022 in HFTD areas are related to the portfolio of mitigation programs progressing, since the impact of EPSS is already accounted for in the 2022 projections.

- Forecasted 2022 and 2023 ignitions for non-HFTD areas are calculated using the same methodology as HFTD, based on the proposed set of mitigations that apply to non-HFTD areas set forth in the GRC application, as described in Exhibit 4 Chapter 3. For example, since EPSS is not enabled in non-HFTD areas, this mitigation is not factored into non-HFTD ignition forecasts.

Table RN-PG&E-22-06-04: Forecast of Equipment Failure Related Ignitions for 2022 and 2023[8]

	HFTD			Non-HFTD		
Equipment	**2021 Ignitions (Actual)**	**2022 Ignitions**	**2023 Ignitions**	**2021 Ignitions (Actual)**	**2022 Ignitions**	**2023 Ignitions**
Conductors	9	4	4	52	49	49
Switches	1	0	0	4	2	2
Crossarms	2	1	1	4	3	3
Reclosers	0	0	0	4	2	2
Connection Devices	10	2	1	31	19	19

Remedy #4

4. PG&E must also explain how mitigations it is implementing for all equipment types affect predicted ignition rates.

Response to Critical Issue RN-PG&E-22-06 Remedy #4

In response to Remedy #3 above, we provided our predicted ignition rates related to equipment failures, taking into consideration the portfolio of mitigations proposed in our 2022 WMP. We understand Remedy #4 to be asking how we calculate the way in which these mitigations, individually or as a portfolio, affect predicted ignition rates.

We address equipment related ignitions through three primary programs:

1) System inspection and maintenance;
2) System Hardening mitigation programs; and
3) EPSS and Public Safety Power Shutoff (PSPS).

System inspections provide the visibility and understanding of the material condition of the electrical system. These inspections generate maintenance repair tags when an asset or component is observed to negatively impact quality. We create a record of these known conditions (*i.e.*, tags) to track conditions that could result in ignition. We also create a record of other non-ignition related defects that populate future workplans to replace or repair equipment with known defects.

These maintenance programs reduce the risk of ignition by identifying and remediating assets or components that have the potential for ignition risk. Based on the tags

[8] Rounded to whole numbers.

identified through system inspections, we prioritize the highest risk tags for work, as well as considering the location in accordance with GO-95, Rule 18.

System Hardening mitigation programs reduce equipment ignition risk further by replacing existing equipment (*e.g.*, non-exempt equipment) with alternative equipment designed for usage in HFTD areas (*e.g.*, exempt equipment), or improving grid design to reduce the potential that a failure induced by contact from a foreign object will result in an ignition. This includes our equipment specific replacement programs and comprehensive fire resilient designs like our overhead System Hardening and Undergrounding programs. These programs reduce the average ignition risk of the system by reducing the equipment failure modes that could lead to an ignition.

EPSS and PSPS reduce all ignition drivers, including both equipment-related ignitions and contact-related ignitions. Both programs reduce ignition risk even if other mitigations have been deployed. EPSS interrupts power momentarily after a fault has occurred, reducing the fault current and the ability for that fault current to lead to an ignition. This does not reduce the frequency of faults but does reduce the frequency of faults becoming ignitions. PSPS proactively turns off power to locations experiencing significantly increased likelihood and consequence of an ignition as a result of extreme fire weather conditions and can prevent ignitions related to equipment failures during these conditions.

To determine the impact of these three approaches in addressing ignition risk, PG&E estimates the impact reduction through the standard framework established by the Safety Model Assessment Phase (SMAP). This approach is described in detail in Section 4.2 of the WMP. Each mitigation is assessed against the sub-drivers of wildfire to determine its individual effectiveness. By applying the mitigation effectiveness across each individual sub-driver, each program has an overall effectiveness on its impacts to wildfire risk reduction.

Once individual impacts from mitigation programs are calculated, the overlapping reductions are accounted for. For example, if two mitigation programs both reduced the likelihood of a crossarm failure ignition, the mitigation effectiveness of those two programs would not be additive. They likely would overlap in terms of the ignitions they reduce. This interaction effect is taken into account and the reduction in expected ignitions by sub-driver is assessed against the portfolio of programs.

The total portfolio mitigation effectiveness by sub-driver is then aggregated across sub-drivers similarly to individual mitigations. This provides a sub-driver reduction in forecast ignitions as well as a territory-wide reduction in forecast ignitions. The detailed values for the forecast ignition reduction, broken down by sub-driver, can be found in the response to Revision Notice PG&E-22-07.

Critical Issue RN-PG&E-22-07

Critical Issue Title: PG&E's ignition projections do not account for its ignition mitigation measures

Remedy # 1:

1. *PG&E must revise and resubmit Table 7.2 from PG&E's 2022 Update to project 2022 and 2023 ignitions factoring in risk reduction benefits of mitigation measures, including (but not limited to) EPSS, undergrounding, and covered conductor.*

Response to Critical Issue RN-PG&E-22-07 Remedy # 1

We have revised Table 7.2 to include projections for 2022 and 2023 ignitions across all circuits (both HFTD and non-HFTD), factoring in risk reduction benefits of traditional wildfire mitigation measures. These mitigation measures include efforts such as undergrounding and covered conductor, as well as new mitigation programs such as EPSS. Overall, across PG&E's system territory, 2022 ignitions are expected to decrease by 9% and 2023 ignitions are expected to decrease by an additional 6%, as compared to the previous year.

The new projections in Table 7.2 were calculated by:

1. Adjusting recent annual average Distribution HFTD ignition counts based on expected mitigation effectiveness for traditional mitigations;

2. Factoring for the additional reduction impact from EPSS; and

3. Accounting for variation in the year 2022 data from that of previous years, based on observed data from the beginning of this calendar year.

A summary is provided in Table RN-PG&E-22-07-01 below broken down by HFTD and non-HFTD areas and by voltage class. We are also providing a system-wide total of observed and forecasted ignitions.

Table RN-PG&E-22-07-01: Ignitions Annual Observed and Forecast

	Voltage Class	2015-2020 Average Observed	2021 Observed	2022 Forecast	2023 Forecast
HFTD	**Distribution**	144	129	97	71
HFTD	**Transmission**	11	4	10	10
HFTD	**Subtotal T&D**	155	133	107	81
Non-HFTD	**Distribution**	321	337	319	319

	Voltage Class	2015-2020 Average Observed	2021 Observed	2022 Forecast	2023 Forecast
Non-HFTD	**Transmission**	11	10	11	11
Non-HFTD	**Subtotal T&D**	332	347	329	329
System	**Total T&D**	487	480	436	410
% Change			-1%	-9%	-6%

*Differences due to rounding

Each of the steps to calculate the forecasted HFTD 2022 and 2023 ignitions is described in the response to Remedy # 2 below. Forecasted 2022 and 2023 ignitions for non-HFTD areas are calculated using the same methodology as HFTD, based on the proposed set of mitigations that apply to non-HFTD areas set forth in the GRC application, as described in Exhibit 4 Chapter 3. For example, since EPSS is not enabled in non-HFTD areas, this mitigation is not factored into non-HFTD ignition forecasts. PG&E can provide workpapers supporting the GRC application if Energy Safety requests.

The revised Table 7.2 is provided with this response as Attachment 2022-06-27_PGE_22-07_RNR_R1_Atch01.

Remedy # 2

2. *PG&E must also provide a narrative description for what factors are considered when calculating ignition projections, inclusive of WMP mitigation measure implementation, the weights of such factors and effects on projected ignitions.*

Response to Critical Issue RN-PG&E-22-07 Remedy # 2

Given that the most frequent ignitions are associated with Distribution facilities, our mitigation work is heavily focused on reducing the number of Distribution ignitions in the HFTD and HFRA areas. Below we provide a narrative description of the factors considered when calculating our ignition projections, including the weights of factors and the effects on projected ignitions.

1. Adjusting recent annual average HFTD ignition counts based on expected mitigation effectiveness for traditional mitigations:

The annual average historical Distribution HFTD ignition counts, for the years 2015 to 2020, is 143 ignitions per year,[9] which was used as an initial projected baseline for the

[9] The 6-year historic average was used for defining the ignitions baseline as it accounts for variation in weather conditions and other environmental factors. Numbers have been rounded to whole numbers.

year 2022. 2021 ignitions were intentionally excluded from the baseline calculations so as not to introduce variability as a result of EPSS being implemented for only a portion of the year and only in a select number of HFTD circuits. Recognizing that there is year-to-year variability in ignition counts, we calculated a 95% confidence interval, based on plus or minus two standard deviations — in line with standard statistical practice — so as to account for variations in ignition rates. Thus, with 95% confidence, our 2022 baseline numbers, excluding all mitigation measures, would range between 110 and 176 ignitions.

Based on the portfolio of mitigations presented in the 2022 WMP and GRC,[10] PG&E expects its mitigation plan, excluding EPSS, to reduce HFTD Distribution ignitions by approximately 3.0% from 2021 to 2022, and by approximately 7.4% from 2022 to 2023.[11] As a result, the projected ignitions for 2022 and 2023 in HFTD Distribution are expected to drop from a historical annual average of 143 in 2021 to 139 in 2022 and 128 in 2023. However, as observed in actual 2021 performance, the impacts of EPSS had not been fully considered in this forecast.

A similar approach for calculating ignition reduction is used for Transmission ignitions. However, there are certain limitations to our ability to estimate Transmission ignition reductions resulting from EPSS, which are described in more detail below.

2. Factoring for additional impact from EPSS:

In 2021, we deployed EPSS on a portion of Distribution HFTD circuits during the second half of the year. Based on the latest EPSS risk-informed decision criteria as of June 2022, greater deployment of EPSS is expected to occur over the course of the year. However, this deployment will also be primarily targeted to occur during periods when the forecasted fire conditions are anticipated to be at level R3 or above.[12] As such, we estimate EPSS's overall effectiveness across the year to be 45%. This number accounts for EPSS's overall 80% effectiveness, when applicable to 88% of primary circuit ignitions, with fire conditions at level R3 above, representing approximately 64% of previous ignitions. With these estimates, when EPSS is included as a mitigation in the HFTD ignition forecast, this reduces our 2022 estimate to 76 ignitions, and our 2023 estimate to 71 ignitions.[13]

As a result of low ignition count data for Transmission HFTD and insufficient observed run time, we were not able to establish effectiveness of EPSS on specific Transmission voltage classes (*i.e.*, 60 kV, 70 kV, and 115 kV) in a statistically valid manner at this

[10] The mitigations include, but are not limited to, the implementation of covered conductor, undergrounding, and various vegetation management initiatives.

[11] Based on the standard framework established by CPUC's SMAP of calculating risk reduction from portfolio effectiveness of mitigations as described in Section 4.2 of the WMP and the GRC.

[12] R3 is a Fire Rating Index for when fire danger is high; in R4, fire danger is critical; and in R5, fire danger is extreme.

[13] 139 x (1-45%) = 76 for 2022 and 128 x (1-45%) = 71 for 2023.

time. Therefore, PG&E has not incorporated an EPSS-based reduction into the projected ignitions for Transmission for 2022 and 2023. While we believe EPSS will have a positive impact on mitigating Transmission-associated ignitions, this more conservative approach to forecasting is purposefully being employed until the impact of EPSS on ignitions from these Transmission voltage classes can be more accurately assessed.

3. Accounting for variation in the year 2022 data from that of previous years, based on observed data from the beginning of the year:

Since we have already observed ignition data from January to May in 2022, we have adjusted the 2022 year-end projections to include these observed ignitions. On average, from 2015 to 2021, January through May makes up approximately 15% of the annual ignitions, with the traditional fire season of June through November comprising 80% of annual ignitions, and the final 5% of ignitions occurring in December. Thus, for 2022, we subtracted the amount of ignitions forecasted to occur in January through May (*i.e.*, 76 x 15% = 12) from the expected annual total of 76, and then added back the actual observed ignitions during this time period (32 ignitions) for the January through May period, as indicated in Table RN-PG&E-22-07-02 below:

Table RN-PG&E-22-07-02: 2022 HFTD Distribution Ignitions Year to Date and Year End Forecast

Month	Historical Average Ignitions w/o EPSS	Historical Average Ignitions w/ Projected EPSS (45% effectiveness)	Revised Forecast to Include 2022 YTD Observed Ignitions
January	2	1	2
February	4	2	5
March	3	2	4
April	4	2	10
May	8	5	11
Year to Date Subtotal	**21**	**12**	**32**
Traditional Fire Season Estimate (Jun to Nov)	111	61	61
December Estimate	7	4	4
Year End Forecast	**139**	**76**	**97**

*Differences due to rounding

While observed ignition data from January to May 2022 was higher than expected, this is largely the result of unpredictable external factors that are expected to revert to historical levels in future months. Specifically, from January through May 2022, we observed:

- an increase in third party-caused ignitions (11 ignitions in 2022 compared to 2015 to 2021 averages of 3 ignitions for the same time period); and
- animal contact ignitions (5 ignitions associated with animal activity in 2022 compared to 2015 to 2021 averages of 1 ignition for the same time period).

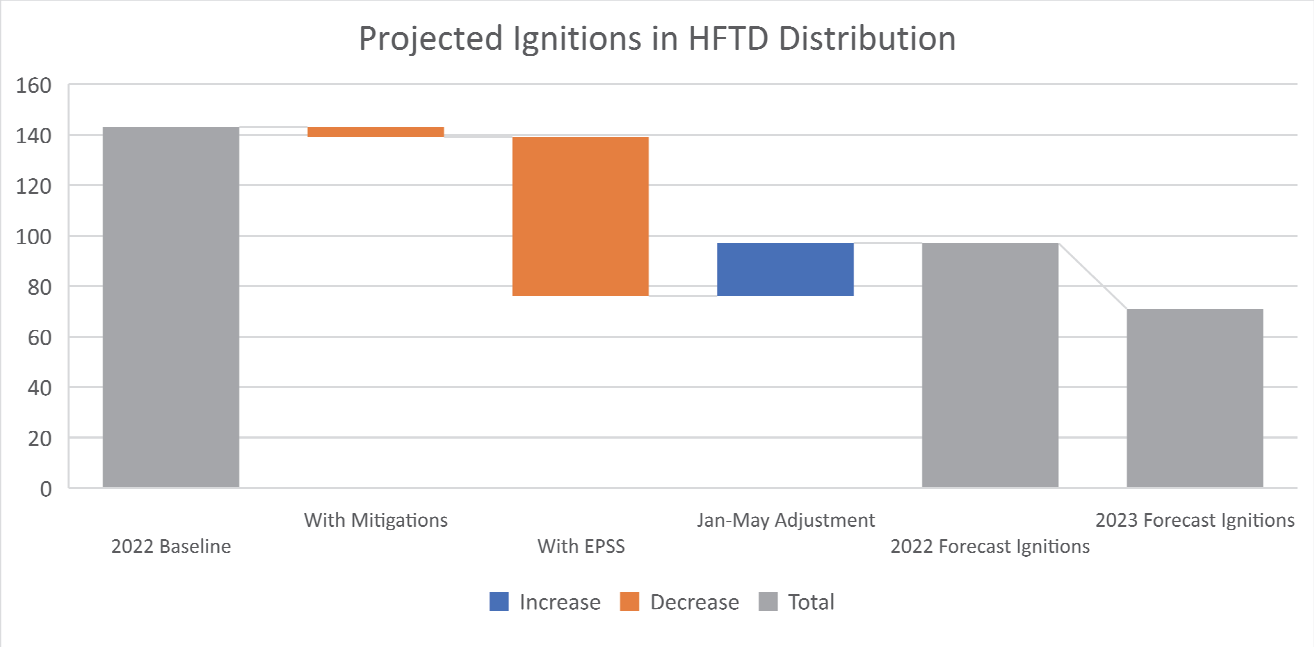
During this same period in 2022, equipment failure and vegetation contact caused ignitions have been below average. PG&E believes the inclusion of the January to May 2022 actual figures is an appropriate adjustment to better reflect our ignition projections for 2022. We expect the remainder of the year to adhere closer to historical averages.

When these values are combined (observed 2022 year to date, and expected forecast), we computed a new projected 2022 year-end value of 97 HFTD distribution ignitions, but highlight that the range for this number, with a 95% confidence interval, is from 79 to 114 ignitions.

For 2023 year-end value, we project HFTD distribution 71 ignitions, after accounting for our continued mitigations, with a 95% confidence interval, and a range of 54 to 87 ignitions. This figure could also substantially change as we continue to evaluate the impacts of EPSS settings on our system. This represents our best available information as of June 2022 and will continue to provide adjustments and updated data as part of our quarterly and annual WMP reporting.

Figure RN-PG&E-22-07-01 below summarizes the changes to the HFTD ignition projections described above.

Figure RN-PG&E-22-07-01: HFTD Distribution Ignitions Forecast Waterfall



4. Resulting Revised Table 7.2

A revised Table 7.2 has been provided, with expected ignition figures. The outputs can be seen in Table 12 of Attachment 2022-06-27_PGE_22-13_RNR_R1_Atch01 with the adjustment due to EPSS shown in Attachment 2022-06-27_PGE_22-07_RNR_R1_Atch02.

Critical Issue RN-PG&E-22-08

Critical Issue Title: PG&E has high find and failure rates in its quality assurance and quality control of asset inspections

Overview

PG&E's Quality system is a critical part of our efforts toward preventing catastrophic wildfires and delivering safe, reliable, and affordable energy to our customers and communities. We take seriously our responsibility to perform high-quality asset inspections and welcome the opportunity to provide additional details on how we are improving and monitoring asset inspection quality. We also welcome feedback into our Quality Assurance (QA) and Quality Control (QC) processes to make them better and more robust.

We strongly believe in the need to continuously improve and, this year, have initiated a significant number of new actions aimed at improving the quality of our inspections and the way we monitor the quality of those inspections. Specifically, we have introduced a refreshed approach involving several layers so our inspections are completed with increased quality, are compliant to requirements, and are efficient.

Key areas of improvement include: (1) qualified journey line-worker skillset; (2) revised training and new skill assessments; (3) increased use of Inspection Review Specialists (IRS); (4) increased QC; (5) QA activities; and (5) improved co-worker performance feedback and coaching strategies. Though underway since the beginning of 2022, many of these actions and processes are newly implemented with most only being active since the second quarter of 2022. We are confident that these actions will have a positive impact on our inspectors and help to improve processes, allowing us to achieve the quality improvement goals described below.

To improve quality, we are:

- Improving our training focused on ignition risk, including moving to hands-on training (as compared to only classroom training). Training materials, courses, and job aids are continuously improved to include common and repeat failure causes identified by our QA/QC assessments;

- Holding poor performing personnel inspectors accountable, coaching, retraining and/or ultimately removing them from performing work when they are unable to maintain required quality levels;

- Implementing hands-on real-world scenario skill assessments to assure contract inspectors possess the necessary proficiency to perform the work prior to allowing them to perform real world inspection; and,

- Reducing the execution window between initial inspection and quality control to early identify and address non-conformances.

Beyond these actions to improve inspection quality at the source, we are also engaging each quality layer to help drive improvements. For example:

- Supervisors and/or IRS (Inspection Review Specialist) workers schedule field meets/ride-along with Inspectors to observe and evaluate the Inspectors in the field.
- We are utilizing daily performance reporting and weekly trend data to inform causal evaluations and necessary corrective actions to isolate and remediate failures causes.
- We are leveraging PG&E's Lean Operating System to maintain daily visibility on performance and facilitate corrective actions.
- Our QA team will increase the pace of feedback and hold workshops to clearly communicate expectations back to inspectors and leadership teams both within PG&E and with our contractors.

With this overview in mind, in the sections below we are providing detailed responses to the specific items identified in Remedies #1(a) through (f).

Required Remedies: *PG&E must explain actions taken to improve its quality control processes. Specifically, PG&E must:*

a. For all listed actions to increase the quality of its asset inspections, provide an update on progress and timeline for implementation.

Response to Critical Issue RN-PG&E-22-08 Remedy # 1(a)

a. Please see Table RN-PG&E-22-08-01 below for the requested timeline and progress update on the implementation of actions to increase the quality of our asset inspections.

Table RN-PG&E-22-08-01: Timeline and Update on Actions To Increase Asset Inspection Quality

	Listed Action	Update of Progress	Timeline for Implementation
1	Launching a pilot to expand the QC program for systems inspections	The pilot for Field QC Review has been completed and the results used to inform the new processes have been implemented.	Completed
2	Enhancing the continuous monitoring of performance trends in systems inspections to provide a	The organization is currently leveraging the PG&E Lean Operating System to keep focus on non-conformances, learning opportunities and trends to	Completed

	Listed Action	Update of Progress	Timeline for Implementation
	better analysis of systemic issues	improve performance and make date informed decisions.	
3	Performing real-time validation and correction of failed or non-conformance issues in systems inspections	The build and implementation of the process has completed. Validation is currently real time. A recent example of a completed corrective action is the implementation of daily and weekly tailboards to clarify requirements and updates to job-aids. Corrective actions, such as this, have resulted in positive improvements as validated in QC Review data.	Completed
4	Immediately escalating any non-adherence to systems inspections processes and procedures	This effort was incorporated into the scope of the activity above (performing real-time validation and correction). Non-adherence is currently escalated using the real-time validation and correction process. We will have seen both favorable and unfavorable trends week-over-week in this area.	Completed
5	Investigating systemic issues in systems inspections	Systemic issue trends are segregated from human performance issues using the above performance trending activity. This enables targeted investigations of causes.	Completed
6	Integrating all systems inspections QC data for ease of access and use	Leveraging an IT solution, the use of Foundry as a single source of data has been implemented. The identified plan will be completed by the end of the year. This will enable real-time reporting/tracking to further improve visibility.	End of Q4 2022
7	Investigating and validating root causes of poor performance in systems inspections	This effort is approximately 30% completed. Analysis, review of findings, identification of root causes, and corrective actions have been implemented. A pilot has been completed. We support learnings monthly, our next phase will improve cadence to weekly.	End of Q4 2022
8	Monitoring systems inspections corrective actions for effectiveness.	This effort was incorporated into the scope of the root cause and corrective action activity above.	End of Q4 2022
9	Creating and focusing on a new category of activity in	This process allows for real-time feedback of performance as well as	Completed

	Listed Action	Update of Progress	Timeline for Implementation
	systems inspections called "Continuous Improvement" activities.	tracking/trending data and identifying systemic issues. To date, we have seen various areas of opportunity shared by inspectors and leaders on our approaches. We also have received insights from external observers and other entities we incorporate. We review and look to implement no regret actions that aid our quality improvement approaches.	

Response to Critical Issue RN-PG&E-22-08 Remedy # 1(b)

b. *Provide quarterly quantitative asset management QA/QC goals for both findings and reducing failure rates for the remainder of 2022 and 2023.*

The PG&E QA/QC 2022 goals are shown in quarterly format in Tables RN-PG&E-22-08-02 and RN-PG&E-22-08-03 below.

The QA and QC goals establish the stated levels of findings, or pass rates, within the inspection checklist. These focus on the critical attributes that have potential ignition risk or immediate public safety concerns and are divided between Distribution Inspection Quality Assurance (DIQA) and Transmission Inspection Quality Assurance (TIQA). They were established based on an improvement goal over the previous year's performance.

Table RN-PG&E-22-08-02: QA Quarterly Goals for 2022

Q1 YTD	Q2 YTD	Q3 YTD	Year End
DIQA: **90.00%** TIQA: **95.50%**	DIQA: **90.00%** TIQA: **95.50%**	DIQA: **90.00%** TIQA: **95.50%**	DIQA: **90.00%** TIQA: **95.50%**

Table RN-PG&E-22-08-03: QC Quarterly Goals for 2022[14]

QC Program	Q1 YTD	Q2 YTD	Q3 YTD	Year End
Transmission Field	95.5%	95.5%	95.5%	95.5%
Transmission Desktop	95.5%	95.5%	95.5%	95.5%
Distribution Field	90%	90%	90%	90%
Distribution Desktop	90%	90%	90%	90%

The QA/QC 2023 goals are not yet established as they are dependent on 2022 performance and will be set at a threshold to improve upon our performance in 2022. Through the third quarter of 2022, we are seeking to achieve a threshold score that will allow us to meet the goals noted above specific to WMP-related inspections and quality improvements. No fourth quarter target is noted as our WMP Initiative Target inspections are generally planned for completion by July 31, 2022.[15] If fourth quarter review actions are needed, they will be the same as the third quarter. In 2023, we plan to set similar threshold scores for each quarter that will improve upon those from 2022.

We plan to achieve our goals through continuous implementation of the actions and timelines laid out in part (a) above, the monitoring, training, and disciplining of our inspectors and contractors described in parts (c) and (d) below, and the systematic improvement of our training processes and materials described in part (e) below.

Response to Critical Issue RN-PG&E-22-08 Remedy # 1(c)

c. Explain whether there is a failure rate threshold at which PG&E will take remedial or disciplinary action on an inspector. If so, provide that threshold and describe the action that PG&E takes to address inspectors with high failure rates.

Individuals found to be performing outside of our processes and procedures are coached, trained, disciplined, or paused from further performance of work, depending upon the severity of the non-adherence. Inspectors with a pass rate below 90% on Distribution and 95.5% on Transmission will receive remedial training and other corrective actions to improve quality and prevent re-occurrence of failure. Below is a

[14] QC quarterly goals are internal, non-committed stretch goals within the QC department to improve the quality of the overall inspection, not just critical attributes.

[15] Infrared inspections of distribution (Initiative Target D.05) is the only inspection-related Initiative Target with a completion date later than July 31, 2022.

detailed list of the actions taken to coach, train, or discipline[16] low-performing inspectors and contractors:

- Beginning in Q3, inspectors with a pass rate below the thresholds noted above will have additional Systems Inspections QC oversight completed to confirm the quality of both internal and contracted inspections. Results of this additional oversight may result in corrective action activities such as retraining, additional skill assessment, and various levels of discipline and/or ultimately termination.

- Inspectors with pass rates below the thresholds noted above may be required to attend an additional "New Inspector" training session.

- Supervisors and/or IRS (Inspection Review Specialist) workers schedule field meets/ride-alongs with inspectors to observe and evaluate the inspectors in the field.

- Supervisors and/or IRS workers may perform their own work verification on additional locations completed by inspectors. The results of these additional WV activities may result in corrective action activities and up to discipline and/or termination.

- Managers may schedule ride-alongs, hold discussions with inspectors to review and discuss results and misses.

- Supervisors review quality and productivity reports, review results in "Engage" application, and review other completed inspection documents to identify the need for follow-up training or ride-along with inspectors.

- Training and job aids are continuously updated throughout the year as needed for identified gaps in process/procedural knowledge, feedback/learnings from working with underperforming inspectors (among other things).

- Confirmed incidents of fraudulent activity (timecards, inspections) will result in discipline and up to termination.

- "All Inspector" (internal & contractor) huddle calls occur weekly to discuss the previous week's Quality Assurance Distribution (QAD) findings, review "top" missed questions, review photos, ensure clarity and understanding, follow-up where needed with our partners in Asset Strategy, Work Methods & Procedures, Standards, SI QC and Centralized Inspection Review Team (CIRT), and QAD Teams to gain consensus and alignment. This huddle supports a direct feedback loop to the entire team regardless if an inspector was actually involved with the quality miss. The intent is to share all findings as they are identified to the team

[16] Depending on the severity of the non-adherence, discipline could involve re-assignment away from inspection work, re-assignment to an entirely different position, or termination of the working relationship with PG&E.

early and in a forum they can engage in. The discussion also allows for Q&A from inspectors so clarity can be provided or actions supported that they identify needing attention (*e.g.*, standard change, job aid creation or update, etc.).

- "All IRS" huddle calls occur weekly to discuss IRS issues, questions, etc., to ensure consistent understanding and support from IRS workers for our contract inspectors.

- Starting in June 2022, each day a daily QAD message is shared in the Systems Inspections Daily Operating Review (DOR), which includes the previous day's QAD findings. This communication is provided to all System Inspectors both internal and external.

- QAD and Systems Inspections support weekly collaboration meetings to review and discuss each missed item recorded from the previous week in detail. This discussion includes reviewing photos and comments from QA and reference to our existing standards. This discussion is supported by QA, QC and SI leaders, along with subject matter experts. prior to sharing with inspectors. The intent of the discussion is to gain consensus and ensure alignment and understanding of quality gaps between teams on previous weeks' findings. This ultimately provides our inspectors with clear communication on the finds and united direction on areas of quality concern between teams.

By combining each of these actions described above, we take a holistic and continuous improvement approach to coaching, training, and disciplining any underperforming inspectors and contractors, up to, and including, suspension or termination. System Inspection evaluations of the quality of inspectors has led to the release of contractors, for quality issues. This includes being added to our "no hire" list to not return to the company.

Response to Critical Issue RN-PG&E-22-08 Remedy # 1(d)

d. Provide a detailed description of how PG&E escalates non-adherence to asset inspections processes and procedures.

In addition to the activities described in response to part (c), we actively manage non-adherence to asset inspection processes and procedures. As described above, individuals who have been found to be performing outside of our processes and procedures are subject to either supplemental coaching and training or are removed from the program entirely.

Failure to adhere to asset inspection processes and procedures is first identified by external QA/QC auditor teams who validate the quality of work submitted by the inspectors/contractors. The auditors measure overall program quality of inspections in order to create trends related to common mistakes. In addition, both supervisors and IRS workers review both internal and external inspections to provide an additional level of oversight. Reports are then created showing performance by inspector to determine

where coaching and training may be necessary. If coaching and training is ineffective, or the non-adherence sufficiently severe, the contractor/inspector is then removed from the program.

We also support immediate termination of an employee when prudent to do so relative to risk and severity. Examples include willful fraud, disregard for procedural adherence or other acts of purposeful noncompliance.

Response to Critical Issue RN-PG&E-22-08 Remedy # 1(e)

e. *Provide actions to improve training for both internal inspectors and contractors in PG&E's asset inspection and management program based on repeat QA/QC findings.*

Coaching and training for individual inspectors and contractors based on QA/QC findings is described above in the response to subpart (c). With regard to general training programs for all inspectors and contractors, in order to improve training for both internal inspectors and contractors, PG&E conducts regular meetings with trainers, the Standards and Procedures team, the Asset Strategy team, CIRT, and the Digital Catalyst team. This training is focused on improving both the training the inspectors/contractors receive and the training checklist used by the inspectors/contractors. These meetings are conducted on an as needed basis and regularly occur multiple times each week, sometimes as often as every day.

The frequency of these meetings essentially allows for continuous improvement of our training courses, training materials, job aids, and other items and will continue to help us reach our quality goals. In addition, training materials, courses, and job aids are continuously improved to include common and repeat mistakes from QA/QC audits, as well as the Inspection Review Specialist audit findings prior to the next inspection cycle. The job updates are also updated to include any changes in processes, standards, and technology.

Earlier this year, our PG&E Academy team audited our 2021 Systems Inspection training materials and provided curriculum and application improvement recommendations for use within 2022. PG&E Academy provided a number of helpful recommendations which have been implemented. Key items included: (1) increased in-classroom training; (2) addition of real-life practice scenarios with accompanied onsite subject matter expert coaching; and (3) administration of a formal knowledge and skill assessment immediately following training, and prior to release of an employee to conduct inspections. The skills assessment program:

- Assesses the proficiency of Distribution contractor inspectors in 2022;
- Utilizes a combination of hands-on, practical, real-world scenarios and written examinations to ensure that contract personnel are knowledgeable of the requirements; and

- Is mandatory for all contractors to pass the skills assessment prior to performing real world inspections of our assets.

Response to Critical Issue RN-PG&E-22-08 Remedy # 1(f)

f. *Provide an update on PG&E's QA/QC findings and failure rates for asset inspections completed since the 2022 WMP Update filing.*

In responding to this request, PG&E is treating the phrases "find rate" and "failure rate" as synonymous and meaning the percentage of reviews in which any discrepancies were identified, including non-critical discrepancies. An inspection either passes or fails based on performance of the critical attributes. We do not track find rates and failure rates separately.

The failure rates for QC of inspections completed since we filed our 2022 WMP (March 1, 2022 through June 14, 2022) are shown below in Table RN-PG&E-22-08-04. QC sampling is currently at approximately 1.5% and approximately 4% of the field and desktop total populations respectively. Statistically valid methodology parameters, such as a confidence level of 95% internally, will be utilized.

QC is performed prior to QA, and QA establishes the final pass rate. Our QC of inspections in most cases is completed within weeks of a completed and recorded inspection. This allows for quality containment actions to be supported timely and communication to inspectors of quality improvement opportunities or observed successes. QA of inspections is completed after QC in most cases within 30-60 days of a completed and recorded inspection. This helps measure if our containment actions as a result of QC are effective.

Table RN-PG&E-22-08-04: QC Find Rates for 3/1/2022 – 6/14/2022

Inspection Type	Completed Inspections	Completed QC Reviews	QC Review HFTD – Failure Rate
Transmission ground, desktop QC	35,241	4%	64%
Transmission ground, field QC	35,241	1.5%	65%
Distribution detailed, desktop QC	278,135	3%	34%
Distribution detailed, field QC	278,135	1.5%	55%

For QA sampling (March 7, 2022 through June 3, 2022), approximately 2.9% and approximately 0.18% of the Transmission and Distribution total populations respectively have been sampled. The pass rates for QA review are reflected below in in Table RN-PG&E-22-08-05. Please note that the QA sampling data below includes only critical attributes (i.e., locations in HFTD areas).

Table RN-PG&E-22-08-05: QA Pass Rates for 3/7/2022 – 6/4/2022

Inspection Type	Completed QA Review Locations	QA Review HFTD Pass Rate
Transmission field and corresponding record (critical attributes only)	2.9%	96.95%
Distribution field and corresponding record (critical attributes only)	0.18%	77.84%

Critical Issue RN-PG&E-22-10:

Critical Issue Title: PG&E does not report targets for its vegetation management quality assurance and quality verification program or for poles brushed

Required Remedies:

1. *PG&E must provide targets in accordance with PG&E-21-24 and the 2022 WMP Guidelines for its QA/QV program and number of poles brushed per PRC 4292.*
    a. *For the QA/QV targets, PG&E may provide either the percentage of vegetation inspections audited (as prescribed by the Guidelines) or the number of audits/reviews it plans to perform (as described in Data Request OEIS-PG&E-22-005, Answer 6, and reiterated in Table 8).*

2. *PG&E must establish an Acceptable Quality Level (AQL) for performance for each QA/QV program listed in Table 8. The AQL for each program may be no lower than 95 percent.*

3. *Targets and associated AQLs must be presented in a revised WMP Table 5.3-1.*

Response to Critical Issue RN-PG&E-22-10, Remedy #1 and #2

Before providing the revised Initiative Targets in response to Remedy #1 and #2, we are sharing some context regarding our Quality Assurance Vegetation Management (QAVM) and Quality Verification Vegetation Management (QVVM) programs.

- **QAVM:** Our QAVM program audits vegetation line clearance activities along overhead electric distribution lines and transmission lines with distribution under-build for compliance with FAC-003-4, General Order (GO) 95 Rule 35, and California Public Resources Code (PRC) Sections 4292 and 4293. These audits are conducted using a statistically valid sampling methodology. QAVM focuses its planned audit work on a higher percentage of HFTD miles. The majority of QAVM audits are Distribution Audits which are comprised of All Circuits audits and HFTD-only audits. The All Circuits audits look at both HFTD and non-HFTD mileage in the bundle. QAVM performs quality assessments on the adherence to and effectiveness of processes of the programs being audited. QAVM audits typically occur before QVVM audits.

- **QVVM:** Our QVVM group, which is separate from QAVM, reviews completed inspections and tree work using a statistically valid sampling methodology to confirm adherence to PG&E standards and procedures and overall quality of work performed by contractors to prevent and/or mitigate hazards (e.g., GO 95, Rule 35, PRC Sections 4292 and 4293). QVVM prioritizes work based on recently completed inspection and tree work using a statistically valid sampling methodology, in order of the highest profile of work starting with the EVM Work Verification, Distribution/Transmission Pre-Inspection, Distribution/Transmission

Tree Trim, Tree Mortality (2nd Patrol), Mid Cycles (were changed in 2021 to focus on High Fire Threat Districts), and Vegetation Control Pole Clearing. The random samples chosen for QVVM and QAVM audits are not the same.

In response to Remedy #1, we are updating an existing Initiative Target (*i.e.*, Initiative target E.05 - Vegetation Management - Quality Assurance) to a quantitative target to include the number of audits/reviews we plan to perform. In addition, for the QA/QV program targets, we have established an AQL for each type of inspection or audit.[17] We will be moving Initiative Target E.05 from Table 5.3-1(B) which is for qualitative targets to Table 5.3-1(A) which is for quantitative targets.

Given the timing of the Revision Notice, some of the work identified in this Initiative Target may already have been performed. For example, pole clearing begins October 1 and concludes September 30 of the following year. Because the Revision Notice directs a minimum AQL of 95%, for some programs that have already been performed, such as pole clearing, achieving the 95% AQL target may be challenging given that much of the work has been completed. We intend to take lessons learned from our 2022 audits and reviews to inform and improve performance in 2023 if we are unable to achieve the 95% AQL target.

Our revised Initiative Target E.05 is provided below:

[17] PG&E understands an AQL to be an evaluation of whether work was performed properly and consistent with standards and requirements based on footnote 93 in the Revision Notice. Thus, the AQL in the Initiative Target is based on work being performed in compliance with procedures and requirements at the time the work was performed.

<table>
<tr><th>ID</th><th>Initiative Target Name</th><th>Initiative Target Description</th><th>Activity Due Date</th><th>Qualitative or Quantitative Target</th></tr>
<tr><td>E.05</td><td>Vegetation Management – Quality Assurance and Quality Verification</td><td>1. Quality Assurance Audits
<table><tr><th>Type of Audits</th><th># of Audits</th><th>AQL</th></tr><tr><td>Distribution - voltages less than 60kV in our Routine, Tree Mortality, EVM and Pole Clearing programs.</td><td>43</td><td>95%</td></tr><tr><td>Vegetation Pole Clearing</td><td>1</td><td>95%</td></tr><tr><td>Transmission - high voltage 60kV and greater and applies to maintaining high voltage transmission corridors to Minimum NERC clearance, PRC 4293 clearance, and GO 95 Rule 35 clearance</td><td>1</td><td>95%</td></tr><tr><td>Procedure audit of the following: Enhanced Vegetation Management, Record Keeping, Transmission and Distribution Line Verification, and Refusal Procedure</td><td>4</td><td>95%</td></tr></table>Distribution and transmission audits include multiple trees and a 95% AQL would represent 95% of the total trees audited being in compliance with PG&E requirements.
The vegetation pole clearing audit includes multiple poles and a 95% AQL would represent 95% of the total poles audited being in compliance with PG&E requirements.
The procedure audit includes a review of PG&E’s vegetation standards and whether PG&E’s vegetation management team adhered to the process and procedures in the standard.</td><td>12/31/2022</td><td>Quantitative</td></tr>
</table>

<table>
<tr><th>ID</th><th>Initiative Target Name</th><th>Initiative Target Description</th><th>Activity Due Date</th><th>Qualitative or Quantitative Target</th></tr>
<tr><td>E.05</td><td>Vegetation Management – Quality Assurance and Quality Verification</td><td>2. Quality Verification Reviews
<table><tr><th>Type of Verification</th><th>#</th><th>AQL</th></tr><tr><td>Distribution - voltages less than 60kV in our Routine, Tree Mortality, EVM and Pole Clearing programs.</td><td>1,522 Reviews[18]</td><td>95%</td></tr><tr><td>Vegetation Pole Clearing</td><td>3,421 Poles</td><td>95%</td></tr><tr><td>Transmission - high voltage 60kV and greater and applies to maintaining high voltage transmission corridors to Minimum NERC clearance, PRC 4293 clearance, and GO 95 Rule 35 clearance</td><td>260 Reviews</td><td>95%</td></tr></table>Distribution and transmission reviews include multiple trees and a 95% AQL would represent 95% of the total trees reviewed being in compliance with PG&E requirements.
The vegetation pole clearing reviews includes multiple poles and a 95% AQL would represent 95% of the total poles reviewed being in compliance with PG&E requirements.</td><td>12/31/2022</td><td>Quantitative</td></tr>
</table>

[18] A review is a group of geographically and timeframe similar locations that are to be reviewed together as a single review.

PG&E already had Initiative Target for pole clearing not required by PRC Section 4292 (*see* Initiative Target E.03). In response to the Revision Notice, we are adding a separate and new Initiative Target for pole clearing that is required by PRC Section 4292.[19]

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
E.10	Pole Clearing in State Responsibility Areas	PG&E will inspect and clear, where clearance is needed, 80,258[20] distribution poles subject to PRC 4292 in State Responsibility Areas identified by PRC 4292, barring External Factors[21] or poles that are exempt under Title 14 Cal. Code of Regulations 1255.[22]	08/31/2022	Quantitative

Response to Critical Issue RN-PG&E-22-10, Remedy #3

Remedy #3 requests that PG&E update Table PG&E-5.3-1 in our 2022 WMP to reflect these Initiative Targets. The Revision Notice also specifies that PG&E submit an updated version of its 2022 WMP on July 26, 2022.[23] We will add the above Initiative Targets into Table PG&E-5.3-1(A) in our July 26th submission of the updated 2022 WMP.

[19] The Revision Notice used the term "pole brushing", which we understand to be pole clearing. Since PG&E uses the term pole clearing internally, we have used pole clearing in our Initiative Target description.

[20] This number may change as poles are added, removed, or have a change in status during the pole clearing program cycle. Any assets discovered between October 1, 2021 and August 31, 2022 will be inspected and cleared (where clearance is needed) by the target due date, barring External Factors. Any assets discovered after August 31, 2022 will be inspected and cleared (where clearance is needed) within 45 days of when added to the Vegetation Management Database, barring External Factors.

[21] External Factors represent circumstances which may impact targets including, but are not limited to, physical conditions, landholder refusals, environmental delays, customer refusals or non-contacts, permitting delays/restrictions or operational holds, weather conditions, removed or destroyed assets, and active wildfire.

[22] Poles in fields that are plowed or cultivated, such as planted row crops, cultivated fields, vineyards, nonflammable summer fallow, irrigated pastureland, fruit, nut, citrus orchards, Christmas tree farms, swamp, marsh or bog land and where vegetation is maintained less than 30.48 cm in height, is fire resistant, and is planted and maintained for the specific purpose of preventing soil erosion and fire ignition.

[23] Revision Notice, p. 35.

Critical Issue RN-PG&E-22-11

Critical Issue Title: PG&E has failed to implement the vegetation management refresher curriculum it committed to implement in its 2021 WMP Update

Required Remedies: *PG&E must provide a progress update, a summary of the curriculum, and a timeline to complete the implementation of its VM refresher training in 2022.*

Response to Critical Issue RN-PG&E-22-11 Remedy #1

For clarification on this Critical Issue, in its 2021 Wildfire Mitigation Plan, PG&E stated:

> PG&E does not have a continuing education, or "refresher" curriculum for VM personnel. However, we are currently in the process of creating a refresher course that will be updated yearly. We intend for the refresher course to cover issues across various scopes of work identified in the previous year. We also anticipate that the refresher course will address any changes to our VM programs or changes to safety or work standards that have been implemented. We also intend to refresh our environmental expectations. This will be a required training for all VM personnel listed in 5.4-1, including VC. We expect to have this WBT ready for use in 2022.[24]

PG&E has not failed to follow through on the statements made in its 2021 WMP as the Critical Issue title implies. Rather, PG&E started the process of creating a refresher curriculum in 2021.

Our current plans for refresher training courses include:

1. Technology Updates: The One Veg Tool is our new software program that was developed to deliver a single tool that incorporates all vegetation management work into one. As of June 1, 2022, we had made available the following training regarding the One Veg Tool for PG&E employees and contractors with a completion target for all employees and contractors of December 31, 2022:

    - VEGM - 9101 – One VM for Veg Mgt Inspectors (VMI)
    - VEGM - 9102 – One VM for Field Tree Crews
    - VEGM - 9103 – One VM for Field Tree Crews (Spanish version)
    - VEGM - 9104 – One VM for Tree Crew back-office support
    - VEGM - 9105 – One VM for Support Teams

[24] 2021 WMP, p. 728.

2. Strike Tree Identification: We will be replacing the interim VEGM-9068RVL training module that was implemented in November 1, 2021 with a new strike tree training module. The strike tree training module will be refresher curriculum to be completed by December 31, 2022.

3. Environmental Training: We are expanding and improving our environmental courses for Field Crews and Tree Crews (VEGM-0301 and VEGM-0302). The updated training will be available for PG&E employees and contractors by December 31, 2022. These courses include expanded course curriculum to cover all Best Management Practices with field examples.

4. Tree Crew Pre-Qualification Program: In December 2021, PG&E launched a Vegetation Management qualification program that focuses on field Vegetation Management Tree Crews having the necessary qualifications to perform their work based on a demonstration of their knowledge and skills during an assessment. At program launch in 2021, four assessments were established in alignment with PG&E Safe Work Practices to address high-risk tasks. The Tree Crew Qualification program is continuing to expand the available assessments. Qualified assessors will perform skills assessments for Tree Crew Workers in a safe and controlled environment. Assessors will evaluate and document a Workers hands-on skills, knowledge, and abilities.

Table RN-PG&E-22-11-01 below provides milestones for the development, implementation, and completion of our vegetation management refresher curriculum plus other noteworthy programs we have underway.

Table RN-PG&E-22-11-01: Vegetation Management Refresher Curriculum Activities

Date	Activity
August 2021	One Veg Tool launches with Salesforce for the development and launching of the software tool (Item #1)
November 1, 2021	Introduced our VEGM-9068RVL training regarding the criteria for the identification of Strike Trees. This training was intended for our Pre-Inspection and Work Verification teams for consistency. This interim training is being used pending completion of the refresher course (Item #2)
November 1, 2021	Initiated discussions regarding environmental training modules to identify integration of new environmental permitting requirements for the refresher curriculum (Item #3)
December 2021	Launched Tree Crew Qualification Program (Item #4)
June 1, 2022	Rolled out One Veg Tool software training (Item #1)
July 1, 2022	Internal governance review and approval of additional training revisions (Items #2 and #3)

Date	Activity
August 19, 2022	Course material review (Items #2 and #3)
October 1, 2022	Course completion for Items #2 and #3 below and added to My Learning[25]
November 1, 2022	Course for Items #2 and #3 appears as required for all VM personnel listed in Table 5.4-1 in 2022 WMP
December 31, 2022	Course completion for Items #1 - #3

In addition, we have implemented targeted trainings, including formal trainings and “5 Minute Meetings” on specific issues as deemed appropriate to address changes in process, the addition of new resources, and other areas to establish consistency.

[25] My Learning is an electronic platform for all PG&E employees that provides notification of all training and courses for an employee that has a LANID is required to complete, and the date completion is required.

Critical Issue RN-PG&E-22-13

Critical Issue Title: PG&E does not provide disaggregated data on its system hardening initiatives

Required Remedies:

1. *PG&E must separately provide detailed costs, miles previously treated, a range for miles planned to be treated, and RSE estimates for covered conductor installation, undergrounding, line removal, and any other system hardening initiatives currently presented together as one value in PG&E's 2022 Update.*

2. *Table 12 must be revised to provide the required information for each initiative listed in Energy Safety's 2022 WMP Guidelines.*

Response to Critical Issue RN-PG&E-22-13 Remedy # 1

In response to Critical Issue RN-PG&E-22-13, we are providing the requested disaggregated information for our System Hardening Program (Section 7.3.3.17.1) in Table 12 using forecasts from our recent 2023 GRC application.[26] The disaggregated information is found in the following initiatives contained in Table 12:

- 7.3.3.3 System Hardening – Covered Conductor Installation;
- 7.3.3.16 System Hardening – Undergrounding;
- 7.3.3.17.1(LR) System Hardening – (Line Removal)[27]; and
- 7.3.3.17.5 Remote Grid.

In Table RN-PG&E-22-13-01 below, we provide a summary table with the forecast changes made to Table 12 Attachment 2022-06-27_PGE_22-13_RNR_R1_Atch01 and updated Attachment 2022-06-27_PGE_22-13_RNR_R1_Atch02 in response to this Critical Issue. As shown, we provide 2022 and 2023 GRC estimated miles, costs, and risk spend efficiencies (RSE) for our combined System Hardening Program, as well as the disaggregated figures for covered conductor installation, undergrounding, line removal, and Remote Grid.[28]

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[26] CPUC Application 21-06-021.

[27] Available line removal information is presented as a second figure in parenthesis in Section 7.3.3.17.1 because line removal is not a separate WMP initiative per Energy Safety's Revised 2022 WMP Guidelines.

[28] In our 2023 GRC application we did not forecast system hardening line removal miles, which takes place as part of various programs (*e.g.*, Remote Grid, fire rebuild, other system hardening projects etc.), for 2022-2023. Therefore, we have not provided forecasted line removal miles in the revised Table 12. We have provided line removal mileage completed in 2022 as of 6/21/22,

Table RN-PG&E-22-13-01: Disaggregated System Hardening Program Information

		Units (Miles)		Cost (millions)		RSE
Initiative #	**Initiative Name**	**2022**	**2023**	**2022**	**2023**	
7.3.3.17.1	Total System Hardening Program, Distribution	470	527	$977	$1,458	5.54
7.3.3.3	Covered Conductor Installation	305	170	$366	$265	7.55
7.3.3.16	Undergrounding	163	357	$611	$1,193	4.40
7.3.3.17.1 (LR)	Line Removal	9.3	-	$0.985	-	140
7.3.3.17.5	Remote Grid	2 (units)	1 (unit)	$17	$8.5	22.6

Below, we provide some additional detail regarding the information in Table RN-PG&E-22-13-01.

- Units (Miles): The 2022 and 2023 System Hardening total program and disaggregated forecasts in the 2023 GRC were developed based on the best available information at the time of the filing. As projects are scoped, engineered, and executed, the actual miles of System Hardening work that fall within each underlying initiative will vary from the forecasts as some projects run into executability issues (e.g., permitting, land, etc.) and other projects move into the plan to achieve the overall System Hardening target. As a result, the disaggregated miles should be considered directional and not as targets for the 2022 WMP.

- RSE Values: Differences in RSE values between our GRC application and this response are a result of differing time horizons for units and cost forecasts.

- 2022 Mileage: The 2022 disaggregated system hardening mileages provided in the Revised Table 12, and in Table RN-PG&E-22-13-01 above, add up to 468 miles rather than the Initiative Target of 470 miles because line removal work is being performed in 2022 that will count toward the Initiative Target. Please see note the Line Removal note below for additional information regarding line removal forecasts and line removal work already completed in 2022.

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the approximate cost of that work using an average unit cost, and the associated RSE for the completed work. Please see the information provided below Table RN-PG&E-22-13-01 for additional detail regarding line removal forecasting.

- Undergrounding: The System Hardening undergrounding forecasts do not include Butte County Rebuild miles because that work does not take place as part of the System Hardening Program and is discussed separately in Section 7.3.3.17.6.

- Line Removal: We have not forecasted line removal miles in the revised Table 12. The 2022 removal miles presented in Table RN-PG&E-22-13-01 above, and in Table 12, reflect the total line miles removed this year as of June 21, 2022. The costs were calculated by multiplying that figure by an average of $106,000 per mile. The RSE is also based on the work completed as of June 21, 2022.

  Line removal is the first system hardening mitigation that we consider when planning system hardening projects because it is generally the fastest and lowest cost approach resulting in the highest risk reduction. However, line removal projects are difficult to forecast for four reasons: (1) customers considering a remote grid project (involving line removal) may decline that option and choose wired service instead; (2) it is difficult to quantify the number of customers that will return to their homes and request service as part of a fire rebuild project which affects the number of service lines that will either be rebuilt or removed in fire rebuild areas; (3) idle facility line removal is an emergent issue driven by inspections and customer investigations each year; and (4) PG&E looks for opportunities to remove lines that are coincident/dependent with other hardening work.

- Remote Grid: PG&E has a target to operate two new Remote Grid Standalone Power System (SPS) Units in 2022. In our 2023 GRC Application, we forecasted only one new Remote Grid for this year and 2023. We have updated Table 12, and Table RN-PG&E-22-13-01 above, to show two SPS units in 2022 in accordance with our target. The 2022 and 2023 forecasted costs were not explicitly budgeted for within Section 7.3.3.17.1. These forecasted costs for 2022 and 2023 were only separated out for purposes of responding to Revision Notice PG&E-22-13 and other system hardening initiatives are planned to be offsets to complete this work. These forecasted costs should not be added to the total WMP system hardening forecast for 2022 and 2023.

In addition to recognizing high-level RSEs for different system hardening methods, like those provided in Table RN-PG&E-22-13-01 above, once individual system hardening projects have been fully designed and vetted, PG&E performs a final economic analysis to create net present values for the lifetime costs of each design approach, including long-term maintenance needs and costs including annual vegetation management, inspections, etc. The final recommendation and associated documentation are then submitted to PG&E's Wildfire Risk Governance Steering Committee (WRGSC) to review the project scope, RSE, and related analysis. The WRGSC provides guidance and approval for the projects that the System Hardening Program executes and the mitigation action to be taken on each project. Please see pages 540-543 in Section 7.3.3.17.1 of the 2022 WMP update for a more detailed discussion of PG&E's system hardening alternatives consideration for location and final design.

Response to Critical Issue RN-PG&E-22-13 Remedy # 2

Table 12 has been revised as requested. As described above, the actual projects and costs will vary as the teams review each project and recommend the most appropriate risk spend efficient solutions. However, 470 miles of total System Hardening Program work remains our 2022 WMP Initiative Target (*i.e.*, Initiative Target C.11).

We also note that if the changes made to Table 12 described above are affected by PG&E's responses to Critical Issues RN-PG&E-22-02, 22-03, and/or 22-04 due following this submission, we will update Table 12 and this response as part of the Revised 2022 WMP Update requested by Energy Safety no later than July 26, 2022.